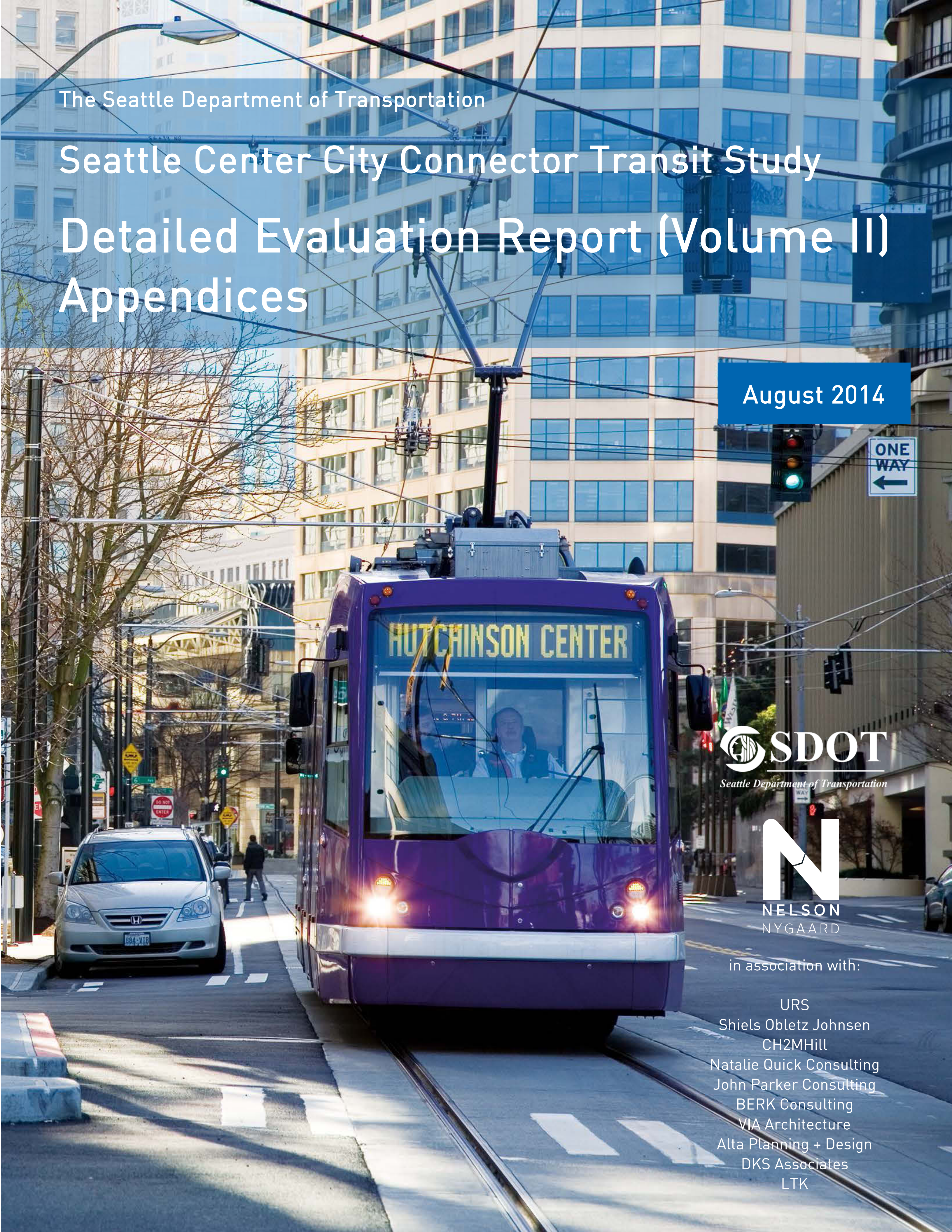
The Seattle Department of Transportation

Seattle Center City Connector Transit Study

Detailed Evaluation Report (Volume II) Appendices

August 2014



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Seattle Center City Connector Transit Study

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APPENDIX A RIDERSHIP PROJECTIONS

Introduction

This appendix[1] describes the ridership projections for the Center City Connector, which were developed using the Federal Transit Administration (FTA) Simplified Trips on Project Software (STOPS) ridership forecasting model. Ridership projections were developed for a No-Build alternative and two Build alternatives for a 2018 opening year. The Build alternatives were Mixed-Traffic and Exclusive Streetcar on 1st Avenue between Jackson Street and Westlake. Ridership for these alternatives was analyzed as part of an integrated streetcar system including the South Lake Union (SLU) and First Hill Streetcar lines. Two operating scenarios for the integrated streetcar system were evaluated (Hub-to-Hub and End-to-End), as described below.

This document is organized into the following sections:

- Methodology
- Assumptions
- Results

In addition, Appendix B describes a separate assessment of the visitor and special events ridership markets.

Methodology

STOPS Model Overview

The FTA Simplified Trips on Project Software (STOPS) model consists of a series of programs designed to estimate transit project ridership using a streamlined set of procedures that bypass the time-consuming process of developing and applying a regional travel demand forecasting model. STOPS is similar to regional models and includes many of the same computations of transit level of service and market shares found in models maintained by Metropolitan Planning Organizations (MPOs). What makes STOPS much simpler to use than regional models is the following:

1. Estimates of total origin-to-destination travel are derived from Census data rather than elaborate trip generation and destination choice procedures. This avoids the need to calibrate these tools to the degree of accuracy required to estimate transit ridership.
2. Representations of transit level-of-service are derived from timetable information obtained directly from the transit agency, bypassing the need to develop detailed transit

[1] Prepared by JPC and Nelson\Nygaard

networks in the planning environment. Timetable information is already available for most agencies and is much more accurate than the representations of travel time and frequencies contained in typical planning networks.

3. The model calibrates itself to represent current conditions. This means that the months, and sometimes years, that are spent developing and documenting effective forecasting tools can be avoided.

The STOPS model can be used to develop ridership forecasts for current and future (opening and horizon) years.

Although STOPS represents a significant simplification over existing procedures, it still requires careful development of input information that describes existing transit ridership, existing transit schedules, and future transit service scenarios.

Key STOPS Data Sources

The types and sources of files that are used by STOPS to arrive at transit ridership forecasts include:

- General Transit Feed (GTF) files to represent transit service networks in a nationally consistent way.
- CTPP (Census Transportation Planning Package) 2000 files to describe metro-area worker flows in a nationally consistent way (when year 2010 files are available for distribution, the STOPS model will be updated to use these files).
- Metro-area demographic forecasts.
- Metro-area highway impedances.
- A set of mode choice models that varies by trip purpose (work, home-based other, non home-based).
- Nationally developed coefficients and constants.

Some of the required inputs are available through the U.S. Census Bureau and online GTF data exchanges, which include files for many transit agencies throughout the country. The Seattle area GTF is available through an exchange, including both Sound Transit and King County Metro. The GTF files are only available for existing transit systems as they currently operate, so updated files need to be incorporated to reflect future transit system changes, including the alternatives under consideration for the Seattle Center City Connector Project. Other data inputs required assistance from the regional MPO, the Puget Sound Regional Council (PSRC). These include PSRC Traffic Analysis Zone (TAZ) definitions and demographics (for the year 2000 and any existing or horizon years desired) and travel times and distances for the PSRC TAZ system. The horizon year used for the Center City Connector analysis was the projected opening year of the Project, assumed to be 2018 for the Tier 2 evaluation. A 2035 horizon year was also included in some runs of the STOPS model.

Assumptions and Input Data

Alternatives and Operating Scenarios

Ridership projections were developed for the following alternatives and operating scenarios:

- No Build Alternative.
- Build Alternatives: Mixed-Traffic and Exclusive Streetcar along 1st Avenue alignment with a Stewart Street/Olive Way connection between 1st Avenue and Westlake.
- Operating Scenarios:
  - **Hub-to-Hub**. Operates as two independent, overlapping lines: (1) South Lake Union (Fairview & Yale Aves) – King Street Intermodal Hub. (2) Capitol Hill (Broadway & Denny Way) – Westlake Intermodal Hub.
  - **End-to-End.** Operates as a single integrated line (comprised of South Lake Union, First Hill, First Hill Broadway Extension, and Center City Connector segments) with no transfers.

See the Detailed Evaluation Report, Chapter 6, for additional description of the alternatives and operating scenarios.

Population/Employment Projections

The following describes current and future population and employment inputs:

- Shapefile with MPO (PSRC) Transportation Analysis Zones (TAZs or zones) that includes Population and Employment for the CTPP Base year (2000), a current year (2010), an opening year (2018) and forecast year (2035). The PSRC 938 zone system was used for this work.
- Current year employment data from PSRC included a number of zones where values were suppressed for confidentiality reasons. Based on discussion with PSRC, data from U.S. Census Bureau Longitudinal Employer-Household Dynamics (LEHD) On-The-Map tool was used to obtain employment data any zone that included suppressed 2010 employment values. Suppression did not affect forecast year employment for 2025 or 2035.
- For the 2018 opening year population and employment, a straight-line interpolation was done between 2010 and 2025 and the resulting values were reviewed for reasonableness by SDOT.

Transit Improvements

Figure A-1 identifies regional transit improvements that were assumed in transit networks for the No-Build and 2018 and 2035 Build Alternatives.

Figure A-1 Transit Network Assumptions by Year and Alternative

Alternative / Assumed Transit Improvement(s)	Source/Notes
2018 No Build	
First Hill Streetcar including Broadway Extension Project to Roy Street	1
University Link Extension to Capitol Hill and University of Washington	2
2018 Build – includes 2018 No-Build plus:	
Center City Connector Streetcar	3
2035 Build – includes 2018 Build plus:	
Northgate Link Extension	4
East Link Extension (Downtown Seattle to Overlake Transit Center)	5
S 200th Link Extension to the south of SeaTac	6
Lynwood Link Extension	7
Federal Way Transit Extension	8

Notes/Sources:

(1) The proposed Broadway Extension was included to be able to compare 2018 Build ridership for the integrated streetcar system, including both CCC and the Broadway extension, while isolating the effects of adding the Center City Connector.

(2) http://www.soundtransit.org/Projects-and-Plans/University-Link-Extension

(3) None

(4) http://www.soundtransit.org/Projects-and-Plans/Northgate-Link-Extension

(5) http://www.soundtransit.org/Projects-and-Plans/East-Link-Extension

(6) http://www.soundtransit.org/Projects-and-Plans/South-200th-Link-Extension. Note: this should be included in the 2018 transit network in future model runs.

(7) http://www.soundtransit.org/Projects-and-Plans/Lynnwood-Link-Extension/Location-and-stations---Lynnwood-Link-Ext

(8) http://www.soundtransit.org/Projects-and-Plans/Federal-Way-Link-Extension. The extension to Kent/Des Moines is a funded component of ST2, with a station location near Highline Community College. Possible extensions beyond a Kent/Des Moines terminus are not yet funded and were not included in the 2035 transit network.

Operating Plan

Appendix C of the Detailed Evaluation Report provides the operating plan assumptions used in the Tier 2 evaluation. Headways of 10 to 15 minutes per line were assumed; in the Hub-to-Hub operating scenario this provided headways of 5 to 7.5 minutes between Westlake and King Street Intermodal Hubs. Figure A-2 summarizes these assumptions.

Figure A-2 Center City Connector Operating Plan Assumed in Tier 2 Evaluation

	Weekday	Saturday	Sunday/Holiday
Service Span			
Service Span	5 – 1 AM	5 – 1 AM	6 AM – 11 PM
Daily Hours	20	20	17
Headway (Individual Lines*)			
Early Morning	15 min (5 – 6 AM)	15 min (5 – 8 AM)	15 min (6 – 8 AM)
Day/Early Evening	10 min (6 AM – 8 PM)	10 min (8 AM – 8 PM)	10 min (8 AM – 8 PM)
Later Evening	15 min (8 PM – 1 AM)	15 min (8 PM – 1 AM)	15 min (8 – 11 PM)

Note: *Under the Hub-to-Hub operating scenario, overlapping service between Westlake and King Street Intermodal Hubs results in 5 to 7.5 minute headways in this segment of the system.

Travel Times

Travel times for Center City Connector are based on the Tier 2 traffic analysis, which was conducted for the PM peak period using the VISSIM traffic simulation software as described in Appendix G. Travel times were provided for both the Mixed-Traffic and Exclusive operating scenarios. Travel times for the First Hill Streetcar were based on projected travel times, obtained from preliminary traffic simulation for the First Hill Streetcar. Travel times for the South Lake Union Streetcar were based on timetables from GTF files.

Auto travel times between TAZs were obtained from PSRC; these TAZs correspond to the PSRC-provided demographic projections (population and employment). General transit travel times were obtained from published agency timetables (GTF files).

Results

Overall Ridership Projections

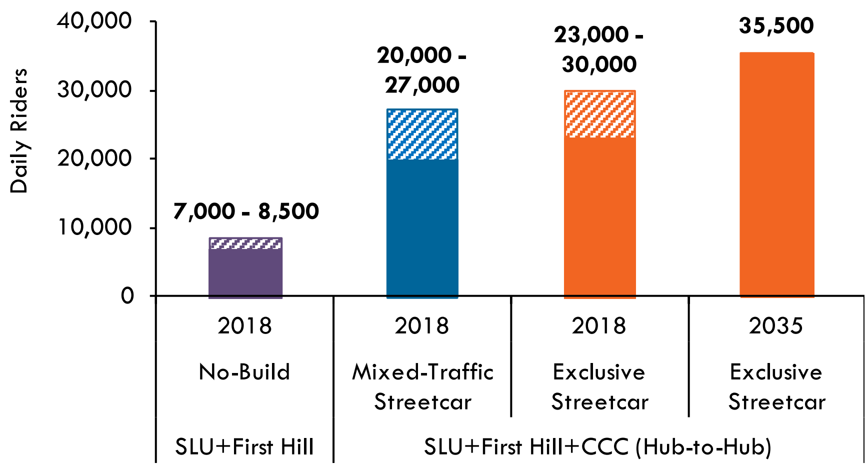
This section describes ridership projections for the Mixed-Traffic and Exclusive Streetcar alternatives. The ridership projections assume an integrated streetcar system including the Center City Connector (CCC) and South Lake Union and First Hill Streetcars along with the First Hill Streetcar Broadway Extension to a Roy terminus.

The STOPS model uses a calibration process based on boardings at fixed guideway stations in the area being studied. For stations that are part of a new project, a station type is coded based on how similar the new stations are to others in the area. In the case of the CCC Project, the coding was varied to develop low- and high-end ranges for projected CCC ridership:

- **Low-end (based on SLU Streetcar).** The low-end of the ridership range was established based on initial STOPS model runs where new CCC stops were calibrated to characteristics of existing SLU Streetcar stops. The project team recognized that coding CCC stops in this manner would not fully capture potential visitor and non home-based trips that are likely to be very different in the CCC corridor.
- **High-end (not constrained to SLU Streetcar).** The high-end of the ridership range was set based on STOPS model runs that did not constrain the CCC to SLU characteristics. In coordination with FTA, the project team felt that the high-end of the ridership range more fully captures visitor and non-work ridership markets that the STOPS model does not explicitly address. A separate analysis was conducted to look at factors influencing visitor trips; a range of ridership potential was calculated using a peer comparison to San Francisco's F-Market Line. The analysis of visitor and special event markets is described in Appendix B.

Figure A-3 illustrates the range of weekday daily projected streetcar boardings in the anticipated Project opening year and projected daily boardings in a 2035 horizon year.

Figure A-3 Projected Weekday Daily Streetcar Boardings, 2018 and 2035



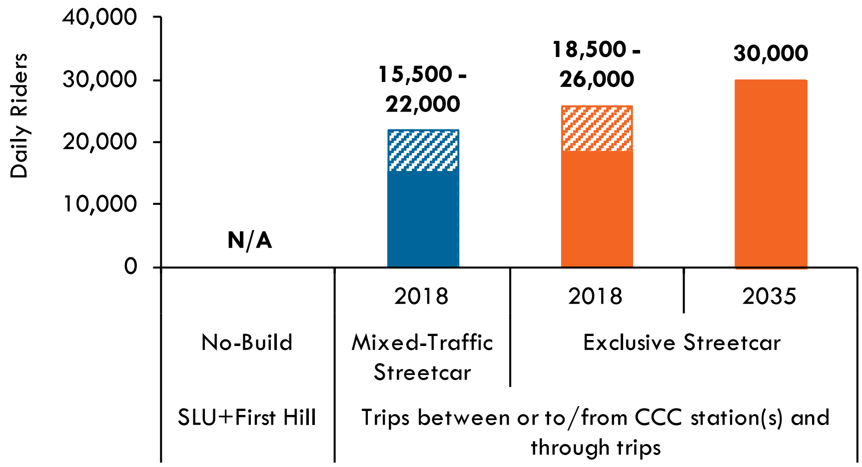
Note: The 2035 projection corresponds to the high-end of the range of the 2018 opening year projections. This figure is based on a STOPS model run that was not constrained to characteristics of the SLU line (as described above).

Trips on Project

"Trips on Project" represent any trip that boards or alights in the Project area (stops including or between Westlake and King Street Intermodal Hubs) and any through trip that uses the Project to travel between stations on the SLU and First Hill Streetcar lines. For example, if someone gets on the SLU portion of the system and then travels through the CCC alignment to a station along the First Hill portion of the system, it would be considered a trip on the Project. Trips on the South Lake Union and First Hill Streetcar lines that do not utilize or pass through the Center City Connector segment are not considered Project Trips.

Figure A-4 illustrates the range of projected daily trips on the CCC Project in the anticipated Project opening year and projected daily Project trips in a 2035 horizon year.

Figure A-4 Projected Weekday Daily Trips on Project, 2018 and 2035, Hub-to-Hub Mixed-Traffic and Exclusive Streetcar



Note: The 2035 projection corresponds to the high-end of the range of the 2018 opening year projections. This figure is based on a STOPS model run that was not constrained to characteristics of the SLU line (as described above).

Markets on Project

Figure A-5 provides a breakdown of the nearly 26,000 Project trips in the Hub-to-Hub Exclusive alternative. Trips along the Center City Connector segment (including Westlake and 5th/Jackson stops) comprise 68% of Project trips. Trips between either First Hill or South Lake Union and CCC stops make up a combined 29% of Project Trips. Through trips between First Hill and South Lake Union stops represent the remaining approximately 650 daily trips.

Figure A-5 Weekday Daily Project Trips by Market, 2018, Hub-to-Hub Exclusive

Trip Movement	Daily Project Trips	% of Total
First Hill - CCC*	4,180	16%
Along CCC*	17,650	68%
SLU - CCC*	3,410	13%
Through Trips (SLU-First Hill)	650	3%
TOTAL	**25,890**	**100%**

Notes: *CCC represents stops including and between Westlake and Jackson/5th. Trips using only stops along the SLU line or along the First Hill line are not counted as Project trips.

Project Trips by Stop

2018 Opening Year

Figure A-6 shows estimated Project trips by stop for the Hub-to-Hub Exclusive and Mixed-Traffic Streetcar alternatives at existing/planned South Lake Union and First Hill Streetcar stop and Center City Connector stops; the CCC Project includes the stops at Westlake, Jackson/Occidental, and Jackson/5th.

Figure A-6 Project Trips by Stop, 2018, Hub-to-Hub Mixed-Traffic and Exclusive Streetcar

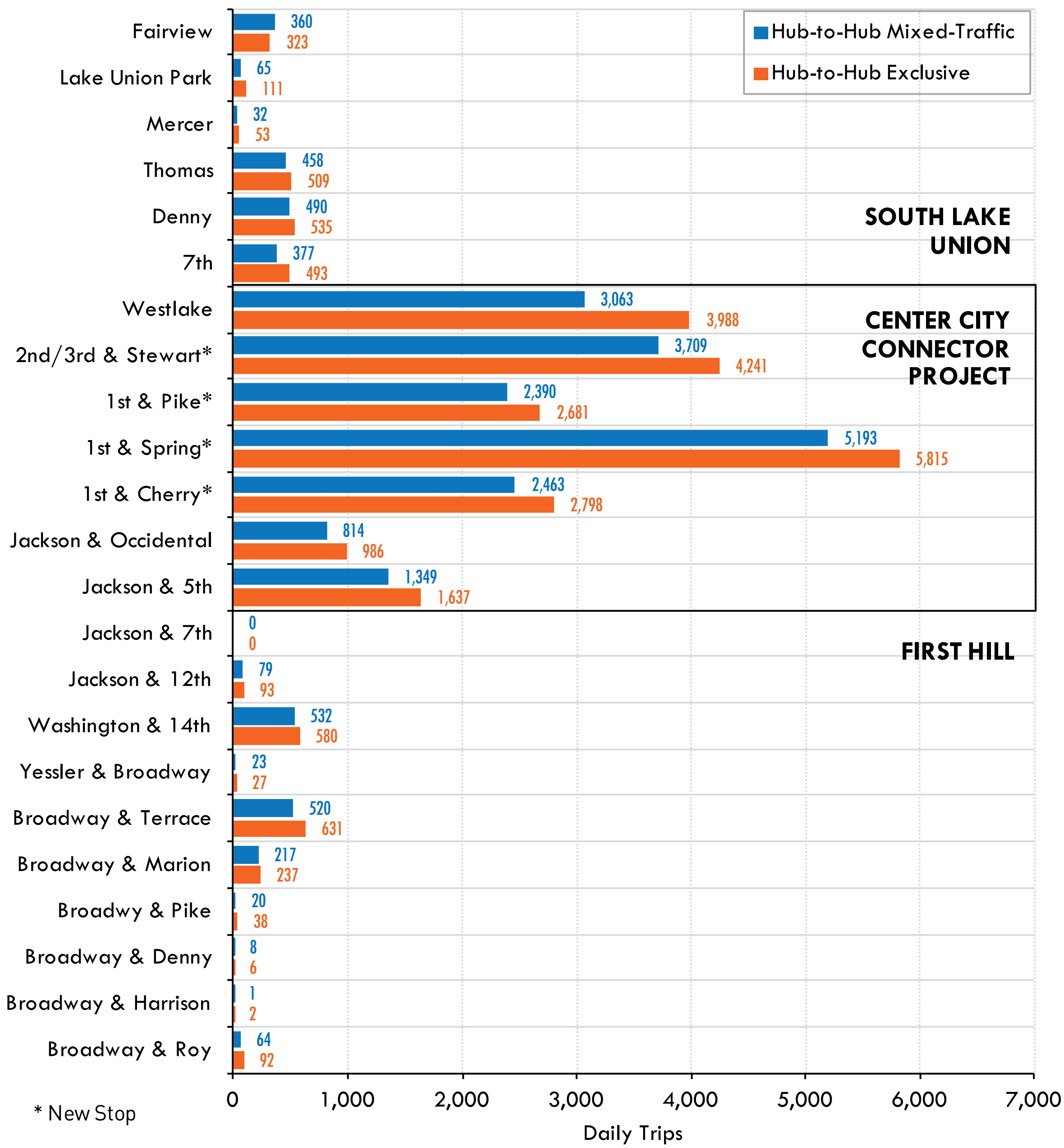


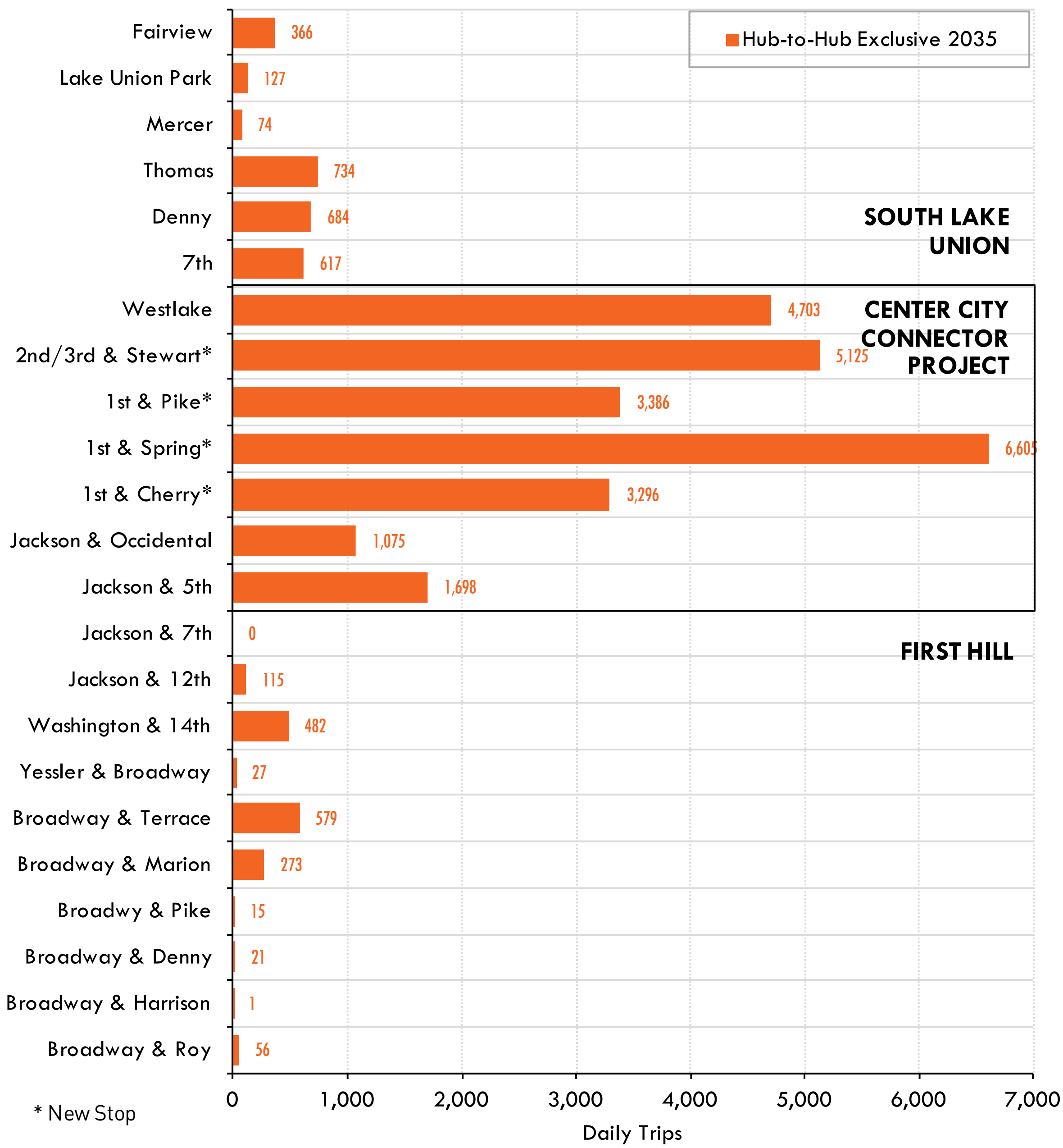
Figure A-7 illustrates Project trips utilizing the Center City Connector stations and/or segment in the projected 2018 opening year relative to total daily boardings. The map provides these results for the Exclusive Streetcar and Hub-to-Hub Operating Scenario.

Figure A-7 Daily Total Boardings and Project Trips by Stop, 2018, Hub-to-Hub Exclusive

2035

Figure A-8 shows estimated Project trips by stop in 2035 for the Hub-to-Hub Exclusive alternative.

Figure A-8 Project Trips by Stop, 2035, Hub-to-Hub Mixed-Traffic and Exclusive Streetcar



District-Level Results

The STOPS model estimated CCC Project trips between PSRC Transportation Analysis Zones (TAZs). These zones were aggregated into 16 districts for easier visualization. Figure A-8 shows the district boundaries and district-to-district travel patterns with over 500 daily trips. Figure A-9 provides these results in a table; the district-to-district pairs with over 500 daily trips are highlighted in yellow shading.

These results illustrate that of the over 25,000 projected daily Project trips:

- Over three-quarters of these trips are between districts directly served by the streetcar alignments (districts either contain or are directly adjacent to a CCC streetcar stop).
- Large shares of trips (about 43% each) of trips have an origin or destination in either the Central Waterfront district or the CBD.
- A relatively small share of trips (about 13%) is from districts outside of the Center City area to one of the districts within the Center City area that is served by the integrated streetcar system.

Figure A-9 District Boundaries and District-to-District Project Trips (500 or more trips)

Figure A-10 District-to-District Project Trips, 2018

		Central Waterfront	CBD	Pioneer Square	Denny Triangle	South Lake Union	First Hill/ Yesler	Belltown	First Hill/ Capitol Hill	Queen Anne/ Westlake	Montlake/ Madrona	UW/U-District	Ballard/ Northgate/ Everett North	SeaTac/ FedWy/ Kent	Tacoma / Bremerton/ West of Seattle	Bellevue and East of Seattle	Far East	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total
Central Waterfront	1	562	1,539	447	330	147	200	418	181	91	11	1	56	34	0	23	19	4,059
CBD	2	1,461	759	522	500	268	92	870	286	57	45	2	0	0	0	3	8	4,873
Pioneer Square	3	449	989	51	126	57	37	294	51	47	1	0	28	9	0	5	1	2,145
Denny Triangle	4	656	771	186	0	0	56	113	61	0	3	0	0	3	0	1	4	1,854
South Lake Union	5	472	791	170	0	0	33	101	32	4	1	0	0	23	0	7	2	1,636
First Hill/Yesler	6	380	393	92	80	45	0	188	2	17	0	0	0	0	0	0	0	1,197
Belltown	7	729	1,341	389	80	72	155	71	143	8	6	0	7	3	0	31	0	3,035
First Hill/ Cap. Hill	8	588	833	143	134	42	0	291	1	49	0	0	12	0	0	2	0	2,095
Queen Anne /Westlake	9	540	701	385	20	10	63	75	45	0	0	15	30	15	0	0	0	1,899
Montlake/ Madrona	10	202	257	32	32	8	0	107	0	6	0	0	3	0	0	0	0	647
UW/U-District	11	1	3	0	0	0	0	0	0	1	0	0	0	0	0	0	0	5
Ballard/ Northgate /Everett North	12	396	76	241	14	11	1	8	13	5	0	0	0	1	0	1	0	767
SeaTac/ FedWy/Kent	13	362	6	43	60	162	1	37	5	27	1	0	5	0	0	1	0	710
Tacoma/ Bremerton/ West of Seattle	14	13	0	1	1	2	0	0	0	0	0	0	0	0	0	0	0	17
Bellevue and East of Seattle	15	666	3	57	26	44	0	47	1	16	0	0	1	0	0	0	0	861
Far East	16	18	0	2	1	4	0	1	0	0	0	0	1	0	0	0	0	27
Total		7,495	8,462	2,761	1,404	872	638	2,621	821	328	68	18	143	88	0	74	34	25,827

Note: Blue shading represents intra-district trips. These figures vary slightly from stop-to-stop project trips due to rounding.

APPENDIX B ADDITIONAL RIDERSHIP MARKETS: VISITORS AND SPECIAL EVENTS

Introduction

In addition to the ridership projections developed using the Federal Transit Administration (FTA) Simplified Trips-on-Project Software (STOPS) model (discussed in Appendix A), two additional ridership markets exist for the Seattle Center City Connector (CCC) Project that the STOPS model does not directly account for, special events and visitors. These markets can both be expected to increase ridership on the Seattle Center City Connector Project. This document provides an assessment of each of these markets.

As noted, the FTA STOPS model does not account for special markets such as events or visitors. As a result, a peer-based off-model approach was recommended after consultation with FTA staff. In general, a peer-based approach to evaluating the potential ridership resulting from special events and visitors is based on information and data from similar cities and streetcar operations throughout the United States in conjunction with local data.

This document is organized into two primary sections describing (1) the special events ridership market and (2) the visitor ridership market.

Special Events Market Analysis

This section describes the basis for determining streetcar ridership resulting from special events at CenturyLink Field and Safeco Field. Both facilities are located in Seattle's Stadium District in South Downtown (SoDo) and are within one-half mile of the proposed streetcar project.

- **CenturyLink Field and Event Center.** CenturyLink Field is home to the Seattle Seahawks (NFL) and Seattle Sounders FC (MLS) teams, and WAMU theatre. These facilities host football games, soccer matches, and other events such as FanFest, exhibition shows, graduations, and concerts. Seahawks football, including pre-season and playoffs, runs from early August to early January. In 2012, there were a total of 10 home games (2 pre-season and 8 regular season) with an average attendance of 67,946. In addition to the Seahawk games, there were a number of other events held at CenturyLink Field such as Supercross, concerts, University of Washington (UW) commencement, and the Susan G. Koman 3-Day Walk event.

The Seattle Sounders season runs from the middle of March through the middle of November. In addition to the 19 home games played as part of the MLS league, the Sounders also play in a number of non-MLS leagues, including the US Open Cup and the Confederation of North, Central American and Caribbean Association Football (CONCACAF). Considering pre-season, post-season, and all league matches, the Sounders played 24 home games, averaging approximately three home games per month. In addition, a total of 116 concerts, flat shows, and other events were held at the Event Center and WAMU theatre in 2012.

- **Safeco Field.** Safeco Field is home to the Seattle Mariners (MLB) team. The regular season runs from April to early October and with the playoffs, the season generally extends through October. During the 2012 season, there were a total of 81 home games with an average attendance of 21,258.

Data Sources

Conditional to their approval, both CenturyLink Field and Safeco Field are required to maintain annual Transportation Management Programs (TMPs). Part of the requirements for the TMP is to conduct an annual survey of event attendees. TMP surveying at CenturyLink Field has historically included information related to travel to events including traffic, pedestrian, and parking demand as well as information related to travel modes used by attendees. Surveying has not included information about origins or destinations of these trips. The Safeco Field TMP program does not require the reporting of travel modes or point of origin data and as a result no current data exists related to these items. However, there is a one-time survey that includes information related to travel modes used by attendees. This survey was conducted in 2001 by the Mariners organization to establish some baseline knowledge to inform the development of the TMP for the opening of nearby CenturyLink Field in 2002.

CenturyLink Field

Annual intercept surveys conducted as part of the CenturyLink Field Transportation Management Program show that about one-half (48%) of the respondents/attendees travel to the game by some mode other than an automobile. Figure B-1 below shows that of the 48% who do not travel by car, approximately 23% walk or bike, 21% take the Sounder Train, 20% travel to the game via Metro or Sound Transit bus, 10% use the Link Light Rail, 8% use the ferry system, and the remaining 18% use either a taxi, limo, charter bus, Amtrak, or were dropped off. Of these non-auto modes, it is reasonable to assume that some portion of the walk trips, ferry trips, and perhaps the bus trips could use the proposed CCC streetcar for a portion of their trip.

Figure B-1 CenturyLink Field Survey Results (Seahawks)

Travel Mode	Survey
Bike/Walk	23%
Sounder Train	21%
Metro/Sound Transit Bus	20%
Link LRT	10%
Taxi/Limo	8%
Ferry	8%
Drop Off	5%
Charter Bus	4%
Amtrak	1%
Other	1%
Total	**100%**

Source: 2012 CenturyLink Field Survey Results Report, November 11, 2012

Safeco Field

In the 2001 Mariners survey at Safeco Field, 82% of attendees travelled by auto to the games. The remaining 18% chose to take public transit, walk, or bike. Figure B-2 below shows multimodal access for Mariners games at Safeco Field.

Figure B-2 Safeco Field Multimodal Access[1] (Mariners)

Travel Mode	Survey
Auto	82%
Transit (Bus/Train)	8%
Ferry	4%
Walk	4%
Bicycle/Other	3%
Charter Bus	0%
Totals	**100%**

Source: Seattle Arena Multimodal Transportation Access and Parking Study, May 23, 2012.

New Starts Working Group

In addition to the TMP survey data, a New Starts Working Group collected data concerning transit mode shares at various sporting event facilities throughout the United States. Figure B-3 shows transit mode shares experienced at events and venues throughout the United States for various years.

Figure B-3 Transit Mode Shares for Sports Venues

City	State	Agency	Transit Options	Facility	Event Type	Year	% Using Transit*
Portland	OR	TriMet	LRT, Bus	Rose Garden Arena	Trail Blazers Basketball Games	2004	33%
Portland	OR	TriMet	LRT, Bus	Jeld-Wen Field	Timbers Soccer Matches	2011	44%
St. Louis	MO	Metro Link	LRT	Busch Stadium Edward Jones Dome Scottrade Center	Cardinals, Rams, and Blues Games	2011	33.3%
Minneapolis	MN	Metro Transit	LRT, Comm. Rail, Bus	Target Field	Twins MLB Games	2011	13%
Minneapolis	MN	Metro Transit	LRT, Comm. Rail	Mall of America Field	Vikings NFL Games	2011	11%

City	State	Agency	Transit Options	Facility	Event Type	Year	% Using Transit*
Phoenix	AZ	Valley Metro	LRT	Chase Field, US Airways Arena, Sun Devil Stadium / Wells Fargo Arena	Diamondbacks Games, Suns Games, Arizona State University Athletics	N/A	10.7%
Phoenix	AZ	Valley Metro	LRT	Dodge Theater	Concerts	N/A	10.1%
Phoenix, Tempe	AZ	Valley Metro	LRT	Fall Frenzy (Tempe), Artlink (Phoenix), Fiesta Bowl Block Party (Tempe)	Festivals	N/A	17%
Dallas	TX	DART	LRT, Comm. Rail, Bus	American Airlines Center	Concerts, Basketball Games, Hockey Games	2010-2011	14.9%
San Diego	CA	MTS	Trolley	Qualcomm Stadium	Football Games	2008-2011	23.2%
San Diego	CA	MTS	Trolley	Petco Park	Baseball Games	2008-2011	13.3%
Cleveland	OH	Cleveland	LRT	Jacobs Field	Baseball Games	2006	6-10%
Cleveland	OH	Cleveland	LRT	Quicken Loans Arena	Hockey and Basketball Games, Concerts	2006	6-10%

City	State	Agency	Transit Options	Facility	Event Type	Year	% Using Transit*
Denver	CO	Denver RTD	LRT	Coors Field	Baseball Games	2006	7-10%
Denver	CO	Denver RTD	LRT	Pepsi Center	Baseball and Hockey Games, Concerts	2006	7-10%
Oakland	CA	BART	Rapid Transit	Oakland Coliseum	A's Baseball Games	2011	17%
Oakland	CA	BART	Rapid Transit	Oakland Coliseum	Warriors NBA Games	2010-2011	23%
Oakland	CA	BART	Rapid Transit	Oakland Coliseum	Raiders NFL Games	2010-2011	13%
Charlotte	NC	CATS	LRT	Time Warner Arena	NBA Games	N/A	7.9%
Charlotte	NC	CATS	LRT	Time Warner Arena	Hockey	N/A	5.7%
Charlotte	NC	CATS	LRT	Time Warner Arena	CIAA Basketball Tournament	N/A	3.7%
Charlotte	NC	CATS	LRT	Bank of America Stadium	College and NFL Football Games, Hockey	N/A	11.8%
San Francisco	CA	SFMTA	Trolley	AT&T Park	Football Games	2006	20%
**People using transit for at least a portion of their trips*							

Source: New Starts Working Group

Figure B-4 applies the transit usage data from the respective TMPs to average attendance figures for both CenturyLink Field and Safeco Field. Transit usage data from the New Starts working group is also included as a point of reference. For CenturyLink Field a transit mode share of 20% was assumed based on the TMP survey share for Metro and Sound Transit buses. This is perhaps a conservative estimate in that another 8% of attendees who use the ferries and another 23% who walk or bike may also be considered potential streetcar riders. For Safeco Field, 8% was used based on survey respondents who indicated they used transit (bus/train) to access the game. Again, this may be conservative in that another 4% of attendees who use the ferries or walk/bike, respectively, could also be potential streetcar riders.

Figure B-4 Seattle Center City Connector – Special Events Analysis

City	State	Transit Option	League	Event	Stadium/ Arena	Stadium Capacity[4]	Average Attendance[5]	Transit Mode Share[1,2,3]	Transit Ridership on all transit modes per Event
Seattle	WA	LRT, Comm. Rail, Bus	NFL	Seahawks	Century Link Field	67,000	67,946	20%	13,589
Seattle	WA	LRT, Comm. Rail, Bus	MLS	Sounders	Century Link Field	67,000	43,975	20%	8,795
Seattle	WA	LRT, Comm. Rail, Bus	MLB	Mariners	Safeco Field	47,476	21,258	8%	1,701
Portland	OR	LRT, Bus, Streetcar	NBA	Trailblazers	Rose Garden Arena	20,636	19,829	33%	6,544
Portland	OR	LRT, Bus, Streetcar	MLS	Portland Timbers	Jeld-Wen Field	20,438	20,674	44%	9,097
St. Louis	MO	LRT	MLB	St. Louis Cardinals	Busch Stadium	43,975	42,212	33%	13,930
St. Louis	MO	LRT	NFL	St. Louis Rams	Edward Jones Dome	66,000	56,703	33%	18,712
St. Louis	MO	LRT	NHL	St. Louis Blues	Scottrade Center	22,000	18,809	33%	6,207
Minneapolis	MN	LRT, Comm. Rail, Bus	MLB	Minnesota Twins	Target Field	39,021	31,744	13%	4,127
Minneapolis	MN	LRT, Comm. Rail, Bus	NFL	Minnesota Vikings	Mall of America Field	64,121	60,725	11%	6,680
Phoenix	AZ	LRT	MLB	Arizona Diamondbacks	Chase Field	48,633	26,518	11%	2,917
Phoenix	AZ	LRT	NBA	Phoenix Suns	US Airways Arena	19,022	15,436	11%	1,698
Phoenix	AZ	LRT	NCAA	ASU Sun Devils	Sun Devil Stadium	71,706	56,835	11%	6,252
Dallas	TX	LRT, Comm. Rail, Bus	NBA	Dallas Mavericks	American Airlines Center	19,200	20,036	15%	3,005
Dallas	TX	LRT, Comm. Rail, Bus	NHL	Dallas Stars	American Airlines Center	18,532	14,226	15%	2,134
San Diego	CA	Trolley	NFL	San Diego Chargers	Qualcomm Stadium	71,294	59,964	23%	13,792

City	State	Transit Option	League	Event	Stadium/ Arena	Stadium Capacity[4]	Average Attendance[5]	Transit Mode Share[1,2,3]	Transit Ridership on all transit modes per Event
San Diego	CA	Trolley	MLB	San Diego Padres	Petco Park	42,524	27,151	13%	3,530
Cleveland	OH	LRT	MLB	Cleveland Indians	Progressive/Jacobs Field	43,545	20,253	8%	1,620
Cleveland	OH	LRT	NBA	Cleveland Cavaliers	Quicken Loans Arena	20,562	16,192	8%	1,295
Denver	CO	LRT	MLB	Colorado Rockies	Coors Field	50,480	34,974	8%	2,798
Denver	CO	LRT	NBA	Denver Nuggets	Pepsi Center	19,155	17,819	8%	1,426
Denver	CO	LRT	NHL	Colorado Avalanche	Pepsi Center	18,007	15,498	8%	1,240
Oakland	CA	BART-Rapid Transit	MLB	Oakland Athletics	Oakland Coliseum	35,067	22,766	17%	3,870
Oakland	CA	BART-Rapid Transit	NBA	Golden State Warriors	Oakland Coliseum	19,596	19,373	23%	4,456
Charlotte	NC	LRT	NBA	Charlotte Bobcats	Time Warner Arena	19,077	15,324	8%	1,226
Charlotte	NC	LRT	AHL	Charlotte Checkers	Time Warner Arena	14,100	6,781	6%	407
Charlotte	NC	LRT	NFL	Carolina Panthers	Bank of America Stadium	73,778	73,293	12%	8,795
San Francisco	CA	Trolley	MLB	San Francisco Giants	AT&T Park	41,915	41,655	20%	8,331

[1] New Starts Working Group - Transit Mode Shares for Sports Venues
[2] Seattle Seahawks Transportation Management Plan Survey
[3] Mariners Survey 2001
[4] Capacity figures shown exclude expandable capacity.
[5] Average attendance sources: ESPN MLB and NBA Attendance Report, 2013, ESPN NFL and NHL Attendance Report 2012, AHL HockeyDB.com, 2012-2013, 2012 NCAA Division I Attendance

To further allocate total transit ridership to streetcar ridership a two-tiered approach was incorporated based on population, employment, and service level data.

Tier 1 calculates the population and employment (2010) within one-half mile of the full integrated streetcar system (including South Lake Union, Center City Connector, and First Hill) as a percentage of the total population and employment within a 30-mile radius of the Stadium District, the approximate "local" market area for events per conversations related to the Seattle Arena Draft Environmental Impact Statement (EIS), and applies the respective percentages to the total transit ridership. As shown in Figure B-5, approximately 3% of the population and nearly 14% of the employment within a 30-mile radius of the Stadium District is within one-half mile of the streetcar line.

Figure B-5 2010 Population and Employment within 0.5 miles of Streetcar Line as a percent of Total Population and Employment within 30-mile radius of Stadium District

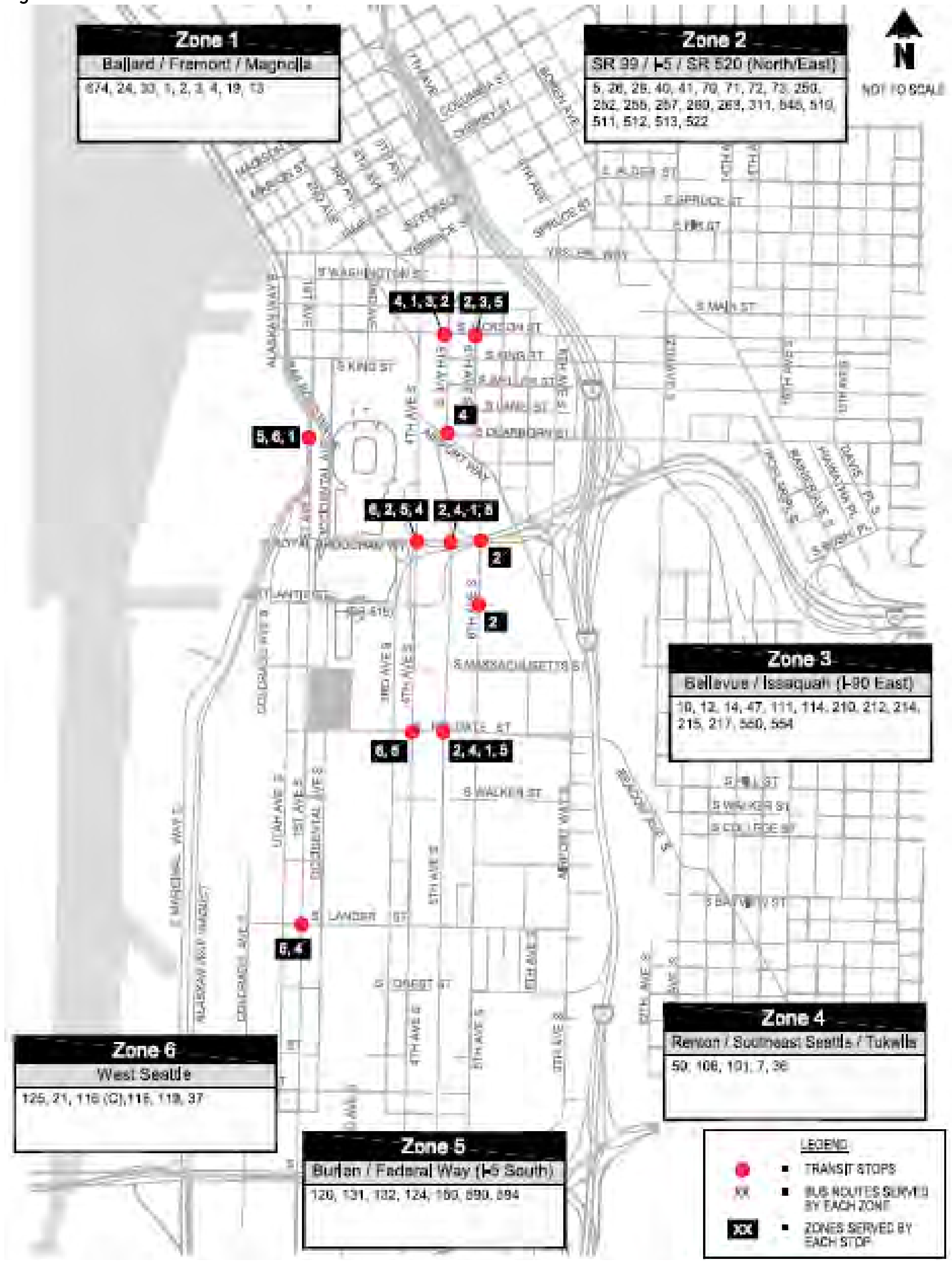
Geography	Population 2010	Employment 2010
1/2 mile	86,249	237,078
30 mile	3,234,908	1,722,799
Ratio	2.7%	13.8%

Tier 2 assesses weekday service levels for all routes available between downtown and the Stadium District during both pre-event and post-event time periods. Figure B-6, from the Seattle Arena EIS analysis, and Figure B-7 summarize bus routes serving the Stadium District by roadway, stop location, and general downtown Seattle service area.[1]

Figure B-7 shows weekday service levels for all routes (local and express) in service outbound from downtown to the Stadium District pre-event (5:00 to 7:00 PM) and inbound from the Stadium District to downtown post-event (9:00 to 11:00 PM). Including Sound Transit express routes, there are 384 buses available between downtown and the Stadium District between 5:00 and 7:00 PM. Post-event, there are 133 buses available to return to downtown between 9:00 and 11:00 PM. The addition of the streetcar at 5-minute headways in the 5:00 to 7:00 PM pre-event time period and 7.5 minute headways in the 9:00 to 11:00 PM post-event time period would add 24 vehicles available to get to an event from downtown and 16 additional vehicles to return to downtown after an event. Streetcar service resulting from the CCC Project would comprise 6% of the total service available pre-event to get to an event and approximately 11% of the available service post-event to return to downtown. Because Sound Transit express bus service is likely to be a more specific market for trips that are traveling further away, even though they may enter downtown before departing for their ultimate destination, it may make sense to exclude these from the calculations. Doing so would increase the streetcar percentages to 7% and 12%, respectively.

[1] Seattle Arena Draft EIS Appendix E – August 15, 2013

Figure B-6 Stadium District Bus Routes



Source: Seattle Arena EIS Analysis

Figure B-7 Stadium Routes Weekday Service Levels; Outbound from Downtown 5:00 to 7:00 PM and Inbound from SODO 9:00 to 11:00 PM

Monday - Friday				
	From CBD Outbound 5 to 7 PM		From SODO Inbound 9 to 11 PM	
Route[1]	# Buses	Headway	# Buses	Headway
Zone 1 (Ballard/Fremont/Magnolia)				
1	6	20	4	30
2	20	6	8	15
3	13	9	7	17
4	12	10	8	15
19	3	40	0	0
24	6	20	2	60
Zone 2 (SR99/I-5/SR520 NE)				
5	11	11	4	30
26	9	13	4	30
28	10	12	4	30
41	15	8	2	60
71	4	30	4	30
72	4	30	2	60
73	4	30	1	120
250	3	40	0	0
252	3	40	0	0
255	12	10	3	40
257	3	40	0	0
260	1	120	0	0
268	2	60	0	0
311	4	30	0	0
545	16	8	2	60
510	8	15	0	0
511	8	15	0	0

Monday - Friday				
	From CBD Outbound 5 to 7 PM		From SODO Inbound 9 to 11 PM	
Route[1]	# Buses	Headway	# Buses	Headway
513	4	30	0	0
522	7	17	2	60
Zone 3 (Bellevue/Issaquah/I-90 E)				
14	13	9	5	24
111	3	40	0	0
114	2	60	0	0
210	2	60	0	0
212	11	11	0	0
214	5	24	0	0
215	2	60	0	0
217	2	60	0	0
550	16	8	4	30
554	5	24	2	60
Zone 4 (Renton/SE Seattle/Tukwilla)				
7	13	9	9	13
36	16	8	9	13
101	7	17	1	120
106	7	17	4	30
Zone 5 (Burien/Fed. Way/I-5 S)				
131	1	120	1	120
132	7	17	6	20
124	4	30	4	30
150	19	6	8	15
590	15	8	0	0
594	1	120	4	30

Monday - Friday				
	From CBD Outbound 5 to 7 PM		From SODO Inbound 9 to 11 PM	
Route[1]	# Buses	Headway	# Buses	Headway
Zone 6 (West Seattle)				
21	17	7	12	10
37	3	40	0	0
116	1	120	0	0
118	6	20	1	120
119	2	60	0	0
125	16	8	6	20
Bus Total	384	0.31	133	0.90
Streetcar	24	5.00	16	7.50
Streetcar Service Share	5.9%	5.9%	10.7%	10.7%

If Excluding Sound Transit Express Routes as an Option

Bus Total Excluding ST Exp.	304	0.39	119	1.01
Streetcar	24	5.00	16	7.50
Streetcar Service Share	7.3%	7.3%	11.9%	11.9%

[1] Stadium routes as identified in Seattle Arena EIS Appendix E – routes in service pre and post event with bus stops near Stadium District.

Figure B-8 applies the Tier 1 population and employment percentage ratios and Tier 2 service level analysis to proportion the total transit event ridership estimated from TMP survey data to estimate streetcar event ridership. Taking into account the population and employment within one-half mile of the streetcar and service levels pre- and post-event, the proportion of total transit event ridership estimated to use streetcar per event is as follows:

- Seahawks game at CenturyLink Field streetcar ridership in the range of 135 to 270 additional riders;
- Sounders game at CenturyLink Field potential streetcar ridership of 90 to 175 additional riders;
- Mariners game at Safeco Field potential streetcar ridership of 20 to 35 additional riders.

Figure B-8 Center City Connector Streetcar Special Events Ridership Analysis

						Tier 1			Tier 2	
Stadium/ Arena	Event	Stadium Capacity[3]	Average Attendance	Transit Mode Share[1,2]	Transit Ridership on all transit modes per Event	Population Ratio[4] (2.7%)	Employment Ratio[5] (13.8%)	Sub-Total	Streetcar Proportion of Service Level[6] Low (6%)	Streetcar Proportion of Service Level[7] High (12%)
CenturyLink Field	Seahawks	67,000	67,946	20%	13,589	367	1,875	2,242	135	269
CenturyLink Field	Sounders	67,000	43,975	20%	8,795	237	1,214	1,451	87	174
Safeco Field	Mariners	47,476	21,258	8%	1,701	46	235	281	17	34

[1] Seattle Seahawks Transportation Management Plan Survey
[2] Mariners Survey 2001
[3] Capacity figures shown exclude expandable capacity.
[4] 2.7% of population (2010) within ½ mile of the streetcar line as a percentage of the total population within a 30 mile radius of the Stadium District
[5] 13.8% of employment (2010) within ½ mile of the streetcar line as a percentage of the total employment within a 30 mile radius of the Stadium District
[6] Streetcar represents approximately 6% of the total service available outbound from downtown to Stadium District between 5:00 and 7:00 PM
[7] Streetcar represents approximately 12% of the total service available inbound from Stadium District to downtown between 9:00 and 11:00 PM

Visitor Market Analysis

This section describes the analysis of potential streetcar ridership by visitors to downtown Seattle. As previously noted the basis for this analysis is a peer-based approach utilizing data and information from similar cities and transit operations in the United States. For the Seattle Center City Connector analysis, the F-Line in San Francisco was used in the analysis. Other areas will be discussed briefly below and then additional detail related to the use of San Francisco for comparisons to Seattle will be provided.

Data Sources

The project team's efforts to obtain data on the use of transit by tourists/visitors in US cities with high visitation rates comparable to Seattle found that there is limited data and research into transit use by visitors/tourists in most markets. Most surveys conducted by transit agencies or visitor attractions do not track visitors/tourists. Our research included:

- A cursory search of various transit agencies' websites, reports, and surveys
- Communication with transit agency representatives, including in Portland and New Orleans.
- Google Scholar, database, and Transportation Research Board searches. Only one Transportation Research Board committee deals with transportation and tourism, more generally (Transportation Needs of National Parks and Public Lands).

Figure B-9 and the following discussion details some general and transit characteristics of cities with tourist-based transit that connect to the greater transit system. Cities with the best information available were San Francisco, New Orleans, and Memphis, along with more basic statistics from other cities. Research into data for Vancouver BC, Charlotte, Boston, New York City, San Diego, and Honolulu did not yield results.

Figure B-9 Characteristics of Cities with Tourist-Based Transit

Measure	Seattle	San Francisco	New Orleans	Memphis	Wash. D.C.	Portland
Population	620,778 (2011)	812,825 (2011)	360,740 (2011)	652,050 (2011)	632,323 (2012)	593,820 (2011)
# of Visitors	10.2 M (2012)	16.5 M	9.0 M	10 M	17.9 M	8.1 M
Visitor-Oriented Transit	SLU Streetcar, Route 99	F-line streetcar	3 streetcar lines	3 trolley lines	D.C. Circulator (rubber-tired)	Streetcar
Annual Ridership of Above Services	700,000 (SLU, 2011) 255,000 (Rt 99, 2011)	6.0 M*	8.9 M	1.1 M	5.7 M	4.1 M (FY 2013)
Visitor Share (if known)	11% / 8% of daily boardings	18.3% of visitors rode F-Line	N/A	N/A	N/A	N/A

* Estimated based on 23,449 average daily riders in 2012 (SFMTA, September 2013) and annualization factor of 255.

Seattle

- 10.2 M visitors[2]
- Based on the onboard survey on Metro Route 99, 8% of riders are visitors to Seattle.[3]
- Based on the onboard survey on the South Lake Union Streetcar, 11% of riders are visitors to Seattle.[4]
- Former waterfront streetcar carried about 404,000 trips a year in 2003. After conversion to rubber-tired service and decreased frequency, about 252,000 in 2010 (and 204,000 in 2009). Some commuters weekdays, 400 per day; Saturday 800, Sunday 600.[5]

San Francisco

- 16.5 million visitors.[6] [1]
- 18.3% of visitors rode the F-Line streetcar. "Survey respondents were asked to indicate the modes of transportation they used (or planned to use) while in San Francisco. Four in ten report taking taxis while in the city (38.1%). Other automobile options are popular amongst San Francisco visitors, with 35.1% using a personal car and 14.6% using a rental car. Additionally, the city's public transportation options are being utilized by significant shares of visitors. Over one

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2 Visit Seattle 2013 Annual Report, 2013.

3 South Lake Union Streetcar and Route 99 Onboard Survey, 2013.

4 Ibid.

5 APTA, Streetcar and Heritage Trolley Site, www.heritagetrolley.org/artcileBringBackStreetcars6.htm

6 http://www.sanfrancisco.travel/research/

quarter (27.6%) rode the cable cars, while 22.9 % took MUNI trains and/or buses and 18.3 % rode the F-Line street cars. One in four used BART (26.7%)." [7,8]

- A study of extending the F-Line to Ft. Mason conducted an intercept survey that found 11-14% of current visitors took transit to Fort Mason and 45% of visitors said that they would have taken Muni if the F-line already served Fort Mason. Noting that stated preference surveys are not always predictors of actual behavior, this would represent approximately 675,000 visitors a year (based on 1.5 million visitors to Ft. Mason Center as of 2009), or 1,849 visitors a day. This is higher than predicted by the San Francisco County Travel demand model.[9]
- Based on existing F-Line data, the Ft. Mason EIS found a 139% seasonal maximum daily ridership differential (May vs. June).[10]
- Fisherman's Wharf
- 42% of visitors arrive by transit and 24% by walking [5b – p. 26 of PDF; 2006 visitor survey]; 8.9% take streetcar, i.e., F-Line.[11]
- New York Times: "While the F Line is fast becoming one of San Francisco's most popular tourist attractions, it may turn out to be much more. Day after day, it is reminding visitors of something they may have forgotten: that trolleys are a good way to get around congested cities."[12]

New Orleans

- 9.01 Million visitors in 2012.[13]
- Three streetcar lines: St. Charles, Canal Street, and the Riverfront. Each originates downtown. Streetcars connect to the New Orleans Museum of Art, Bestoff Sculpture Garden, CBD, Jazz and Heritage Festival sites, Fairgrounds Race Track, French Market, Aquarium, and other popular destinations.
- Though the service is popular with tourists, the low-cost and ability to transfer (compared to SF's $6, no transfer fare for the cable car) make NORTA streetcars an integrated part of the transportation system. Additionally, no parallel/ redundant service is available along much of the system.
    - 2011 Streetcar ridership: 8,984,813 unlinked trips (8,984,813/20,634,592= 43.5% of all trips).[14]

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7 http://www.sanfrancisco.travel/media/San-Francisco-Travel-Association-releases-economic-impact-figures-for-2010-and-results-of-year-long-Visitor-Profile-Research.html

8 http://media.sanfrancisco.travel/documents/2010_exec_summary.pdf

9 Fort Mason FEIS, Transit Operations Analysis. http://parkplanning.nps.gov/documentsList.cfm?parkID=303&projectID=15547

10 Ibid.

11 Fisherman's Wharf Public Realm Plan, http://www.sf-planning.org/ftp/CDG/docs/fishermans_wharf/Gehl_Report_P2.pdf

12 Prial, Frank. "New Life for Old Trolleys." http://www.nytimes.com/2001/12/09/travel/new-life-for-old-trolleys.html

13 http://www.neworleanscvb.com/articles/index.cfm?action=view&articleID=7792&menuID=1602

Washington D.C.[15,16]

- 39% of travel was for leisure/recreation
- 10% of respondents were first time riders
- 7% of respondents reside outside of the Washington D.C., Maryland, or Virginia areas

Memphis

- Over 10 million visitors per year to greater Memphis.[17]
- MATA operates a vintage trolley rail system that has "become a part of downtown Memphis culture and is a tourist attraction all on its own." The re-launched trolleys have been operating for 20 years.
- Three trolley lines: the Main Street Line, the Madison Avenue Line, and the Riverfront Line.
- The Trolley lines transport 1.1 million people per year; 259,867 revenue miles, 3 lines, 19 trolleys, 36 stations, 10 route miles of track.[18]
- Memphis notes that it is a tourist attraction on its own and it moves people to different attractions. Convention Center, Sun Studio, Beale Street, National Civil Rights Museum, FedEx Forum, Medical Center, and Historic Arts District. Three trolley lines.

Portland[19,20]

Portland's recently opened Eastside streetcar extension serves the Oregon Museum of Science and Industry, which attracts over 1 million visitors annually. The Streetcar loop project and MAX Orange Line will also serve OMSI starting in 2015. Based on consultation with agency/institution staff, data about current or projected visitor use of these transit services is not available.

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14 http://www.ntdprogram.gov/ntdprogram/pubs/profiles/2011/agency_profiles/6032.pdf

15 Howard University Transportation Safety Data Center, Circulator Survey, Summer 2012, Draft Report.

16 Visitor Statistics, http://washington.org/sites/washington.org/master/files/2011_VisitorStatistics2.pdf

17 http://www.ntdprogram.gov/ntdprogram/pubs/profiles/2011/agency_profiles/4003.pdf

18 http://www.memphischamber.com/Articles/Community/MemphisBraggingRights.aspx

19 http://www.travelportland.com/about-us/research/visitor-statistics-research

20 Oregon 2011 Regional Visitor Report – Greater Portland. http://industry.traveloregon.com/wp-content/uploads/2013/03/OR-Greater-Portland-2011-Final-Report.pdf

Similarities between San Francisco and Seattle

The cities of San Francisco and Seattle are similar in many ways. Geographically, large bodies of water surround both cities – Puget Sound and San Francisco Bay – and both have steep grades in and around the downtown core. In terms of population and economies, both cities have highly educated populations and both cities are considered new economy "high-tech" cities. As for visitor attractions, both cities have instantly recognizable skylines—Seattle: Columbia Seafirst Center and Space Needle; San Francisco: Transamerica Tower and Golden Gate Bridge. Both cities have historic waterfront districts with significant visitor attractions (Fisherman's Wharf and Pike Place Market) that attract millions of visitors each year. Both cities also have major museums and sports arenas/stadiums in downtown for professional NFL, MLS, and MLB teams, which attract local and visitors alike. Finally, in terms of transit service, both cities have robust, multimodal transit systems including Light Rail, Commuter Rail, Bus, Electric Trolley Bus, and Streetcar modes with interconnection between modes, including ferries, at major hubs in downtown. In Seattle, there is the Downtown Seattle Transit Tunnel (DSTT), Westlake Intermodal Hub, King Street Intermodal Hub, and Colman Dock (Washington State Ferry terminal). In San Francisco, there are major downtown subway stations served by BART and MUNI Metro as well as the King Street Caltrain Depot. Also, the Transbay Terminal (major downtown bus transfer facility) in San Francisco is currently being redeveloped into a multimodal Transbay Center that will include an extension of the Caltrain terminal and future high-speed rail terminus. Market Street in San Francisco (as well as parallel streets such as Mission Street) is also a major on-street bus/rail facility comparable to the 3rd Avenue transit way and adjacent downtown bus streets in Seattle. Electric transit modes in both cities take advantage of clean hydroelectric power. And in both cities rail, bus, and electric trolley bus routes need to be designed to operate on steep grades in and around downtown and throughout each city.

San Francisco's F-Market Line

The F-Market Line is an integral part of San Francisco's transportation network. It carries local commuters and tourists alike, and links residential, business, and tourist attractions in San Francisco. The F-Market Line operates between the Castro District in downtown San Francisco and Fisherman's Wharf along Market Street and the Embarcadero. It operates at frequent intervals, at least every 15 minutes and as often as every 6 minutes during daylight hours, for 20 hours per day, seven days a week with standard fares required. Average daily ridership is approximately 23,500 with even higher ridership, approximately 29,000, in the summer tourist season, making it one of the highest ridership streetcar lines in the nation. Based on a yearlong visitor profile research done by the San Francisco Travel Association in 2010/2011, surveys indicate that 18.3% of visitors rode the F-Line while in San Francisco.

Fort Mason Extension

In February 2012, the National Park Service released a Final Environmental Impact Statement (FEIS) to extend the F-Market Line to Fort Mason Center. The preferred alternative (Alternative 2) would add approximately 0.85 miles of streetcar track and construct 8 to 9 station platforms to serve the approximately 1.8 million people who work or attend events at the facility annually. Intercept surveys conducted in support of the Draft Environmental Impact Statement (DEIS) and FEIS found that 11 to 14% of current visitors took transit to Fort Mason and 45% of visitors said that they would have taken MUNI if the F-Market Line already served Ft. Mason.[21]

South Lake Union Streetcar

The South Lake Union streetcar is Seattle's first operating streetcar line since the 1940s. The line is operated by King County Metro and began service between the South Lake Union neighborhood and Downtown Seattle in December 2007. Originally, the line offered 15-minute headways seven days a week. In May 2011, increasing ridership led to the purchase of additional vehicles reducing peak period service to 10-minute headways. Currently a fare of $2.50 is required per trip.

Ridership on the South Lake Union line started slowly but has consistently increased with the redevelopment of South Lake Union. In early 2010, Amazon opened its new campus adjacent to the line in the South Lake Union neighborhood and ridership increased substantially. Ridership is typically higher in the summer months with good weather and tourists, and in June 2012 the line recorded its highest-ever ridership level of 2,812 rides per weekday. Current ridership (2013) is approximately 2,800 to 3,000 riders per day, higher in the summer months.

First Hill Streetcar

In April 2013, construction began on the First Hill Streetcar line. The First Hill line is a 2.5-mile route that will connect Capitol Hill, First Hill, Central Area, Yesler Terrace, the Chinatown International District, and Pioneer Square as well as the serve employment centers, medical centers, Seattle University and Seattle Central Community College, and major sporting event locations at CenturyLink and Safeco Fields. The streetcar will operate with 10 stops along South Jackson Street, 14th Avenue, Yesler Way, and Broadway, between Occidental Avenue in Pioneer Square and Denny Way on Capitol Hill. Service is scheduled to begin in fall 2014.

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[21] Environmental Impact Statement for the Extension of Historic Streetcar Service from Fisherman's Wharf to the San Francisco Maritime National Historic Park and Golden Gate National Recreation Area's Fort Mason Center Task 10 Working Paper Transit operations Plan July 2009

Comparison

Figure B-10 below provides a side-by-side comparison of Seattle and San Francisco in terms of population, visitors, major attractions, hotels, and transit service and ridership in the respective downtowns.

Figure B-10 San Francisco and Seattle Visitor Market Characteristics Comparison

Measure	San Francisco	Seattle
Population (2011)	812,825	620,778
Annual Visitors[1,4]	16,500,000	10,200,000
Daily Visitors	45,205	27,945
Visitor Oriented Transit	F-Line Streetcar	SLU Streetcar/Rt. 99
Frequency of Service	5-10 minute	10-15 min./20-30 min.
Average Daily Streetcar Ridership[7,8]		
Weekday	23,449	2,872 (SLU)/840 (Rt.99)
Saturday	15,194	2,317 (SLU)/390 (Rt.99)
Sunday	17,870	2,146 (SLU)/370 (Rt.99)

Measure	San Francisco	Seattle
Major Attractions within 1/2 mile of Streetcar Line[9,10]	▪ Pier 39 ▪ Alcatraz Island Ferries ▪ San Francisco MOMA ▪ Yerba Buena Gardens ▪ Cont. Jewish Museum of SF ▪ Davies Symphony Hall ▪ War Memorial Opera House ▪ Museum of the African Diaspora ▪ Fort Mason ▪ Ferry Building ▪ Ghirardelli Square ▪ COIT Tower ▪ California Academy of Sciences ▪ The de Young Museum ▪ SF Cable Car Museum ▪ Asian Art Museum of SF ▪ The Exploratorium ▪ Legion of Honor ▪ Moscone Center (Conv. Ctr.)	▪ Pike Place Market ▪ Space Needle ▪ Pacific Science Center ▪ Seattle Aquarium ▪ EMP Museum ▪ Seattle Art Museum ▪ Benaroya Hall ▪ WA. State Conv. Center ▪ Olympic Sculpture Park ▪ 5th Avenue Theatre ▪ The Paramount Theatre ▪ Seattle Childrens Museum ▪ Pacific Northwest Ballet ▪ Showbox at the Market ▪ Showbox SoDo ▪ Seattle Childrens Theatre ▪ Seattle Opera ▪ Seattle Repertory ▪ The Moore Theatre
Number of Hotel Rooms within 1/2 mile of Streetcar Line[6,10]	24,912	11,924
Visitor Streetcar Mode Share[2,3,5]	18.3%	11% SLU/8% Rt.99
Streetcar Visitor Ridership	8,273	See Estimates in Figure B-11

Sources:
(1) http://www.sanfrancisco.travel/research/
(2) http://www.sanfrancisco.travel/media/San-Francisco-Travel-Association-releases-economic-impact-figures-for-2010-and-results-of-year-long-Visitor-Profile-Research.html
(3) http://media.sanfrancisco.travel/documents/2010_exec_summary.pdf
(4) http://www.visitseattle.org/About-Us/Facts-And-Figures.aspx
(5) South Lake Union Streetcar and Route 99 On-Board Survey, June 2013
(6) Seattle: Visit Seattle. SF: San Francisco Planning Dept, Annual Inventory of Large Tourist Hotel Rooms, 2011.
(7) SF: F-Line boardings based on 2008 stop-level data, adjusted to 2012 based on overall 2009-2012 increase in F-Line ridership. Average overall weekday ridership of 23,449 in FY 2012.
(8) King County Metro, 2012

(9) Seattle: Visit Seattle, 2012 Visitor Impact to Seattle/King County. SF: San Francisco Travel Association, 2011.
(10) San Francisco = F-Line and Seattle = SLU/Center City Connector /First Hill Line

Visitor Ridership Estimates

Applying survey-based visitor streetcar mode shares of 10% (Seattle) and 18% (San Francisco) to the number of average daily visitors to Seattle yields a range of 2,800 to 5,000 additional streetcar riders that can be expected from visitors to the city. Figure B-11 summarizes estimated visitor ridership for streetcar in Seattle:

- **Low (existing Seattle streetcar-based mode share):** Applying a survey-based visitor streetcar mode share of 10% to the number of average daily visitors to Seattle yields an estimate of 2,800 streetcar trips by visitors per day. The Seattle visitor streetcar mode share of 10% is an average of the visitor mode share on the South Lake Union Streetcar (11%) and Route 99 (8%), based on a 2013 on-board survey.
- **High (San Francisco-based mode share):** Based on the similarity of Seattle to San Francisco in terms of the visitor attractions, the visitor market and the transit services available, particularly in with the proposed implementation of the Center City Connector providing circulation within downtown and within close proximity to the major attractions, . San Francisco's 18% visitor streetcar mode share was applied to the number of daily visitors to Seattle. This yields an estimate of just over 5,000 additional streetcar trips by visitors per day.

The methodology for developing both the low- and high-end estimates assumes visitors are evenly distributed throughout the year and ignores seasonal fluctuations in the number of visitors, which is typically higher in the summer months and during holidays.

Figure B-11 Seattle Center City Connector -- Visitor Market Analysis

Measure	Low	High
Average Daily Visitors[1]	27,945	
Visitor Streetcar Mode Share [2,3]	10% (SLU/Rt.99 Average)	18.3% (SF F-Market)
Streetcar Visitor Ridership Estimate	**2,795**	**5,030**

Notes/Sources:
(1) http://www.visitseattle.org/About-Us/Facts-And-Figures.aspx
(2) Seattle (low) South Lake Union Streetcar and Route 99 On-Board Survey, June 2013
(3) San Francisco (high): http://www.sanfrancisco.travel/media/San-Francisco-Travel-Association-releases-economic-impact-figures-for-2010-and-results-of-year-long-Visitor-Profile-Research.html; http://media.sanfrancisco.travel/documents/2010_exec_summary.pdf

Limitations/Uncertainties

The above estimates of streetcar ridership with respect to special markets are based on existing data and similar experiences in similar cities throughout the United States. However, there are uncertainties which could affect streetcar ridership positively or negatively thus making it higher or lower depending on the circumstances.

- **Economic Slowdown**. A stall or slowdown in the economic recovery typically lowers household income, which in turn typically results in a slowing of visitor travel as well as attendance to major events.
- **Sport Franchise Longevity**. Although major sports franchises are typically major investments, it is not unheard of for major sports franchises to move to a different city. Seattle itself has experienced this with its former NBA team the Seattle Supersonics, which moved to Oklahoma in 2008. Certainly, the loss of any major sport franchise in Seattle would negatively affect streetcar ridership. However, with recent investments in new, major facilities, it is likely that the major sports franchise currently in Seattle will remain for the long-term.
- **New Facilities/Arenas**. The city of Seattle is currently considering a new Seattle Arena in the SODO area adjacent to CenturyLink Field and Safeco field. The proposed multipurpose sports arena would seat approximately 18,000 to 20,000 people and be home to possibly a new NBA team and/or NHL team. The addition of another sporting venue near the streetcar line would likely add to the attractiveness of the streetcar and other non-auto modes and positively affect ridership.
- **Limited Parking Supply**. Continued limited parking and the potential addition of a Seattle Arena for NBA/NHL games, which currently is not proposing additional parking, is likely to add to attractiveness of streetcar and non-auto modes.

APPENDIX C OPERATING AND MAINTENANCE COST ESTIMATES

This document[1] describes the methodology used to develop an operations plan for the Tier 2 evaluation of alternatives for the Center City Connector. The analysis includes estimates of the total operating and maintenance costs for the Seattle Center City Streetcar System (network) comprised of four segments—South Lake Union (SLU), Center City Connector (CCC), First Hill (FH), and First Hill Broadway Extension—based on considerations such as frequency, travel speed, operating period, etc.

Tier 2 Operating Scenarios

The Center City Connector will connect the South Lake Union Streetcar line with the First Hill Streetcar line. Two operating scenarios were modeled and evaluated in the Tier 2 evaluation.

- **Hub-to-Hub**. Operates as two independent, overlapping lines, as shown in Figure C-1:
  - SLU-King Street Intermodal Hub (”Red”). One line operates between South Lake Union (Fairview & Yale Aves) and the King Street Intermodal Hub.
  - Capitol Hill-Westlake Intermodal Hub (”Blue”). One line operates between Capitol Hill (Broadway & Denny Way) and the Westlake Intermodal Hub.

  Trains on each line arrive as often as every 10 minutes. The lines provide overlapping service between these intermodal hubs in the downtown core along the CCC segment’s preferred alignment (trains arrive as frequently as every 5 minutes in this core area).
- **End-to-End**. Operates as a single integrated line (comprised of SLU, FH, Broadway Extension, and CCC segments) with no transfers, as shown in Figure C-2. Trains arrive as often as every 10 minutes along the integrated line.

The Hub-to-Hub operating scenario was recommended as the preferred operating scenario and is included in the recommended Locally Preferred Alternative (LPA).

[1] Prepared by Shiels Obletz Johnsen (SOJ) and Nelson\Nygaard

Figure C-1 Hub-to-Hub Operating Plan

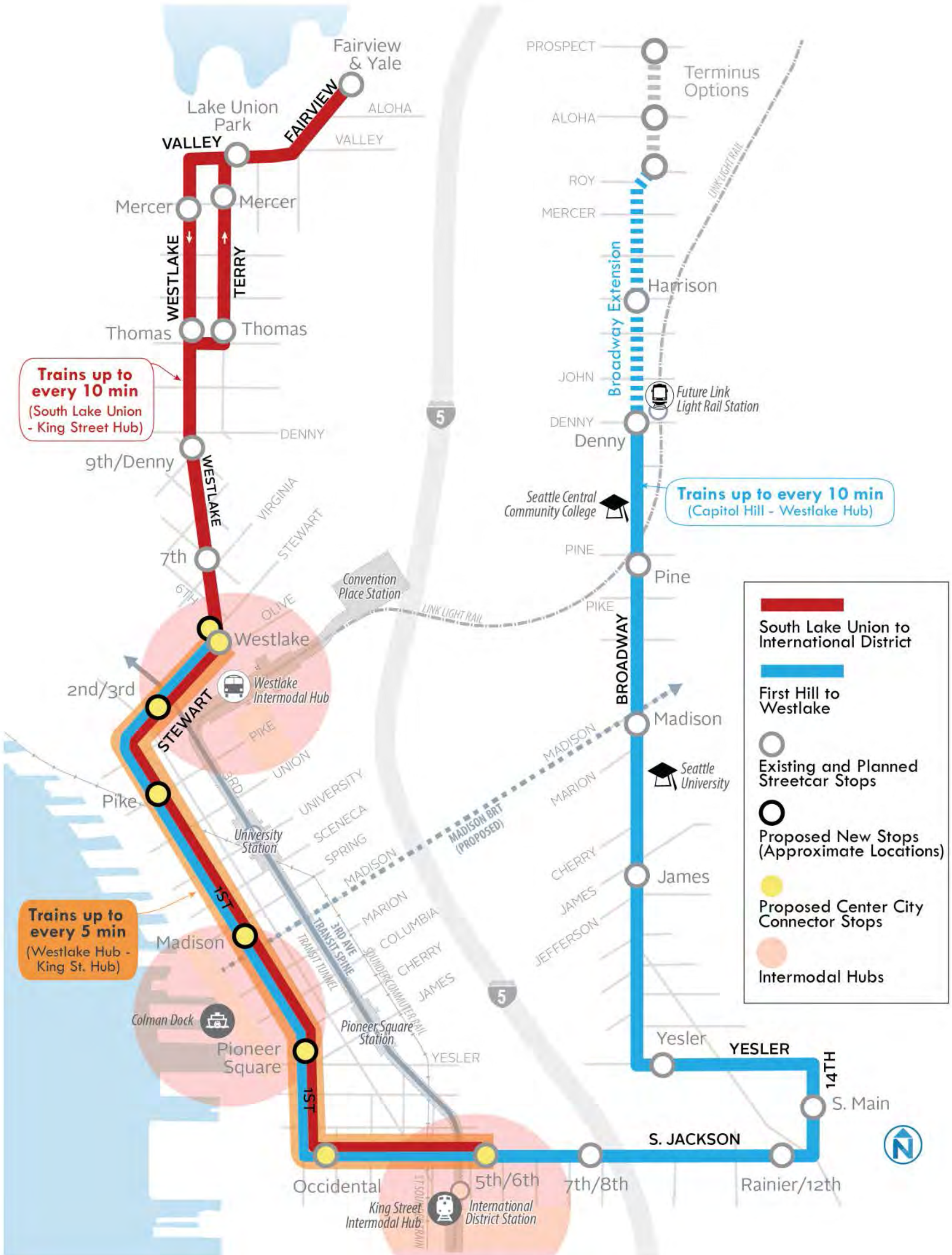
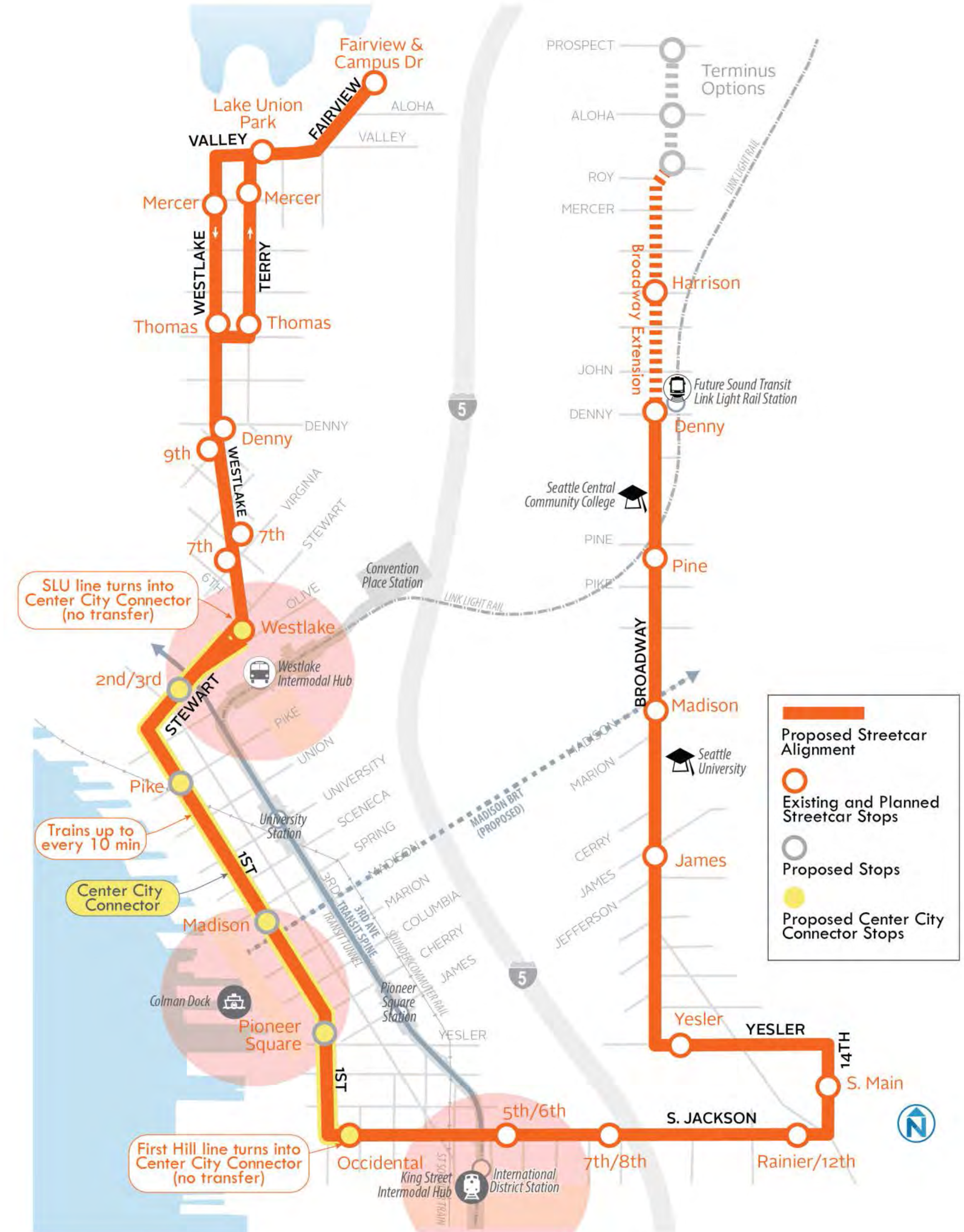


Figure C-2 End-to-End Operating Plan



Tier 2 Operating Assumptions

Figure C-3 provides the detailed operating assumptions (headway and service span) used in the Tier 2 evaluation.

Figure C-3 Tier 2 Service Hours and Headway Assumptions

	Start Time:	End Time:	Headway (Minutes)	Span (Hours)
Weekday	5:00 AM	1:00 AM	Varies	20
Weekday Early Morning	*5:00 AM*	*6:00 AM*	*15*	*1*
Weekday Day/Early Eve	*6:00 AM*	*7:00 PM*	*10*	*13*
Weekday Later Eve	*7:00 PM*	*1:00 AM*	*15**	*6*
Saturday	5:00 AM	1:00 AM	Varies	20
Saturday Early Morning	*5:00 AM*	*8:00 AM*	*15*	*3*
Saturday Day/Early Eve	*8:00 AM*	*7:00 PM*	*10*	*11*
Saturday Later Eve	*7:00 PM*	*1:00 AM*	*15*	*6*
Sunday/Holiday	7:00 AM	11:00 PM	Varies	17
Sunday Early Morning	*6:00 AM*	*8:00 AM*	*15*	*2*
Sunday Day/Early Eve	*8:00 AM*	*7:00 PM*	*10*	*11*
Sunday Later Eve	*7:00 PM*	*11:00 PM*	*15*	*4*
TOTAL HOURS / WEEK				137

Approach and Detailed Methodology

Approach

An operating cost model for the Center City Connector was initially developed for the Tier 1 screening based on the following high-level approach:

- Estimate annual operating cost of SLU, FH, and CCC segments (individually).
- Estimate annual operating cost and characteristics for combined, single-line Streetcar System network comprised of SLU, FH, Broadway Extension and CCC segments.
- Estimate annual operating cost and characteristics for other operating scenarios defined for Tier 1 analysis.

This model was adapted and refined in the Tier 2 evaluation based on the following approach:

- Estimate annual revenue hours and operating cost of the Hub-to-Hub scenario.
- Estimate annual revenue hours and operating cost of the End-to-End operating scenario.
- Model each scenario under a Mixed-Traffic condition (shares travel lane with general purpose traffic and limited signal priority) and under an Exclusive condition (exclusive lanes and traffic signal priority).

Data Inputs and Sources

The following data sources were utilized to develop and refine the operating cost model for the Center City Connector.

Figure C-4 Operating Plan Data Sources

Line	Data	Notes/Source(s)
South Lake Union Streetcar	Historic, current, and projected operating costs	SDOT
	Operating data	SDOT
First Hill Streetcar	Projected operating data	1
Center City Connector	Projected operating speed as modeled for Mixed-Traffic and Exclusive conditions	See Appendices G and H
Integrated System (Hub to Hub or End to End scenarios)		3

Notes: (1) Initially, preliminary operating plans for the First Hill Streetcar (February 2012) were used to develop the operating cost model. It was anticipated that once operating plans are formally established by the City and its operator (King County Metro), they can be used to further refine the Operating Hours and Cost Estimate model; as described in the final section of this Appendix, updated cost projections available following completion of the Tier 2 analysis were used in preparing the Finance Plan for the Center City Connector. (2) Operating Hours and Cost Estimate Model (SOJ).

Detailed Methodology

The operations plan was based upon the distance the streetcar must travel and assumptions with regard to speed of operation. The following are key parameters:

- **Operating Speed**. Traffic analysis conducted for the Tier 2 Evaluation included simulation of Mixed-Traffic and Exclusive Streetcar alternatives. Travel time and operating speed assumptions from the traffic analysis were incorporated into the operations methodology and cost model.

  Vehicles are assumed to operate in mixed-traffic with similar operating speeds as buses, except where the design alternatives indicate otherwise. Operating speed includes dwell time or stopping to board and disembark passengers. Average speeds for streetcar in mixed-traffic range from 5.5 mph to 7.5 mph depending upon the number of stops and volume of passenger load. Peak periods with high traffic and high loads can average as low as 5 mph. The Tier 1 and Tier 2 analysis include consideration of the benefits from priority and "rapid streetcar" type features in achieving desired average speeds. The average operating speed is determined by dividing the distance by the travel time estimated. This is varied depending upon verification of estimated travel times from simulations.
- **Distance**. The distance of the line is used as a base to estimate round trip time. The distance is assumed as one-way distance with the return trip included at the same travel speed. The estimates are for round trip times.
- **Travel Time.** The actual travel time for the streetcar for each route modeled. This is estimated based upon anticipated or modeled operating speeds, and may vary for different priority scenarios.
- **Travel Time + Recovery.** A minimum of 5 minutes is added to the travel time as "recovery" time which allows for the streetcar to make up its schedule. Additional time may be required to assure proper breaks and layover for the operation. Up to an additional 5 minutes or more is included for such layover. The travel time plus recovery is divided by the number of vehicles to determine frequency.
- **Headway**. The number of minutes between vehicles traveling in the same direction, calculated as travel time and recovery divided by number of vehicles operating.
- **Vehicles.** Service headway goals and the end-to-end travel time including recovery determine the required number of vehicles on a line. The existing fleet of vehicles includes three vehicles in operation and one spare (this does not include one additional vehicle that will be funded by Amazon and used to increase peak frequency).
- **Service Span.** The operating assumptions used in the Tier 2 analysis, identified in Figure C-3 above, are similar to the First Hill Streetcar operations plan as of February 2012, but assume an additional 5 weekly service hours. Three service span categories of operation are assumed, with up to 20 daily hours on Weekdays and Saturdays and up to 17 hours on

Sundays and Holidays. The following allocation of service is used to determine the total number of annual revenue hours operated:

- **Early Morning and Evening**. 15-minute headways for 7 daily hours on weekdays, 9 hours on Saturdays, and 6 hours on Sundays and Holidays.
- **Day/Early Evening**. 10-minute headways for 13 hours on weekdays and 11 hours on Saturdays, Sundays, and Holidays.

- **Cost per Hour.** The annual operating and maintenance (O&M) cost per revenue hour is used to estimate the total cost of operations by multiplying the total modeled annual revenue hours by the cost per revenue hour. A cost of $189 (2018 dollars) is assumed, based on updated cost projections for the South Lake Union and First Hill Streetcar lines.[2,3]

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[2] For purposes of the Tier 2 model, as reported at the October 29, 2013 open house, a cost per revenue hour of $200 (2013 dollars) was assumed, based on the existing Seattle South Lake Union Streetcar segment and Tacoma Link (streetcar) as a baseline. An efficiency factor was applied, recognizing that once the First Hill Streetcar segment commences, the ratio of supervision to total operating hours will drop with increased service. The opening of the First Hill segment will more than triple the length of the existing SLU segment. Once the CCC segment service commences, further efficiencies in supervision expense would be anticipated.

[3] Subsequent to the Tier 2 evaluation, an updated operations and maintenance cost estimate was developed for the Center City Connector Funding Options Report based on more recent SDOT and Metro cost projections (including 2014 staffing plans for operators, maintenance support, general administration and management, operating materials & supplies and inspections) that are lower than the initial CCC cost estimates, based on preliminary data, that were used in the Tier 1 and Tier 2 cost analysis. The 2014 cost projections were inflated to an assumed 2018 opening year. The resulting annual O&M cost per revenue hour is approximately $189 in 2018 dollars. Applied to the total modeled annual revenue hours for the recommended Center City Connector LPA with the Hub-to-Hub operating scenario, the estimated annual O&M cost is $14.96M (rounded to $15.0M). This cost estimate was incorporated into the final City Center Connector reports.

Tier 2 Operating and Maintenance Cost Model

The following tables provide Tier 2 operating plan scenarios for the Seattle Center City Streetcar System consisting of the four integrated streetcar segments under the Hub-to-Hub or End-to-End operating scenarios with travel times for Mixed-Traffic or Exclusive operating conditions based on the Tier 2 traffic analysis. Figure C-5 provides a summary of the annual service hours and cost. The total annual revenue hours under each operating scenario was modeled based on the methodology described above. The number of annual revenue hours was multiplied by the cost per revenue hour, yielding an annual O&M cost for each scenario. The total number of vehicles required for each scenario was incorporated into the capital cost for each alternative.

Figure C-5 Operating and Maintenance Cost Summary, 2018 Dollars

Operating Scenario	Operating Condition	Line	Annual Hours	Annual Cost[1]
Hub-to-Hub	Exclusive (Figure C-6)	SLU-King St.	34,424	$6.5 M
		Cap. Hill-SLU	44,668	$8.4 M
		TOTAL	79,092	$15.0 M
	Mixed-Traffic (Figure C-7)	SLU-King St.	39,364	$7.4 M
		Cap. Hill-SLU	48,048	$9.1 M
		TOTAL	87,412	$16.5 M
End-to-End	Exclusive (Figure C-8)	Single Line	63,440	$12.0 M
	Mixed-Traffic (Figure C-9)	Single Line	65,260	$12.3 M

Notes: (1) Assumes $189 cost per revenue hour (2018 dollars).

Figure C-6 Hub to Hub Operating Scenario O&M Cost Model by Segment, Exclusive Condition, 2018 Dollars

(a) South Lake Union to King Street Intermodal Hub (SLU + CCC to King Street) – Hub-to-Hub Exclusive									
	Vehicles	Distance	Travel Time [1]	Time +Recovery	Headway	Hours per week	Annual Hours	Annual Cost [2]	MPH
Weekday Early Morning	4	2.78	49	59	15	5	1,040		6.81
Weekday Peak	6	2.78	50	59	10	15	4,680		6.67
Weekday Day/Early Eve	4	2.78	49	59	15	30	6,240		6.81
Weekday Peak	6	2.78	50	59	10	20	6,240		6.67
Weekday Early Eve	4	2.78	49	59	15	20	4,160		6.81
Weekday Later Eve	4	2.78	49	59	15	10	2,080		6.81
Sat Early Morning	4	2.78	49	59	15	3	624		6.81
Sat Day/Early Eve	6	2.78	49	59	10	11	3,432		6.81
Sat Early Eve	4	2.78	49	59	15	4	832		6.81
Sat Later Eve	4	2.78	49	59	15	2	416		6.81
Sun Early Morning	4	2.78	49	59	15	2	416		6.81
Sun Day/Early Eve	6	2.78	49	59	10	11	3,432		6.81
Sun Early Eve	4	2.78	49	59	15	4	832		6.81
SUB-TOTAL	**6 [a]**					**137**	**34,424**	**$6.5 M**	

Assumptions/Notes: (1) Including spare vehicles. (2) Exclusive-running and/or priority operations. (3) Assumes $189 cost per revenue hour (2018 dollars). (a) Peak vehicle count.

(b) Capitol Hill to Westlake Intermodal Hub (First Hill with Broadway Extension + CCC to Westlake) – Hub-to-Hub Exclusive									
	Vehicles	Distance	Travel Time [1]	Time +Recovery	Headway	Hours per week	Annual Hours	Annual Cost [2]	MPH
Weekday Early Morning	5	4.16	65	73	15	5	1,300		7.68
Weekday Peak	7	4.16	65	73	10	15	5,460		7.68
Weekday Day/Early Eve	7	4.16	65	73	10	30	10,920		7.68
Weekday Peak	7	4.16	65	73	10	20	7,280		7.68
Weekday Early Eve	5	4.16	65	73	15	20	5,200		7.68
Weekday Later Eve	5	4.16	65	73	15	10	2,600		7.68
Sat Early Morning	5	4.16	65	73	15	3	780		7.68
Sat Day/Early Eve	7	4.16	65	73	10	11	4,004		7.68
Sat Early Eve	5	4.16	65	73	15	4	1,040		7.68
Sat Later Eve	5	4.16	65	73	15	2	520		7.68
Sun Early Morning	5	4.16	65	73	15	2	520		7.68
Sun Day/Early Eve	7	4.16	65	73	10	11	4,004		7.68
Sun Early Eve	5	4.16	65	73	15	4	1,040		7.68
SUB-TOTAL	7 [a]					137	44,668	$8.4 M	
TOTAL	13 [a] / 16 [b]					137	79,092	$15.0 M	

Assumptions/Notes: (1) Exclusive-running and/or priority operations. (2) Assumes $189 cost per revenue hour (2018 dollars). (a) Peak vehicle count. (b) Including spare vehicles.

Figure C-7 Hub-to-Hub Operating Scenario O&M Model by Segment, Mixed-Traffic Condition, 2018 Dollars

(a) South Lake Union to King Street Intermodal Hub (SLU + CCC to King Street) – Hub-to-Hub Mixed-Traffic									
	Vehicles	Distance	Travel Time [1]	Time +Recovery	Headway	Hours per week	Annual Hours	Annual Cost [2]	MPH
Weekday Early Morning	4	2.78	55	60	15	5	1,040		6.07
Weekday Peak	7	2.78	61	70	10	15	5,460		5.47
Weekday Day/Early Eve	6	2.78	55	60	10	30	9,360		6.07
Weekday Peak	7	2.78	61	70	10	20	7,280		5.47
Weekday Early Eve	4	2.78	55	60	15	20	4,160		6.07
Weekday Later Eve	4	2.78	55	60	15	10	2,080		6.07
Sat Early Morning	4	2.78	55	60	15	3	624		6.07
Sat Day/Early Eve	6	2.78	55	60	10	11	3,432		6.07
Sat Early Eve	4	2.78	55	60	15	4	832		6.07
Sat Later Eve	4	2.78	55	60	15	2	416		6.07
Sun Early Morning	4	2.78	55	60	15	2	416		6.07
Sun Day/Early Eve	6	2.78	55	60	10	11	3,432		6.07
Sun Early Eve	4	2.78	55	60	15	4	832		6.07
SUB-TOTAL	**7** [a]					**137**	**39,364**	**$7.4M**	

Assumptions/Notes: (1) Including spare vehicles. (2) Mixed-traffic operations. (3) Assumes $189 cost per revenue hour (2018 dollars). (a) Peak vehicle count.

(b) Capitol Hill to Westlake Intermodal Hub (First Hill with Broadway Extension + CCC to Westlake) – Hub-to-Hub Mixed-Traffic									
	Vehicles	Distance	Travel Time [1]	Time +Recovery	Headway	Hours per week	Annual Hours	Annual Cost [2]	MPH
Weekday Early Morning	5	4.16	69	77	15	5	1,300		7.23
Weekday Peak	8	4.16	72	81	10	15	6,240		6.93
Weekday Day/Early Eve	8	4.16	69	79	10	30	12,480		7.23
Weekday Peak	8	4.16	72	81	10	20	8,320		6.93
Weekday Early Eve	5	4.16	69	77	15	20	5,200		7.23
Weekday Later Eve	5	4.16	69	77	15	10	2,600		7.23
Sat Early Morning	5	4.16	69	77	15	3	780		7.23
Sat Day/Early Eve	7	4.16	68	72	10	11	4,004		7.34
Sat Early Eve	5	4.16	69	77	15	4	1,040		7.23
Sat Later Eve	5	4.16	69	77	15	2	520		7.23
Sun Early Morning	5	4.16	69	77	15	2	520		7.23
Sun Day/Early Eve	7	4.16	68	72	10	11	4,004		7.34
Sun Early Eve	5	4.16	69	77	15	4	1,040		7.23
SUB-TOTAL	**8**					**137**	**48,048**	**$9.1M**	
TOTAL	**15 [a] / 18 [b]**					**137**	**87,412**	**$16.5M**	

Assumptions/Notes: (1) Mixed-traffic operations. (2) Assumes $189 cost per revenue hour (2018 dollars). (a) Peak vehicle count. (b) Including spare vehicles.

Figure C-8 End-to-End Operating Scenario O&M Cost Model by Segment, Exclusive Condition, 2018 Dollars

South Lake Union to Capitol Hill (SLU + CCC + First Hill with Broadway Extension) – End-to-End Exclusive									
	Vehicles	Distance	Travel Time [1]	Time +Recovery	Headway	Hours per week	Annual Hours	Annual Cost [2]	MPH
Weekday Early Morning	7	5.46	92	102	15	5	1,820		7.12
Weekday Peak	10	5.46	93	102	10	15	7,800		7.05
Weekday Day/Early Eve	10	5.46	92	102	10	30	15,600		7.12
Weekday Peak	10	5.46	93	102	10	20	10,400		7.05
Weekday Early Eve	7	5.46	92	102	15	20	7,280		7.12
Weekday Later Eve	7	5.46	92	102	15	10	3,640		7.12
Sat Early Morning	7	5.46	92	102	15	3	1,092		7.12
Sat Day/Early Eve	10	5.46	92	102	10	11	5,720		7.12
Sat Early Eve	7	5.46	92	102	15	4	1,456		7.12
Sat Later Eve	7	5.46	92	102	15	2	728		7.12
Sun Early Morning	7	5.46	92	102	15	2	728		7.12
Sun Day/Early Eve	10	5.46	92	102	10	11	5,720		7.12
Sun Early Eve	7	5.46	92	102	15	4	1,456		7.12
TOTAL	**10 [a] / 12 [b]**					**137**	**63,440**	**$12.0M**	

Assumptions/Notes: (1) Including spare vehicles. (2) Exclusive-running or Priority operations. (3) Assumes $200 cost per revenue hour; Tier 2 estimate in 2012 dollars. (a) Peak vehicle count.

Figure C-9 End-to-End Scenario Operating Cost O&M Model by Segment, Mixed-Traffic Condition, 2018 Dollars

South Lake Union to Capitol Hill (SLU + CCC + First Hill with Broadway Extension) – End-to-End Mixed-Traffic									
	Vehicles	Distance	Travel Time [1]	Time +Recovery	Headway	Hours per week	Annual Hours	Annual Cost [2]	MPH
Weekday Early Morning	7	5.46	98	105	15	5	1,820		6.69
Weekday Peak	11	5.46	102	110	10	15	8,580		6.42
Weekday Day/Early Eve	10	5.46	98	103	10	30	15,600		6.69
Weekday Peak	11	5.46	102	110	10	20	11,440		6.42
Weekday Early Eve	7	5.46	98	105	15	20	7,280		6.69
Weekday Later Eve	7	5.46	98	105	15	10	3,640		6.69
Sat Early Morning	7	5.46	98	105	15	3	1,092		6.69
Sat Day/Early Eve	10	5.46	98	103	10	11	5,720		6.69
Sat Early Eve	7	5.46	98	105	15	4	1,456		6.69
Sat Later Eve	7	5.46	98	105	15	2	728		6.69
Sun Early Morning	7	5.46	98	105	15	2	728		6.69
Sun Day/Early Eve	10	5.46	98	103	10	11	5,720		6.69
Sun Early Eve	7	5.46	98	105	15	4	1,456		6.69
SUB-TOTAL	**11 [a] / 14 [b]**					**137**	**65,260**	**$12.3M**	

Assumptions/Notes: (1) Including spare vehicles. (2) Mixed-traffic operations. (3) Assumes $189 cost per revenue hour (2018 dollars). (a) Peak vehicle count.

APPENDIX D PASSENGER LOADING ANALYSIS

Introduction

This document describes an analysis of passenger loading for the Hub-to-Hub streetcar system operating scenario. The purpose of the analysis is to compare projected passenger loads along the Center City Connector (CCC) segment to passenger-carrying capacity, given the planned streetcar operating plan and existing type of vehicle used for the Seattle Streetcar system.

Methodology and Assumptions

Daily Ridership and Streetcar Operating Plan

The analysis is based on projected Center City Streetcar System station-to-station ridership for 2035 (see Appendix A), which identified over 30,000 Project trips (using CCC stops or making through trips). In the Hub-to-Hub operating scenario two streetcar lines provide overlapping service between the King Street and Westlake Intermodal Hubs:

- South Lake Union (SLU) to King Street Intermodal Hub line
- First Hill to Westlake Intermodal Hub line

This analysis categorizes projected 2035 station-station Project trips based on which of the two lines they would be likely to use (Figure D-1). These trips fall into several categories:

- **SLU-only or First Hill-only** trips do not travel on the CCC segment. (SLU-only trips are those starting and ending north of the Westlake stop; First Hill-only trips are those starting and ending east of the stop serving King Street Intermodal Hub, i.e., 5th Avenue/Jackson Street stop).
- **Through trips** traveling between the SLU and First Hill segments would need to transfer between the two lines. A daily round trip is assumed to use one line to pass through the CCC segment in one direction, and the other line through the CCC segment in the return direction. For example, a First Hill to SLU trip would likely pass through the CCC on the First Hill to Westlake line and then transfer to an SLU train. In the return direction, such a trip would use the SLU to King Street line through the CCC segment and then transfer to a First Hill train.
- **SLU to CCC trips** would use the SLU to King Street line.
- **First Hill to CCC** trips would use the First Hill to Westlake line.
- **Hub-to-Hub trips** traveling between King Street and Westlake Intermodal Hubs, including intermediate stops, could take either line.

Figure D-1 Categorized Station-Station Project Trips, 2035

Trip Category (Directional)	Uses SLU to King Street Line	Uses First Hill to Westlake Line	Transfer Required?	TOTAL without Through Trips	TOTAL including Through Trips	Notes
SLU[1]	X			0	0	Does not use CCC segment
First Hill[1]		X		0	0	Does not use CCC segment
SLU to First Hill	X		X	0	368 [a]	Through Trips
First Hill to SLU		X	X	0	368 [a]	Through Trips
Westlake/CCC to First Hill		X		5,536	5,536	Use First Hill-Westlake line
SLU to CCC / King Street	X			2,967	2,967	Use SLU-King Street line
Westlake/CCC to King Street	X	X		21,545	21,545	Could take either line
TOTALS				**30,048**	**30,784**	

Notes: (1) Trips between Westlake Hub, 5th/Jackson, or Occidental/Jackson and new CCC stops are included in the CCC totals. (a) Not included in current version of STOPS Table 6.01 (detailed stop activity). Summary total split between the lines as each would be used for the first leg of the through trip in each direction.

Source: STOPS 2035 Model Run, Table 6.01: Avg Weekday Station Utilization by Project Trips

Based on this categorization, these trips were allocated to either the South Lake Union to King Street line or the First Hill to Westlake line (Figure D-2). This analysis indicates that passenger demand is likely to be slightly higher on the First Hill to Westlake line—about 16,700 boardings compared to just over 14,000 on the SLU to King Street line.

Figure D-2 Categorized Station-Station Project Trips

Line	Daily Boardings
SLU to King Street Line (SLU+CCC)	14,108
First Hill to Westlake Line (First Hill+CCC)	16,677
TOTAL	**30,784**

Maximum Loading Point

However, based on the above categorization of Project trips and station-station ridership projections from the STOPS model (see Appendix A), the highest passenger demand at a particular stop would occur on the SLU to King Street Station line. The Madison/Spring stop is projected to be the maximum loading point on either line. The capacity analysis determined that:

- About 5,587 daily passengers could be boarding, alighting, or traveling through the Madison/Spring stop on the SLU to King Street Station line.
- About 4,775 daily passengers could be boarding, alighting, or traveling through the Madison/Spring stop on the First Hill to Westlake line.

Time-of-Day Distribution

It is not yet known how ridership for the Center City Connector will be distributed throughout the day.[1] Project trips by time-of-day at the maximum loading point was estimated for each line based on the time distribution of riders on the existing South Lake Union Streetcar and the San Francisco (SF) F-Market line. [2] Figure D-3 provides the percentage of total daily riders by time-of-day, peaking at about 10% (AM) and 11% (PM) for the existing SLU Streetcar and at nearly 9% for the SF F-Market line.

[1] The STOPS ridership model provides average weekday daily ridership.

[2] As discussed in Appendix B, San Francisco's F-line line was identified as a peer serving both commuter and a visitor/tourist market, comparable to the travel markets that the Center City Connector is likely to serve in Seattle. In addition, the Center City Connector would also serve the special event market, which is not accounted for in the STOPS model projections and would generate high peak ridership demand. Appendix B of the Detailed Evaluation Report discusses both visitor and special event markets.

Figure D-3 Estimated Ridership Time-of-Day Distribution, 2035 Project Trips at Madison/Spring Stop by Time of Day

	Time-of-Day Percentages		SLU to King Street Line Project Trips		First Hill to Westlake Line Project Trips	
Hour	SLU %	SF F-Line %	Based on SLU	Based on F-Line	Based on SLU	Based on F-Line
5 AM	0.4%	0.5%	20	27	17	23
6 AM	2.9%	1.5%	162	82	139	70
7 AM	8.1%	4.3%	452	242	386	206
8 AM	9.9%	4.3%	551	242	471	206
9 AM	7.0%	5.1%	389	284	333	243
10 AM	4.2%	6.7%	236	374	202	319
11 AM	5.3%	6.7%	297	374	254	319
12 PM	6.6%	6.7%	369	374	316	319
1 PM	5.5%	6.7%	310	374	265	319
2 PM	6.3%	7.9%	353	442	302	377
3 PM	6.7%	7.9%	377	442	322	377
4 PM	11.1%	8.7%	618	486	528	415
5 PM	8.4%	8.7%	467	486	399	415
6 PM	4.1%	7.1%	231	396	197	338
7 PM	3.6%	4.4%	200	245	171	209
8 PM	3.2%	4.4%	179	245	153	209
9 PM	2.8%	4.4%	156	245	134	209
10 PM	2.2%	2.1%	123	115	105	98
11 PM	1.4%	1.4%	78	81	67	69
12 AM	0.4%	0.6%	20	35	17	30
TOTAL	**100%**	**100%**	**5,588**	**5,587**	**4,775**	**4,774**

Source: Time-of-day allocations based on boarding data by stop from South Lake Union Streetcar Onboard Survey, 2013, and San Francisco F-Market Line On-Board Survey, 2008.

Figure D-4 and Figure D-5 illustrate the two time distributions applied to projected daily riders at the maximum load point on the SLU to King Street and First Hill to Westlake lines, respectively. In each graphic, the distribution based on the SLU line is characterized by morning and late afternoon peaks (dashed red line) while the distribution based on the F-Market line (solid red) is characterized by more level all-day ridership, with an afternoon peak running from about 4 PM to 6 PM.

Figure D-4 Estimated Ridership Time-of-Day Distribution, Madison/Spring Stop, SLU to King Street Line (Hub-to-Hub Operating Scenario), 2035

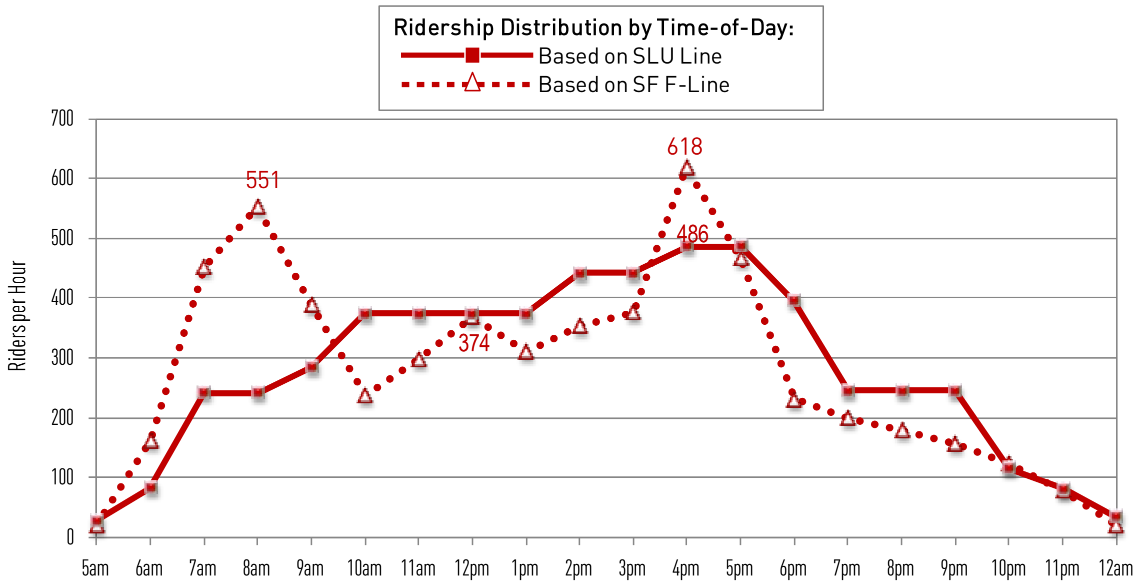
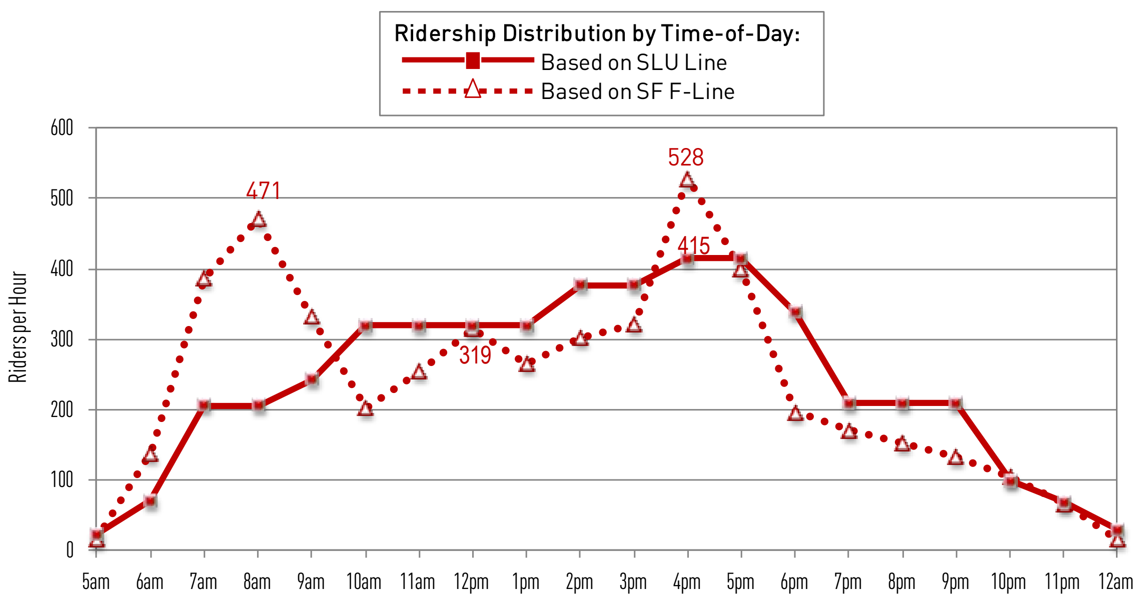


Figure D-5 Estimated Ridership Time-of-Day Distribution, Madison/Spring Stop, First Hill to Westlake Line (Hub-to-Hub Operating Scenario), 2035



Passenger Capacity Results

This section compares estimated passenger load at the projected maximum load point (Madison/Spring stop) to passenger-carrying capacity per line per direction. Passenger-carrying capacity is based on the Hub-to-Hub streetcar operating plan (10-minute headways per line between 6 AM and 7 PM, or 5-minute headways between King Street and Westlake Intermodal Hubs) and the existing streetcar vehicle type used on the SLU and First Hill lines. The graphics in this section illustrate both seated passenger capacity (29 passengers; thin blue line) and a range of comfortable passenger capacity including standees, shown with a thick blue band.

Streetcars are designed to accommodate standing passengers and many trips on streetcar are short and well-suited to standing, particularly in the Center City Connector segment. Acceptable capacity with standees is assumed to be a range between 50 to 75% of “crush” passenger load, or about 80 to 120 passengers.[3] Overcrowded streetcars impact the efficiency of passenger loading and off-loading and may cause passengers to choose an alternate travel option. This point is certainly higher than 50% of crush load, which is a comfortable carrying capacity, but may be lower than 75% of crush load.

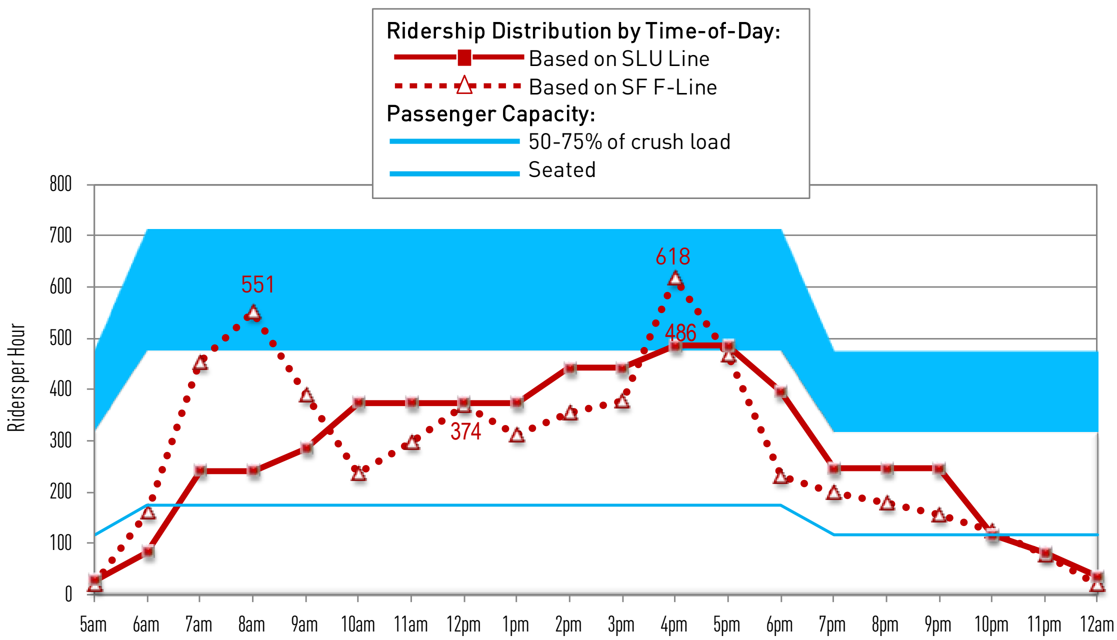
[3] Based on an assumed crush load of 159 passengers.

South Lake Union to King Street Line (SLU + CCC)

The capacity analysis described above determined that about 5,587 daily passengers could be boarding, alighting, or traveling through the Madison/Spring stop on the SLU to King Street Station line. The time of day distribution of ridership at this point was estimated based on the existing South Lake Union Streetcar (dashed red) and the San Francisco F-Market Line (solid red). As described above, the thin blue line indicates seated capacity and the thick blue band indicates a range of acceptable capacity including standing passengers. Figure D-6 illustrates that:

- Based on both time-of-day distributions, ridership exceeds seated capacity of the current type of streetcar vehicle (thin blue line) at nearly all times of the day.
- The peaks of both time-of-day distributions reach or are within the 50 to 75% of crush load range.

Figure D-6 Passenger Capacity Analysis, South Lake Union to King Street Station Line (Hub-to-Hub Operating Scenario), 2035

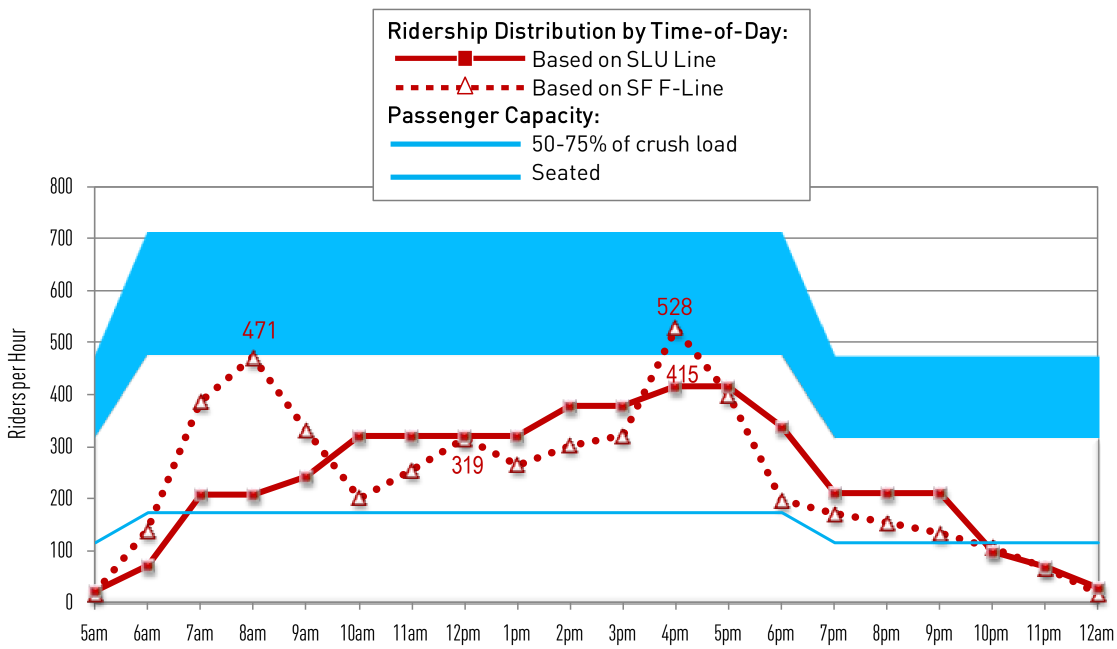


First Hill to Westlake Line (First Hill + CCC)

The capacity analysis described above determined that about 4,775 daily passengers could be boarding, alighting, or traveling through the Madison/Spring stop on the First Hill to Westlake line. As described above, the time of day distribution of ridership at this point was estimated based on the existing South Lake Union Streetcar (dashed red) and the San Francisco F-Market Line (solid red). The thin blue line indicates seated capacity and the thick blue band indicates a range of acceptable capacity including standing passengers. Figure D-7 illustrates that:

- Based on both time-of-day distributions, ridership exceeds seated capacity of standard streetcar vehicles (thin blue line) at nearly all times of the day.
- The morning peak of the SLU time-of-day distributions reaches the 50% of crush load level and the afternoon peak is within the 50 to 75% range; the afternoon peak of the F-Line time-of-day distribution approaches but does not exceed 50% of crush load.

Figure D-7 Passenger Capacity Analysis, First Hill to Westlake Line (Hub-to-Hub Operating Scenario), 2035



APPENDIX E CAPITAL COST ESTIMATES AND METHODOLOGY

Note: This appendix provides detailed capital cost estimation methodology and supplements the evaluation results that are provided in Chapter 7 of the Detailed Evaluation Report.[1]

Tier 2 Estimates

This methodology provide capital cost estimates and cost categories consistent with the FTA's Standard Cost Categories (SCC), and is formatted to be useful as the project progresses into more detailed design in preliminary engineering and final design.

Format

This methodology uses a modified Construction Specifications Institute (CSI) format that allows development of comparative cost estimates suitable for an Alternatives Analysis. The capital cost estimates developed in this format are ordered and summarized into major cost categories consistent with FTA 5309 New Starts Criteria and appropriate to the level of project definition. Cost categories can be expanded or reduced as needed to provide appropriate levels of detail.

Estimate Development

Estimates of project capital costs were developed in three general steps under this methodology. First, potential alignment alternatives identified during initial screening and scoping were defined in enough detail to enable the necessary analysis and conceptual engineering to be performed for cost estimating purposes. Second, project components, consistent with the application of unit costs and appropriate to the level of definition, were identified. Quantities and appropriate unit cost data were then be developed. The capital costs were then summarized in the various cost categories and for each alternative.

Unit Costs

Unit costs were developed from selected historical data including final engineer's estimates, completed projects, First Hill Streetcar bid information from 2012, Portland Streetcar Loop bid information from 2009, and standard estimating practices. Unit costs may include an aggregation of cost elements that are typically itemized in a detailed engineer's estimate. For example, the unit cost for the track construction includes such activities as excavation, soil

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[1] Prepared by URS

preparation, aggregate base, and rail procurement. Unit costs also include allowances for contractor's margins such as overhead, profit and insurance costs.

Cost Categories

Cost categories were used to summarize the project component costs into a comprehensive total estimate for each alternative. The major cost categories are listed in Figure E-1 below and described in detail in the "Project Cost Categories" section below.

Figure E-1 Major Cost Categories

Trackwork	Traffic Control and Lighting
Stops	Right of Way Allowance
Support Facilities	Vehicle Storage and Turnback Facilities
Site Work and Special Conditions	Professional Services
Systems	Contingency
Public Utility Relocation Allowance	Vehicles

Fixed facility categories, e.g. Stop Platforms, encompass site-specific project component costs. Capital costs for these categories are typically calculated by using known unit costs and measured quantities for each component. System-wide costs, e.g. trackwork, are calculated on an alignment length instead of from measured quantities. Route-foot or track-foot unit costs were developed from historical data to apply to the length of each section.

The engineering, administration and contingency categories are dependent on the fixed facility and system-wide cost categories. The sum of the categories listed above is the total capital cost estimate for each alignment option.

Management of Costs

Project costs can often be underestimated in the early planning stages and costs tend to grow as project development progresses. The methodology employed in the Center City AA includes measures to guard against the underestimation of project costs and attempt to reduce this problem. Measures applied included comparing unit costs to historical unit cost bid estimates and construction costs for comparable work, and identifying the specific year-of-expenditure.

Cost Data Sources

The sources of data used to develop unit costs must be suitable for the type of work, local conditions and scale of the work proposed for the Project. Historical competitive bid data for comparable work is a reliable source. Recent information is the most reliable because it relies less on escalation assumptions. Contract as-built prices are the most comprehensive sources because they include the total cost of construction at project closeout and acceptance. This methodology employed recent cost information; typically contractors bid information or engineer's estimates for the First Hill Streetcar project and other recent projects in Seattle and the Pacific Northwest.

Project Cost Categories

This section describes each of the major capital cost categories that were used to assemble the estimates, together with specific assumptions.

Trackwork – This category includes capital costs for procurement and installation of tracks, track slab, special trackwork, crossovers, turnouts, track crossings, welding, track drains and other miscellaneous track items. Embedded trackwork is assumed as the project standard consisting of girder rail with electrical isolation embedded in a concrete slab and located in an existing traffic lane. The type of trackwork to be used in later phases of design may vary depending on funding sources and availability of materials. Measurement of embedded trackway is on a track-foot basis. Measurement of special trackwork is per individual unit, e.g. per turnout or crossing.

Stops – This category includes the capital costs for fixed facilities and amenities for streetcar stops. The capital costs for stops include platforms, shelters, lighting, signage, landscaping, furnishings and sidewalks for pedestrian access. The following types of stops were measured by this methodology: side loading (incorporated into the sidewalk), center loading (in the roadway median), and special platform (usually with architectural upgrades). This category also includes an allowance to convert the existing 1st and Jackson stop from single-sided loading to double-sided. Measurement is for each complete stop platform. It is assumed that stops and amenities will be similar to South Lake Union and First Hill Streetcar stops. Consistent with cost estimates for the First Hill Streetcar, shelters are designed and constructed ready to install real-time information displays; the displays are assumed to be provided and installed by SDOT.

> Appendix R provides a sample design specification for a South Lake Union streetcar shelter.

Support Facilities – This category includes an allowance for expansion of vehicle storage facilities, assumed to be two new tracks to store a maximum of four streetcar vehicles at either one of the existing maintenance facility sites. Measurement is by the lump sum with cost based on historic costs of similar facilities. Associated right of way costs are presented separately, below.

Site Work and Special Conditions – This category includes the capital costs for infrastructure improvements necessary for each alignment alternative as well as trackway enhancements, temporary traffic control, and some of the costs associated with construction administration. System wide items estimated by the track-foot include allowances for road, curb, driveway, sidewalk, and pole foundation construction, and an allowance for anticipated costs related to modifying existing areaways (sidewalk vaults). This allowance includes overhead catenary system (OCS) pole installation; using areaway mapping from SDOT, proposed stop locations were not sited on identified areaways. Lump sums are included for mobilization, general conditions, landscaping, exclusive guideway treatments and temporary traffic control. Unit costs were based on recent projects and SDOT comments.

Systems – This category includes capital costs for the systems providing electrical power to streetcar vehicles as well as train control and signals, and fare collection. Based on the length of the track alignment it was assumed that two traction power substations would be required. It was also assumed that suitable locations for the substations exist within the public right of way and therefore purchase of real estate will not be required. The overhead catenary system (OCS) was estimated per track-foot based on recent costs of similar facilities. OCS pole foundations are included in the Site Work category. A lump sum allowance for relocating OCS for the existing electric trolley bus line on 1st Avenue was developed through discussions with SDOT; additional refinement of these costs will be conducted in the next study phase. Train control systems were included for track crossovers at Westlake/6th and Jackson/Occidental, with costs per each based on recent costs for similar systems. SDOT provided a unit cost for platform based ticket vending machines based on existing equipment.

Utility Coordination Allowance – This lump sum allowance is intended to cover project costs for coordination of public and private utility relocation and modification work as required by streetcar system infrastructure. The unit cost was provided by SDOT.

Traffic Control and Lighting – This category includes modifications to roadway signals and signing and striping to accommodate streetcar operations. For each signalized intersection along the alignment a lump sum cost was assigned based on one of four anticipated signal treatments; add new signal (to existing unsignalized intersection), modify existing signal (expand or upgrade equipment), add new signal phase to existing signal, or add new pedestrian signal. Allowances for anticipated improvements to roadway lighting, signing and striping were included, with measurement on a track-foot basis. Costs include transit signal priority (TSP) equipment.

Right of Way Allowance – This category includes the costs for acquisition of additional property to allow for construction of vehicle storage tracks. Expansion of storage tracks at either existing maintenance facility site would displace the existing or future use of that land. The right of way allowance assumes purchase of an as-yet unidentified property to accommodate the displaced use. The lump sum cost was developed in discussions with SDOT, and contingency was not applied to it in the estimate.

Vehicle Storage and Turnback Facilities – The preferred streetcar operations scenario assumes that the existing South Lake Union and First Hill Lines will overlap, providing more frequent service on the proposed Center City Connector Line. This scenario requires that new turnback facilities be constructed on the existing lines. For this analysis the preferred turnback facilities were located on Jackson at 10th Avenue and on Westlake at 6th Avenue. Costs would be similar at other feasible locations. Estimated costs for this category include crossovers and storage tracks for two vehicles at both locations, and associated roadway reconstruction and signal systems. Costs were based on historic costs of similar facilities.

Appendix R provides conceptual drawings of storage and turnback facilities.

Professional Services – This category includes the costs for engineering, administration and construction management services. Costs for these services are based on a percentage of the total cost of all direct capital cost categories. Cost items assumed for this category are as follows:

Figure E-2 Professional Services Cost Assumptions

Cost Category	Cost Assumption
Preliminary Engineering	4%
Final Design	6%
Project Management for Design Construction	4.5%
Construction Administration and Management	4%
Insurance	2%
Legal (permits and review fees by other agencies, cities, etc.)	2%
Survey, Testing, Investigation, Inspection	2%
Start-Up Costs and Agency Force Account Work	0.5%

The total percentage applied to all capital cost categories except contingencies is 25%. Percentages were based on recent projects and SDOT comments.

Contingency – This cost category accounts for the uncertainties inherent in project definition and conceptual design at the alternatives analysis phase. A contingency is added to the project cost as a percentage of all the capital cost categories except Right of Way and Professional Services. Contingency costs are calculated as twenty (20) percent for all capital costs. Contingency should reflect the degree of risk associated with the level of design detail available and the characteristics of the design component. The contingency for future design stages will be reduced as the design process progresses.

Vehicles – This category includes capital costs for procuring new streetcar vehicles compatible with the existing streetcar system and the needs identified for this project. It was assumed that the vehicles will be Buy-America compliant. The number of vehicles for each alignment option is based on the proposed operating plans. The unit cost (per each) was provided by SDOT and is based on recent vehicle procurement experience.

Capital Cost Summary

Comparative cost estimates (opinions of cost) for each option are presented in Figure E-3.

Figure E-3 Capital Cost Estimate Summary, 2013 Dollars, and Escalated to 2017

Capital Cost Elements	Mixed-Traffic Streetcar	Exclusive Streetcar
Costs Not Including Vehicles		
Trackwork	$9,610,000	$9,610,000
Platforms	$1,730,000	$1,730,000
Support Facilities (Storage Tracks)	$1,780,000	$1,780,000
Sitework and Special Conditions	$20,580,000	$21,760,000
Systems	$10,670,000	$10,670,000
Traffic Control and Lighting	$3,610,000	$3,770,000
Utility Coordination Allowance	$500,000	$500,000
Storage @ Westlake/6th for Overlapping Service	$3,360,000	$3,360,000
Turnback @ Jackson/10th for Overlapping Service	$2,270,000	$2,270,000
SUBTOTAL	**$54,110,000**	**$55,450,000**
12% ESCALATION, 2013 - 2017	$6,490,000	$6,650,000
TOTAL NOT INCLUDING VEHICLES	**$60,600,000**	**$62,100,000**
Costs Including Right-of-Way (ROW)		
Right-of-Way (Land for Storage Tracks)	$10,000,000	$10,000,000
TOTAL INCLUDING RIGHT-OF-WAY	**$70,600,000**	**$72,100,000**
Costs Including Vehicles (Hub-to-Hub Operations)		
New Hybrid Vehicles @ $4.5M Each	8	6
Replacement Hybrid Vehicles for Non-Hybrid SLU Vehicles @ $3.0M Each (Net)	3	3
TOTAL VEHICLE COSTS	**$45,000,000**	**$36,000,000**
TOTAL INCLUDING VEHICLES AND ROW	**$115,600,000**	**$108,100,000**

Detailed Capital Costs

Figure E-4 and Figure E-5 provide more detailed cost breakdowns for the Mixed-Traffic and Exclusive Streetcar alternatives. They do not include the utility coordination, additional vehicle turnback and storage, or cost escalation.

Figure E-6 and Figure E-7 provide more detailed cost breakdowns for additional vehicle storage and turnbacks at Westlake and on Jackson Street, required to support the Hub-to-Hub operating scenario. Figure E-8 provides a more detailed cost breakdown of maintenance facility expansion costs.

Figure E-4 Detailed Capital Costs, Mixed-Traffic Alternative (Not Including Vehicles, Westlake/Jackson Storage/Turnbacks, Utility Coordination, or Escalation to 2017), 2013 Dollars

		Seattle Center City Connector Streetcar Project											
			Seattle, WA		Outbound Alignment				Inbound AlignmentAlignment				
			Order of Magnitude Opinion of Cost		Start Sta	End Sta	Length		Start Sta	End Sta	Length		
			Summary Mixed Traffic Option (Westlake to 1st and Jackson)		0+00	66+38	6,638 TF		0+00	63+71	6,371 TF	13,009 TF	1st Quarter
							1.26 TK-mile				1.21 TK-mile	1.23 Rt-mile	2013$
URS Line NO.	**Base**	**Code**	**Description**	**Quantity**	**Unit**	**Unit Cost**	**Extension**	**E&A %**	**E&A**	**Cont%**	**Unallocated Contingency**	**Detail Total**	**Summary Total**
10.0	**TRACKWORK**												$9,611,155
10.1		10.02	Embedded Trackway Southbound	6,638	TF	$462	$3,066,756	29%	$874,025	20%	$613,351	$4,554,133	
10.2		10.02	Embedded Trackway Northbound	6,371	TF	$462	$2,943,402	29%	$838,870	20%	$588,680	$4,370,952	
10.3		10.12	Track Crossing	0	EA	$157,500	$0	29%	$0	20%	$0	$0	
10.4		10.12	Turnout	2	EA	$231,000	$462,000	29%	$131,670	20%	$92,400	$686,070	
10.5		10.12	Switch Heater	0	EA	$10,000	$0	29%	$0	20%	$0	$0	
20.0	**PLATFORMS**							29%					$1,727,055
20.1		20.01	Side Loading	1	PR	$136,500	$136,500	29%	$38,903	20%	$27,300	$202,703	
20.2		20.01	Center Loading	5	EA	$157,500	$787,500	29%	$224,438	20%	$157,500	$1,169,438	
20.3		20.01	Allowance to Modify Occidental Platform	1	LS	$50,000	$50,000	29%	$14,250	20%	$10,000	$74,250	
20.4		20.01	Special Platform (Pioneer Square)	1	EA	$189,000	$189,000	29%	$53,865	20%	$37,800	$280,665	
30.0	**SUPPORT FACILITIES**												$1,782,000
30.1		30.05	Allowance for Expansion of Storage Tracks	1	LS	$1,200,000	$1,200,000	29%	$342,000	20%	$240,000	$1,782,000	
40.0	**SITE WORK AND SPECIAL CONDITIONS**												$20,582,152
40.1		40.08	Mobilization	1	LS	$1,027,011	$1,027,011	29%	$292,698	20%	$205,402	$1,525,111	
40.2		40.08	Specified General Conditions	1	LS	$1,283,763	$1,283,763	29%	$365,873	20%	$256,753	$1,906,389	
40.3		40.08	Reimbursible General Conditions	1	LS	$2,567,527	$2,567,527	29%	$731,745	20%	$513,505	$3,812,777	
40.4		40.06	Allowance for Areaway Treatments	13,009	TF	$40	$520,360	29%	$148,303	20%	$104,072	$772,735	
40.5		40.07	Road Construction Allowance	13,009	TF	$341	$4,439,321	29%	$1,265,207	20%	$887,864	$6,592,392	
40.6		40.06	Sidewalk, Driveway and Curb Allowance	13,009	TF	$117	$1,522,053	29%	$433,785	20%	$304,411	$2,260,249	
40.7		40.01	Remove Existing Trolley Track	0	TF	$0	$0	29%	$0	20%	$0	$0	
40.8		40.07	Major Street Reconstruction Allowance	0	LS	$500,000	$0	29%	$0	20%	$0	$0	
40.9		40.06	Landscaping Allowance	1	LS	$500,000	$500,000	29%	$142,500	20%	$100,000	$742,500	
40.10		40.06	Allowance for exclusive guideway treatments	0	LS	$650,000	$0	29%	$0	20%	$0	$0	
40.11		40.08	Allowance for Temporary Traffic Control	1	LS	$2,000,000	$2,000,000	29%	$570,000	20%	$400,000	$2,970,000	
50.0	**SYSTEMS**												$10,672,510
50.1		50.03	Traction Power Substations (TPSS)	2	EA	$735,000	$1,470,000	29%	$418,950	20%	$294,000	$2,182,950	
50.2		50.04	Trolley-Bus Catenary Modifications Allowance	0	LS	$750,000	$0	29%	$0	20%	$0	$0	
		50.04	Metro ETB Relocation Allowance	1	LS	$2,500,000	$2,500,000	0%		20%	$500,000	$3,000,000	
50.3		50.04	OCS including Catenary	13,009	TF	$242	$3,141,674	29%	$895,377	20%	$628,335	$4,665,385	
50.4		50.01	Train Control System	2	EA	$157,500	$315,000	29%	$89,775	20%	$63,000	$467,775	
50.5		50.02	Allowance for Platform Fare Collection	8	EA	$30,000	$240,000	29%	$68,400	20%	$48,000	$356,400	
90.0	**TRAFFIC CONTROL AND LIGHTING**												$3,611,077
90.1		50.02	New Traffic Signal	0	EA	$168,000	$0	29%	$0	20%	$0	$0	
90.2		50.02	New Ped-only	0	EA	$100,000	$0	29%	$0	20%	$0	$0	
90.3		50.02	Modify Existing Traffic Signal	3	EA	$109,000	$327,000	29%	$93,195	20%	$65,400	$485,595	
90.4		50.02	Add Transit Phase	10	EA	$109,000	$1,090,000	29%	$310,650	20%	$218,000	$1,618,650	
90.5		50.02	Signing and Striping Alowance	13,009	TF	$28	$364,252	29%	$103,812	20%	$72,850	$540,914	
90.6		50.02	Lighting Allowance	13,009	TF	$50	$650,450	29%	$185,378	20%	$130,090	$965,918	
60.0	**RIGHT OF WAY**												$10,000,000
60.1		60.01	Allowance for Land for Vehicle Storage	1	LS	$10,000,000	$10,000,000	0%	$0	0%	$0	$10,000,000	
	SUBTOTAL						$42,793,569		$8,633,667		$6,558,714	$57,985,949	**$57,985,949**
100.0	**VEHICLES**												$0
100.1		70.01	Vehicles, Hybrid, incl. SLU Replacements	0	EA	$4,500,000	$0	10%	$0	20%	$0	$0	
	TOTAL 2013$						$42,793,569		$8,633,667		$6,558,714	$57,985,949	**$57,985,949**
	Professional Services												
		80.01	Preliminary Engineering			4.0%	$1,211,743						
		80.02	Final Design			6.0%	$1,817,614						
		80.03	Project Management for Design and Construction			6.0%	$1,817,614						
		80.04	Construction Administration & Management			6.0%	$1,817,614						
		80.05	Insurance			2.0%	$605,871						
		80.06	Legal; Permits;Review Fees by other agencies, cities, etc.			2.0%	$605,871						
		80.07	Surveys, Testing, Investigation, Inspection			2.0%	$605,871						
		80.08	Start-up Costs & Agency Force Account Work			0.5%	$151,468						
						28.5%	$8,482,199						
	Contingency												
		90.01	Unallocated Contingency				$6,558,714						

Figure E-5 Detailed Capital Costs, Exclusive Alternative (Not Including Vehicles, Westlake/Jackson Storage/Turnbacks, Utility Coordination, or Escalation to 2018) 2013 Dollars

		Seattle Center City Connector Streetcar Project											
			Seattle, WA		Outbound Alignment				Inbound AlignmentAlignment				
			Order of Magnitude Opinion of Cost		Start Sta	End Sta	Length		Start Sta	End Sta	Length		
			Summary Exclusive Option (Westlake to 1st and Jackson)		0+00	66+38	6,638 TF		0+00	63+71	6,371 TF	13,009 TF	1st Quarter
							1.26 TK-mile				1.21 TK-mile	1.23 Rt-mile	2013$
URS Line NO.	**Base**	**Code**	**Description**	**Quantity**	**Unit**	**Unit Cost**	**Extension**	**E&A %**	**E&A**	**Cont%**	**Unallocated Contingency**	**Detail Total**	**Summary Total**
10.0	**TRACKWORK**												$9,611,155
10.1		10.02	Embedded Trackway Southbound	6,638	TF	$462	$3,066,756	29%	$874,025	20%	$613,351	$4,554,133	
10.2		10.02	Embedded Trackway Northbound	6,371	TF	$462	$2,943,402	29%	$838,870	20%	$588,680	$4,370,952	
10.3		10.12	Track Crossing	0	EA	$157,500	$0	29%	$0	20%	$0	$0	
10.4		10.12	Turnout	2	EA	$231,000	$462,000	29%	$131,670	20%	$92,400	$686,070	
10.5		10.12	Switch Heater	0	EA	$10,000	$0	29%	$0	20%	$0	$0	
20.0	**PLATFORMS**							29%					$1,727,055
20.1		20.01	Side Loading	1	PR	$136,500	$136,500	29%	$38,903	20%	$27,300	$202,703	
20.2		20.01	Center Loading	5	EA	$157,500	$787,500	29%	$224,438	20%	$157,500	$1,169,438	
20.3		20.01	Allowance to Modify Occidental Platform	1	LS	$50,000	$50,000	29%	$14,250	20%	$10,000	$74,250	
20.4		20.01	Special Platform (Pioneer Square)	1	EA	$189,000	$189,000	29%	$53,865	20%	$37,800	$280,665	
30.0	**SUPPORT FACILITIES**												$1,782,000
30.1		30.05	Allowance for Expansion of Storage Tracks	1	LS	$1,200,000	$1,200,000	29%	$342,000	20%	$240,000	$1,782,000	
40.0	**SITE WORK AND SPECIAL CONDITIONS**												$21,761,554
40.1		40.08	Mobilization	1	LS	$1,057,371	$1,057,371	29%	$301,351	20%	$211,474	$1,570,196	
40.2		40.08	Specified General Conditions	1	LS	$1,321,713	$1,321,713	29%	$376,688	20%	$264,343	$1,962,744	
40.3		40.08	Reimbursible General Conditions	1	LS	$2,643,427	$2,643,427	29%	$753,377	20%	$528,685	$3,925,489	
40.4		40.06	Allowance for Areaway Treatments	13,009	TF	$40	$520,360	29%	$148,303	20%	$104,072	$772,735	
40.5		40.07	Road Construction Allowance	13,009	TF	$341	$4,439,321	29%	$1,265,207	20%	$887,864	$6,592,392	
40.6		40.06	Sidewalk, Driveway and Curb Allowance	13,009	TF	$117	$1,522,053	29%	$433,785	20%	$304,411	$2,260,249	
40.7		40.01	Remove Existing Trolley Track	0	TF	$0	$0	29%	$0	20%	$0	$0	
40.8		40.07	Major Street Reconstruction Allowance	0	LS	$500,000	$0	29%	$0	20%	$0	$0	
40.9		40.06	Landscaping Allowance	1	LS	$500,000	$500,000	29%	$142,500	20%	$100,000	$742,500	
40.10		40.06	Allowance for exclusive guideway treatments	1	LS	$650,000	$650,000	29%	$185,250	20%	$130,000	$965,250	
40.11		40.08	Allowance for Temporary Traffic Control	1	LS	$2,000,000	$2,000,000	29%	$570,000	20%	$400,000	$2,970,000	
50.0	**SYSTEMS**												$10,672,510
50.1		50.03	Traction Power Substations (TPSS)	2	EA	$735,000	$1,470,000	29%	$418,950	20%	$294,000	$2,182,950	
50.2		50.04	Trolley-Bus Catenary Modifications Allowance	0	LS	$750,000	$0	29%	$0	20%	$0	$0	
		50.04	Metro ETB Relocation Allowance	1	LS	$2,500,000	$2,500,000	0%		20%	$500,000	$3,000,000	
50.3		50.04	OCS including Catenary	13,009	TF	$242	$3,141,674	29%	$895,377	20%	$628,335	$4,665,385	
50.4		50.01	Train Control System	2	EA	$157,500	$315,000	29%	$89,775	20%	$63,000	$467,775	
50.5		50.02	Allowance for Platform Fare Collection	8	EA	$30,000	$240,000	29%	$68,400	20%	$48,000	$356,400	
90.0	**TRAFFIC CONTROL AND LIGHTING**												$3,772,942
90.1		50.02	New Traffic Signal	0	EA	$168,000	$0	29%	$0	20%	$0	$0	
90.2		50.02	New Ped-only	0	EA	$100,000	$0	29%	$0	20%	$0	$0	
90.3		50.02	Modify Existing Traffic Signal	7	EA	$109,000	$763,000	29%	$217,455	20%	$152,600	$1,133,055	
90.4		50.02	Add Transit Phase	7	EA	$109,000	$763,000	29%	$217,455	20%	$152,600	$1,133,055	
90.5		50.02	Signing and Striping Alowance	13,009	TF	$28	$364,252	29%	$103,812	20%	$72,850	$540,914	
90.6		50.02	Lighting Allowance	13,009	TF	$50	$650,450	29%	$185,378	20%	$130,090	$965,918	
60.0	**RIGHT OF WAY**												$10,000,000
60.1		60.01	Allowance for Land for Vehicle Storage	1	LS	$10,000,000	$10,000,000	0%	$0	0%	$0	$10,000,000	
	SUBTOTAL						$43,696,779		$8,891,082		$6,739,356	$59,327,216	**$59,327,216**
100.0	**VEHICLES**												$0
100.1		70.01	Vehicles, Hybrid, incl. SLU Replacements	0	EA	$4,500,000	$0	10%	$0	20%	$0	$0	
	TOTAL 2013$								$8,891,082		$6,739,356	$59,327,216	**$59,327,216**
	Professional Services												
		80.01	Preliminary Engineering			4.0%	$1,247,871						
		80.02	Final Design			6.0%	$1,871,807						
		80.03	Project Management for Design and Construction			6.0%	$1,871,807						
		80.04	Construction Administration & Management			6.0%	$1,871,807						
		80.05	Insurance			2.0%	$623,936						
		80.06	Legal; Permits;Review Fees by other agencies, cities, etc.			2.0%	$623,936						
		80.07	Surveys, Testing, Investigation, Inspection			2.0%	$623,936						
		80.08	Start-up Costs & Agency Force Account Work			0.5%	$155,984						
						28.5%	$8,735,098						
	Contingency												
		90.01	Unallocated Contingency				$6,739,356						

Figure E-6 Detailed Capital Costs, Westlake, 2013 Dollars (Before Escalation)

URS Line NO.	Base	Code	Description	Quantity	Unit	Unit Cost	Extension	E&A %	E&A	Cont%	Unallocated Contingency	Detail Total	Summary Total
		Seattle Center City Connector Streetcar Project											
			Seattle, WA		Outbound Alignment				Inbound AlignmentAlignment				
			Order of Magnitude Estimate		Start Sta	End Sta	Length		Start Sta	End Sta	Length		
			Summary Westlake Pocket Track (Modern)		0+00	7+00	700 TF		0+00	0+00	0 TF	700 TF	1st Quarter
							0.13 TK-mile				0.00 TK-mile	0.07 Rt-mile	2013$
10.0	TRACKWORK												$1,473,780
10.1		10.02	Embedded Trackway Southbound	700	TF	$462	$323,400	25%	$80,850	20%	$64,680	$468,930	
10.2		10.02	Embedded Trackway Northbound		TF	$462	$0	25%	$0	20%	$0	$0	
10.3		10.12	Track Crossing		EA	$157,500	$0	25%	$0	20%	$0	$0	
10.4		10.12	Turnout	3	EA	$231,000	$693,000	25%	$173,250	20%	$138,600	$1,004,850	
10.5		10.12	Switch Heater		EA	$10,000	$0	25%	$0	20%	$0	$0	
20.0	PLATFORMS							25%					$0
20.1		20.01	Side Loading		PR	$136,500	$0	25%	$0	20%	$0	$0	
20.2		20.01	Center Loading		EA	$157,500	$0	25%	$0	20%	$0	$0	
20.3		20.01	Allowance to Modify Occidental Platform		LS	$50,000	$0	25%	$0	20%	$0	$0	
20.4		20.01	Special Platform (Pioneer Square)		EA	$189,000	$0	25%	$0	20%	$0	$0	
30.0	SUPPORT FACILITIES												$0
30.1		30.05	Allowance for Expansion of Storage Tracks		LS	$1,200,000	$0	25%	$0	20%	$0	$0	
40.0	SITE WORK AND SPECIAL CONDITIONS												$985,187
40.1		40.08	Mobilization	1	LS	$72,891	$72,891	25%	$18,223	20%	$14,578	$105,692	
40.2		40.08	Specified General Conditions	1	LS	$91,114	$91,114	25%	$22,778	20%	$18,223	$132,115	
40.3		40.08	Reimbursible General Conditions	1	LS	$182,228	$182,228	25%	$45,557	20%	$36,446	$264,230	
40.4		40.06	Allowance for Areaway Treatments		TF	$40	$0	25%	$0	20%	$0	$0	
40.5		40.07	Road Construction Allowance	500	TF	$341	$170,625	25%	$42,656	20%	$34,125	$247,406	
40.6		40.06	Sidewalk, Driveway and Curb Allowance	400	TF	$42	$16,800	25%	$4,200	20%	$3,360	$24,360	
40.7		40.01	Remove Existing Trolley Track		TF	$0	$0	25%	$0	20%	$0	$0	
40.8		40.07	Major Street Reconstruction Allowance		LS	$500,000	$0	25%	$0	20%	$0	$0	
40.9		40.06	Landscaping Allowance		LS	$100,000	$0	25%	$0	20%	$0	$0	
40.10		40.06	Allowance for Unidentified Scope		LS	$500,000	$0	25%	$0	20%	$0	$0	
40.11		40.08	Temporary Traffic Control	1	LS	$145,782	$145,782	25%	$36,446	20%	$29,156	$211,384	
50.0	SYSTEMS												$631,838
50.1		50.03	Traction Power Substations (TPSS)		EA	$735,000	$0	25%	$0	20%	$0	$0	
50.2		50.04	Trolley-Bus Catenary Modifications Allowance		TF	$30	$0	25%	$0	20%	$0	$0	
50.3		50.04	OCS including Catenary	500	TF	$242	$120,750	25%	$30,188	20%	$24,150	$175,088	
50.4		50.01	Train Control System	2	EA	$157,500	$315,000	25%	$78,750	20%	$63,000	$456,750	
80.0	UTILITIES												$0
80.1		40.02	Parallel Water <12" dia		LF	$270	$0	25%	$0	20%	$0	$0	
90.0	TRAFFIC CONTROL AND LIGHTING												$264,915
90.1		50.02	New Traffic Signal		EA	$168,000	$0	25%	$0	20%	$0	$0	
90.2		50.02	New Ped-only		EA	$100,000	$0	25%	$0	20%	$0	$0	
90.3		50.02	Modify Existing Traffic Signal		EA	$84,000	$0	25%	$0	20%	$0	$0	
90.4		50.02	Add Transit Phase	2	EA	$84,000	$168,000	25%	$42,000	20%	$33,600	$243,600	
90.5		50.02	Signing and Striping Alowance	700	TF	$21	$14,700	25%	$3,675	20%	$2,940	$21,315	
90.6		50.02	Lighting Allowance		TF	$11	$0	25%	$0	20%	$0	$0	
60.0	RIGHT OF WAY												$0
100.0	VEHICLES												$0
100.1		70.01	Vehicles, Hybrid, incl. SLU Replacements		EA	$4,500,000	$0	10%	$0	20%	$0	$0	
	TOTAL 2013$								$578,572		$462,858	$3,355,719	$3,355,719
	Professional Services												
		80.01	Preliminary Engineering			4.0%	$92,572						
		80.02	Final Design			6.0%	$138,857						
		80.03	Project Management for Design and Construction			4.5%	$104,143						
		80.04	Construction Administration & Management			4.0%	$92,572						
		80.05	Insurance			2.0%	$46,286						
		80.06	Legal; Permits;Review Fees by other agencies, cities, etc.			2.0%	$46,286						
		80.07	Surveys, Testing, Investigation, Inspection			2.0%	$46,286						
		80.08	Start-up Costs & Agency Force Account Work			0.5%	$11,571						
						25.0%	$567,001						
	Contingency												
		90.01	Unallocated Contingency				$462,858						

Figure E-7 Detailed Capital Costs, Jackson, 2013 Dollars (Before Escalation)

		Seattle Center City Connector Streetcar Project											
			Seattle, WA		Outbound Alignment				Inbound AlignmentAlignment				
			Order of Magnitude Estimate		Start Sta	End Sta	Length		Start Sta	End Sta	Length		
			Summary Jackson/6th Turnback		0+00	0+00	0 TF		0+00	0+00	0 TF	0 TF	1st Quarter
							0.00 TK-mile				0.00 TK-mile	0.00 Rt-mile	2013$
URS Line NO.	Base	Code	Description	Quantity	Unit	Unit Cost	Extension	E&A %	E&A	Cont%	Unallocated Contingency	Detail Total	Summary Total
10.0	TRACKWORK												$0
10.1		10.02	Embedded Trackway Southbound		TF	$462	$0	25%	$0	20%	$0	$0	
10.2		10.02	Embedded Trackway Northbound		TF	$462	$0	25%	$0	20%	$0	$0	
10.3		10.12	Track Crossing		EA	$157,500	$0	25%	$0	20%	$0	$0	
10.4		10.12	Turnout		EA	$231,000	$0	25%	$0	20%	$0	$0	
10.5		10.12	Switch Heater		EA	$10,000	$0	25%	$0	20%	$0	$0	
20.0	PLATFORMS							25%					$0
20.1		20.01	Side Loading		PR	$136,500	$0	25%	$0	20%	$0	$0	
20.2		20.01	Center Loading		EA	$157,500	$0	25%	$0	20%	$0	$0	
20.3		20.01	Allowance to Modify Occidental Platform		LS	$50,000	$0	25%	$0	20%	$0	$0	
20.4		20.01	Special Platform (Pioneer Square)		EA	$189,000	$0	25%	$0	20%	$0	$0	
30.0	SUPPORT FACILITIES												$0
30.1		30.05	Allowance for Expansion of Storage Tracks		LS	$1,200,000	$0	25%	$0	20%	$0	$0	
40.0	SITE WORK AND SPECIAL CONDITIONS												$0
40.1		40.08	Mobilization		LS	$0	$0	25%	$0	20%	$0	$0	
40.2		40.08	Specified General Conditions		LS	$0	$0	25%	$0	20%	$0	$0	
40.3		40.08	Reimbursible General Conditions		LS	$0	$0	25%	$0	20%	$0	$0	
40.4		40.06	Allowance for Areaway Treatments		TF	$40	$0	25%	$0	20%	$0	$0	
40.5		40.07	Road Construction Allowance		TF	$341	$0	25%	$0	20%	$0	$0	
40.6		40.06	Sidewalk, Driveway and Curb Allowance		TF	$42	$0	25%	$0	20%	$0	$0	
40.7		40.01	Remove Existing Trolley Track		TF	$0	$0	25%	$0	20%	$0	$0	
40.8		40.07	Major Street Reconstruction Allowance		LS	$500,000	$0	25%	$0	20%	$0	$0	
40.9		40.06	Landscaping Allowance		LS	$100,000	$0	25%	$0	20%	$0	$0	
40.10		40.06	Allowance for Unidentified Scope		LS	$500,000	$0	25%	$0	20%	$0	$0	
40.11		40.08	Temporary Traffic Control		LS	$0	$0	25%	$0	20%	$0	$0	
50.0	SYSTEMS												$0
50.1		50.03	Traction Power Substations (TPSS)		EA	$735,000	$0	25%	$0	20%	$0	$0	
50.2		50.04	Trolley-Bus Catenary Modifications Allowance		TF	$30	$0	25%	$0	20%	$0	$0	
50.3		50.04	OCS including Catenary		TF	$242	$0	25%	$0	20%	$0	$0	
50.4		50.01	Train Control System		EA	$157,500	$0	25%	$0	20%	$0	$0	
80.0	UTILITIES												$0
80.1		40.02	Parallel Water <12" dia		LF	$270	$0	25%	$0	20%	$0	$0	
90.0	TRAFFIC CONTROL AND LIGHTING												$0
90.1		50.02	New Traffic Signal		EA	$168,000	$0	25%	$0	20%	$0	$0	
90.2		50.02	New Ped-only		EA	$100,000	$0	25%	$0	20%	$0	$0	
90.3		50.02	Modify Existing Traffic Signal		EA	$84,000	$0	25%	$0	20%	$0	$0	
90.4		50.02	Add Transit Phase		EA	$84,000	$0	25%	$0	20%	$0	$0	
90.5		50.02	Signing and Striping Alowance		TF	$21	$0	25%	$0	20%	$0	$0	
90.6		50.02	Lighting Allowance		TF	$11	$0	25%	$0	20%	$0	$0	
60.0	RIGHT OF WAY												$0
100.0	VEHICLES												$0
100.1		70.01	Vehicles, Hybrid, incl. SLU Replacements		EA	$4,500,000	$0	10%	$0	20%	$0	$0	
	TOTAL 2013$								$0		$0	$0	**$0**
	Professional Services												
		80.01	Preliminary Engineering			4.0%	$0						
		80.02	Final Design			6.0%	$0						
		80.03	Project Management for Design and Construction			4.5%	$0						
		80.04	Construction Administration & Management			4.0%	$0						
		80.05	Insurance			2.0%	$0						
		80.06	Legal; Permits;Review Fees by other agencies, cities, etc.			2.0%	$0						
		80.07	Surveys, Testing, Investigation, Inspection			2.0%	$0						
		80.08	Start-up Costs & Agency Force Account Work			0.5%	$0						
						25.0%	$0						
	Contingency												
		90.01	Unallocated Contingency				$0						

Figure E-8 Detailed Capital Costs, Maintenance Facility Expansion, 2013 Dollars (Before Escalation)

		Seattle Center City Connector Streetcar Project											
			Seattle, WA		Outbound Alignment				Inbound AlignmentAlignment				
			Order of Magnitude Estimate		Start Sta	End Sta	Length		Start Sta	End Sta	Length		
			Summary MF Storage Tracks (2 tracks for 4 vehicles)		0+00	6+00	600 TF		0+00	0+00	0 TF	600 TF	1st Quarter
							0.11 TK-mile				0.00 TK-mile	0.06 Rt-mile	2013$
URS Line NO.	**Base**	**Code**	**Description**	**Quantity**	**Unit**	**Unit Cost**	**Extension**	**E&A %**	**E&A**	**Cont%**	**Unallocated Contingency**	**Detail Total**	**Summary Total**
10.0	**TRACKWORK**												$1,071,840
10.1		10.02	Embedded Trackway Southbound	600	TF	$462	$277,200	25%	$69,300	20%	$55,440	$401,940	
10.2		10.02	Embedded Trackway Northbound		TF	$462	$0	25%	$0	20%	$0	$0	
10.3		10.12	Track Crossing		EA	$157,500	$0	25%	$0	20%	$0	$0	
10.4		10.12	Turnout	2	EA	$231,000	$462,000	25%	$115,500	20%	$92,400	$669,900	
10.5		10.12	Switch Heater		EA	$10,000	$0	25%	$0	20%	$0	$0	
20.0	**PLATFORMS**							25%					$0
20.1		20.01	Side Loading		PR	$136,500	$0	25%	$0	20%	$0	$0	
20.2		20.01	Center Loading		EA	$157,500	$0	25%	$0	20%	$0	$0	
20.3		20.01	Allowance to Modify Occidental Platform		LS	$50,000	$0	25%	$0	20%	$0	$0	
20.4		20.01	Special Platform (Pioneer Square)		EA	$189,000	$0	25%	$0	20%	$0	$0	
30.0	**SUPPORT FACILITIES**												$0
30.1		30.05	Allowance for Expansion of Storage Tracks		LS	$1,200,000	$0	25%	$0	20%	$0	$0	
40.0	**SITE WORK AND SPECIAL CONDITIONS**												$508,089
40.1		40.08	Mobilization	1	LS	$41,496	$41,496	25%	$10,374	20%	$8,299	$60,169	
40.2		40.08	Specified General Conditions	1	LS	$51,870	$51,870	25%	$12,968	20%	$10,374	$75,212	
40.3		40.08	Reimbursible General Conditions	1	LS	$103,740	$103,740	25%	$25,935	20%	$20,748	$150,423	
40.4		40.06	Allowance for Areaway Treatments		TF	$40	$0	25%	$0	20%	$0	$0	
40.5		40.07	Road Construction Allowance	400	TF	$341	$136,500	25%	$34,125	20%	$27,300	$197,925	
40.6		40.06	Sidewalk, Driveway and Curb Allowance	400	TF	$42	$16,800	25%	$4,200	20%	$3,360	$24,360	
40.7		40.01	Remove Existing Trolley Track		TF	$0	$0	25%	$0	20%	$0	$0	
40.8		40.07	Major Street Reconstruction Allowance		LS	$500,000	$0	25%	$0	20%	$0	$0	
40.9		40.06	Landscaping Allowance		LS	$100,000	$0	25%	$0	20%	$0	$0	
40.10		40.06	Allowance for Unidentified Scope		LS	$500,000	$0	25%	$0	20%	$0	$0	
40.11		40.08	Temporary Traffic Control		LS	$82,992	$0	25%	$0	20%	$0	$0	
50.0	**SYSTEMS**												$210,105
50.1		50.03	Traction Power Substations (TPSS)		EA	$735,000	$0	25%	$0	20%	$0	$0	
50.2		50.04	Trolley-Bus Catenary Modifications Allowance		TF	$30	$0	25%	$0	20%	$0	$0	
50.3		50.04	OCS including Catenary	600	TF	$242	$144,900	25%	$36,225	20%	$28,980	$210,105	
50.4		50.01	Train Control System		EA	$157,500	$0	25%	$0	20%	$0	$0	
80.0	**UTILITIES**												$0
80.1		40.02	Parallel Water <12" dia		LF	$270	$0	25%	$0	20%	$0	$0	
90.0	**TRAFFIC CONTROL AND LIGHTING**												$0
90.1		50.02	New Traffic Signal		EA	$168,000	$0	25%	$0	20%	$0	$0	
90.2		50.02	New Ped-only		EA	$100,000	$0	25%	$0	20%	$0	$0	
90.3		50.02	Modify Existing Traffic Signal		EA	$84,000	$0	25%	$0	20%	$0	$0	
90.4		50.02	Add Transit Phase		EA	$84,000	$0	25%	$0	20%	$0	$0	
90.5		50.02	Signing and Striping Alowance		TF	$21	$0	25%	$0	20%	$0	$0	
90.6		50.02	Lighting Allowance		TF	$11	$0	25%	$0	20%	$0	$0	
60.0	**RIGHT OF WAY**												$0
100.0	**VEHICLES**												$0
100.1		70.01	Vehicles, Hybrid, incl. SLU Replacements		EA	$4,500,000	$0	10%	$0	20%	$0	$0	
	TOTAL 2013$								$308,627		$246,901	$1,790,034	**$1,790,034**
	Professional Services												
		80.01	Preliminary Engineering			4.0%	$49,380						
		80.02	Final Design			6.0%	$74,070						
		80.03	Project Management for Design and Construction			4.5%	$55,553						
		80.04	Construction Administration & Management			4.0%	$49,380						
		80.05	Insurance			2.0%	$24,690						
		80.06	Legal; Permits;Review Fees by other agencies, cities, etc.			2.0%	$24,690						
		80.07	Surveys, Testing, Investigation, Inspection			2.0%	$24,690						
		80.08	Start-up Costs & Agency Force Account Work			0.5%	$6,173						
						25.0%	$302,454						
	Contingency												
		90.01	Unallocated Contingency				$246,901						

APPENDIX F UNDERGROUND UTILITY IMPACTS ASSESSMENT

This appendix[1] provides additional details on utility impacts including order-of-magnitude costs.

Note: The costs identified in this appendix are not included in the Center City Connector Tier 2 capital cost estimate provided in the Detailed Evaluation Report, Chapter 7 and Appendix E. Utilities are required to relocate utility infrastructure for transportation projects at their own expense; public utility costs will be budgeted for in Seattle Public Utilities (SPU) and Seattle City Light (SCL) capital improvement plans.

Summary of Costs

Figure F-1 summarizes utility impacts for the Mixed-Traffic and Exclusive Streetcar alternatives and provides estimated order-of-magnitude costs for comparative purposes. A more detailed analysis will be required to estimate actual construction costs. Utility impacts will be more fully examined during the environmental/preliminary engineering phases of the project.

[1] Prepared by URS

Figure F-1 Preliminary Utility Impacts Assessment Summary

	Mixed Use Option					Exclusive Option				
	Qty	Unit	Unit Cost	Extension	Summary	Qty	Unit	Unit Cost	Extension	Summary
WATER					**$2,016,629**					**$1,177,102**
Distribution Main	681	LF	$220	$149,857		608	LF	$220	$133,846	
Feeder Main	4,667	LF	$400	$1,866,772		2,608	LF	$400	$1,043,256	
SEWER					**$1,389,248**					**$2,009,638**
18" VC	519	LF	$480	$249,048		1,012	LF	$480	$485,688	
24" DIP and RCP	597	LF	$520	$310,440		128	LF	$520	$66,560	
30" Detention Lateral	82	LF	$600	$49,200		0	LF	$600	$0	
33" RCP	0	LF	$580	$0		580	LF	$580	$336,400	
24" RCP w/ 48" Stl Case	605	LF	$750	$453,750		720	LF	$750	$540,000	
48" Brick	213	LF	$1,000	$212,850		462	LF	$1,000	$461,850	
Manhole/Structure	22	EA	$5,180	$113,960		23	EA	$5,180	$119,140	
ELECTRIC					**$1,724,282**					**$1,833,281**
Lines	5,011	LF	$310	$1,553,342		5,312	LF	$310	$1,646,801	
Manhole/Structure	33	EA	$5,180	$170,940		36	EA	$5,180	$186,480	
GAS					**$1,565,173**					**$910,377**
2" IP	458	LF	$350	$160,325		458	LF	$350	$160,325	
4" IP	3,512	LF	$400	$1,404,848		1,875	LF	$400	$750,052	
STEAM					**$1,720,628**					**$1,612,939**
8" Low Pressure	653	LF	$900	$587,727		696	LF	$900	$625,968	
10" Low Pressure	578	LF	$1,000	$577,520		424	LF	$1,000	$423,590	
12" Low Pressure	207	LF	$1,100	$227,381		207	LF	$1,100	$227,381	
Manhole/Structure	41	EA	$8,000	$328,000		42	EA	$8,000	$336,000	
FIBER OPTIC COMM					**$503,275**					**$370,250**
Lines	1,007	LF	$500	$503,275		741	LF	$500	$370,250	
TOTAL					**$8,919,235**					**$7,913,586**

*Notes: Preliminary alignments and GIS data were used for this analysis. A utility was considered impacted if the edge of the pipe or duct was within 8 feet of the proposed track center line.
Parallel utilities and vaults were quantified, crossing utilities were not.
This order-of-magnitude estimate is intended only for comparison of potential alignment options.
A more detailed analysis will be necessary for estimating construction costs.

Assessment Details

A tabular listing and map of the identified utility impacts is provided for each segment of the proposed alignment along 1st Avenue as well as east-west connections between 1st Avenue and Westlake.

Underground utility impacts were quantified using GIS-level mapping provided by SPU, SCL, Puget Sound Energy (PSE), and Seattle Steam. The utility mapping was overlaid on conceptual alignment layout maps. For purposes of comparison it was assumed that parallel utilities, structures and manholes within 8 feet of the track alignment center lines were considered impacted. Crossing utilities were not quantified because they can typically remain in place under streetcar tracks.

On the utility maps the 16-foot wide "utility impact zone" is shown with dashed lines. Color coding for existing utility lines is as follows:

- Red – Electrical (SCL)
- Green – Storm and Sanitary Sewer
- Blue – Water
- Yellow – Natural Gas (PSE)
- Pink – Seattle Steam

Order-of-magnitude unit costs were developed using cost data from recent local utility construction projects and information provided by utility representatives.

Alignment Segment	Table	Map
1st Avenue		
Stewart to University Streets	Figure F-2	Figure F-3
University to Columbia Streets	Figure F-4	Figure F-5
Columbia to Jackson Streets	Figure F-6	Figure F-7
East-West Connections		
Stewart Street, Westlake to 1st Avenues	Figure F-8	Figure F-9
Pike/Pine Streets, 1st to 6th Avenues	N/A	Figure F-10

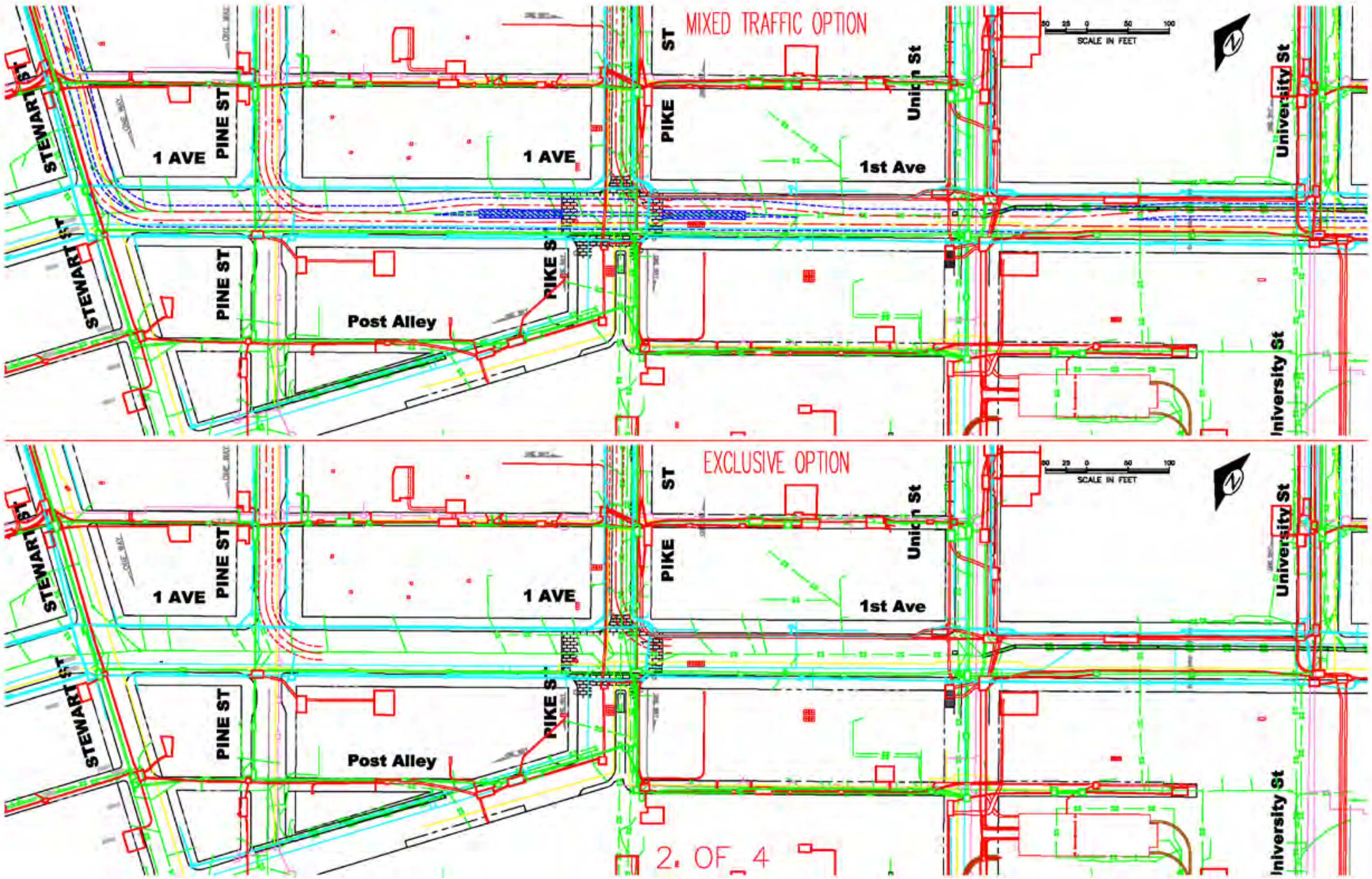
1st Avenue Alignment

Stewart to University Streets

Figure F-2 Preliminary Utility Impacts Assessment, 1st Avenue, Stewart to University Streets (Table)

	Mixed Use Option			Exclusive Option		
Utility Type	SB	NB	Size/Notes	SB	NB	Size/Notes
Water - SPU						
- Lines (LF)	1165	163	feeder main	790	291	feeder main
- Structures (EA)						
Sewer - SPU						
- Lines (LF)	166	714	12" VC and DIP	420	475	12" VC and DIP
- Lines (LF)	0	265	24" RCP w/ 48" Stl Case	0	380	24" RCP w/ 48" Stl Case
- Structures (EA)	2	6	manhole	2	5	manhole
Electric - SCL						
- Lines (LF)	587	0		43	0	
- Structures (EA)	2	0		2	2	
Gas - PSE						
- Lines (LF)	933	15	4" IP	459	15	4" IP
- Structures (EA)						
Steam - Seattle Steam						
- Lines (LF)	0	0		0	0	
- Structures (EA)	1	0	vault	1	0	vault
Fiber Optic - PSE						
- Lines (LF)	0	0		0	0	
- Structures (EA)						

Figure F-3 Preliminary Utility Impacts Assessment, 1st Avenue, Stewart to University Streets (Map)

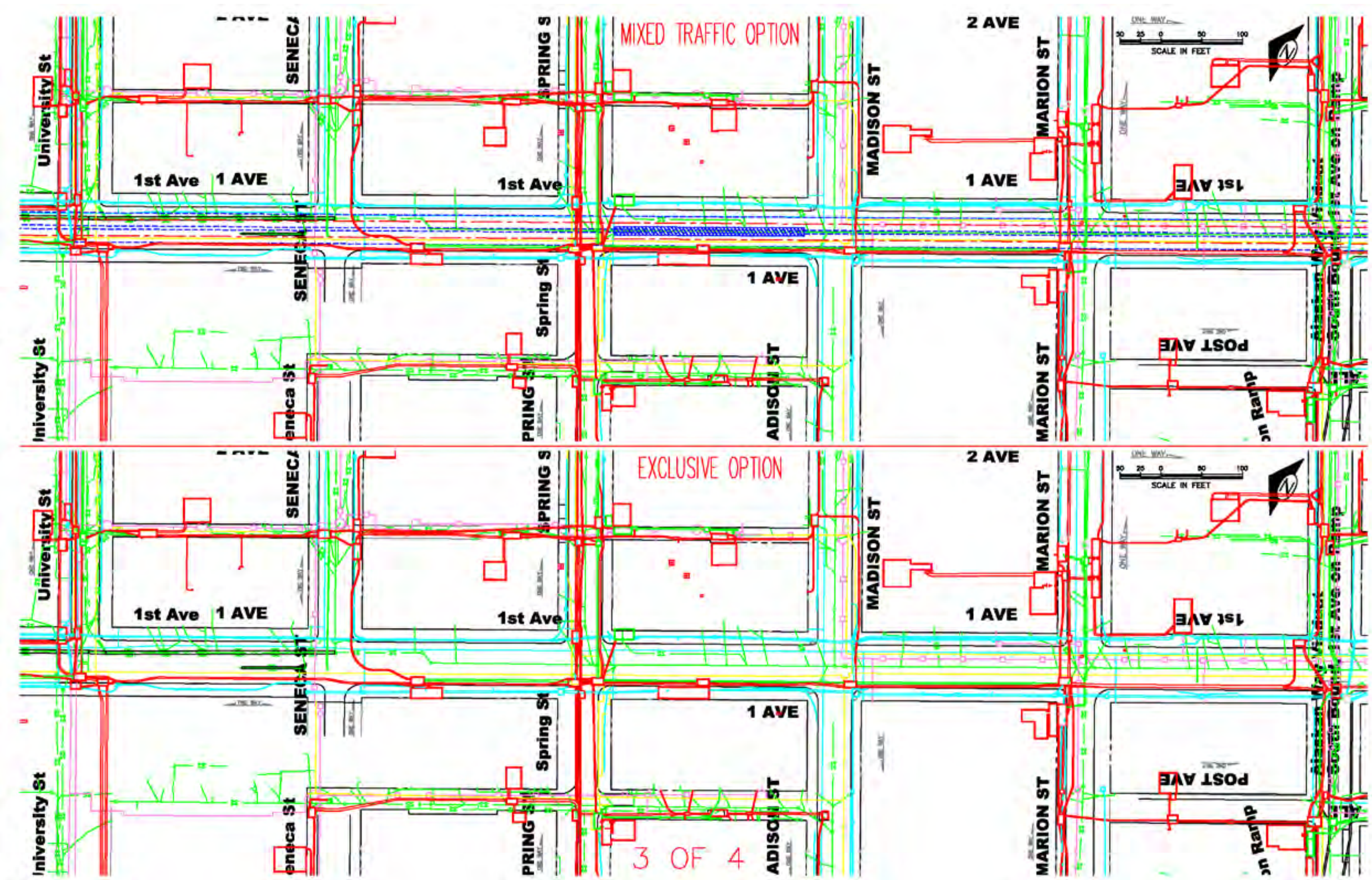


University to Columbia Streets

Figure F-4 Preliminary Utility Impacts Assessment, 1st Avenue, University to Columbia Streets (Table)

	Mixed Use Option			Exclusive Option		
Utility Type	SB	NB	Size/Notes	SB	NB	Size/Notes
Water - SPU						
- Lines (LF)	0	1270	feeder main, east edge	0	867	feeder main, east edge
- Structures (EA)						
Sewer - SPU						
- Lines (LF)	0	155	18" VC	0	494	18" VC
- Lines (LF)	0	110	24" RCP	0	128	24" RCP
- Lines (LF)	82	0	30" Detention Lateral	0	0	30" Detention Lateral
- Lines (LF)	0	0	33" RCP	580	0	33" RCP
- Lines (LF)	0	340	24" RCP w/ 48" Stl Case	0	340	24" RCP w/ 48" Stl Case
- Structures (EA)	0	6	manhole	3	7	manhole
Electric - SCL						
- Lines (LF)	119	0		34	0	
- Structures (EA)	7	0		3	0	
Gas - PSE						
- Lines (LF)	1538	41	4" IP	875	33	4" IP
- Structures (EA)						
Steam - Seattle Steam						
- Lines (LF)	0	578	10" low pressure	0	424	10" low pressure
- Structures (EA)	1	11	manhole & vault	0	11	manhole & vault
Fiber Optic - PSE						
- Lines (LF)		567	6" NA		301	6" NA
- Structures (EA)						

Figure F-5 Preliminary Utility Impacts Assessment, 1st Avenue, University to Columbia Streets (Map)

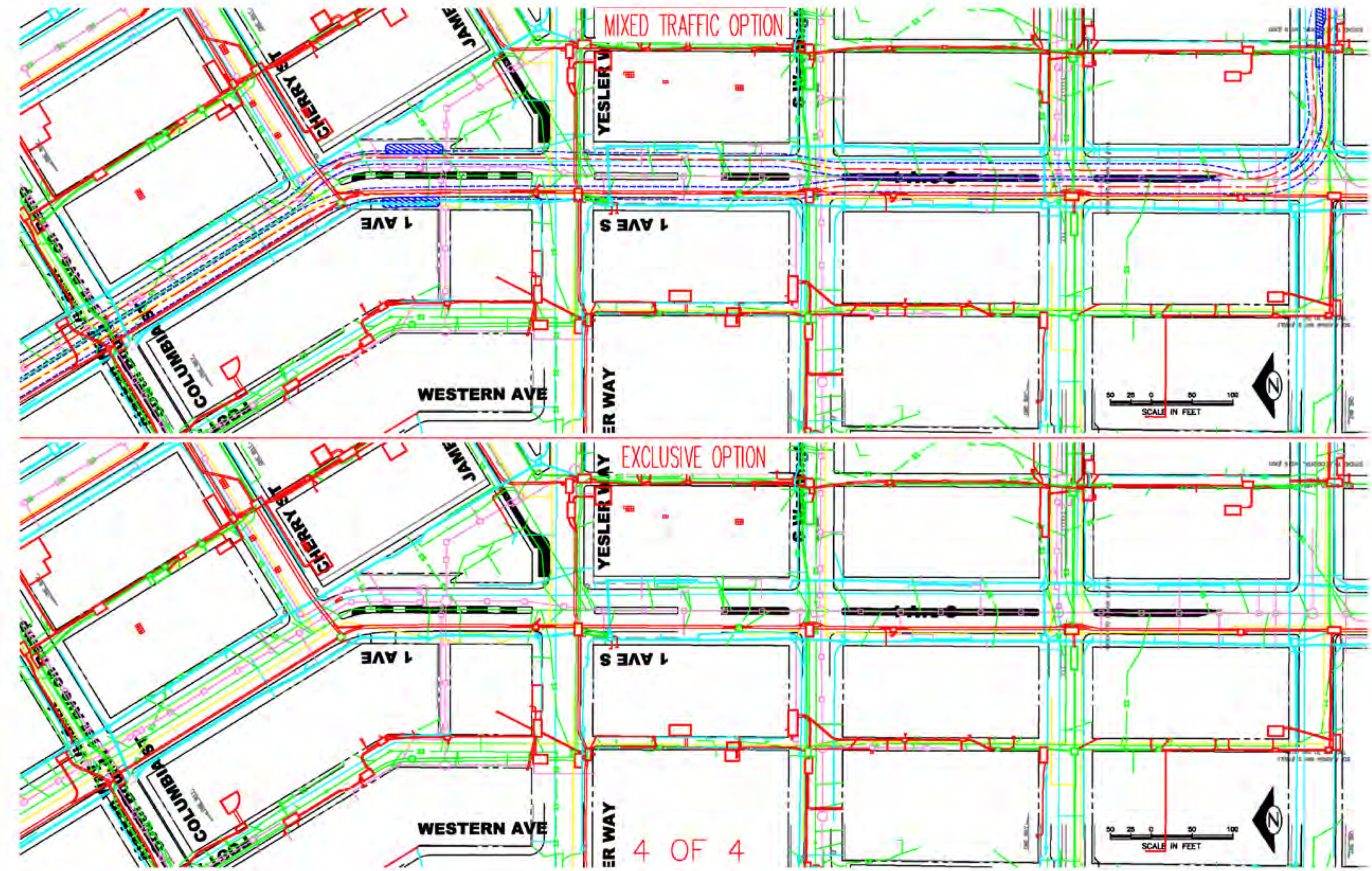


Columbia to Jackson Streets

Figure F-6 Preliminary Utility Impacts Assessment, 1st Avenue, Columbia to Jackson Streets (Table)

	Mixed Use Option			Exclusive Option		
Utility Type	SB	NB	Size/Notes	SB	NB	Size/Notes
Water - SPU						
- Lines (LF)	0	963	feeder main, east edge	0	660	feeder main, east edge
- Structures (EA)						
Sewer - SPU						
- Lines (LF)	0	213	48" Brick (deep) on RWCL	368	94	48" Brick (deep) on RWCL
- Structures (EA)	2	2	manhole	3	2	manhole
Electric - SCL						
- Lines (LF)	844	65		652	0	
- Structures (EA)	8	0		5	0	
Gas - PSE						
- Lines (LF)	985	0	4" STW IP	493	0	4" STW IP
- Structures (EA)						
Steam - Seattle Steam						
- Lines (LF)	0	653	8" low pressure	0	696	8" low pressure
- Structures (EA)	1	20	manhole & vault	1	22	manhole & vault
Fiber Optic - PSE						
- Lines (LF)	0	339			339	
- Structures (EA)						

Figure F-7 Preliminary Utility Impacts Assessment, 1st Avenue – Columbia to Jackson Streets (Map)



East-West Connections

Several east-west connections between 1st Avenue and Westlake were assessed in the early stage of the Tier 2 evaluation, and a Stewart/Olive connection was assumed in the alternatives analyzed in Tier 2. The Pike/Pine east-west connection was not included in the analysis of utility impacts conducted in the Tier 2 evaluation, and therefore only a map of utilities is included. Generally, one of the primary utility impacts related to a Pike/Pine connection is a large water main in 6th Avenue, but Pike/Pine have fewer impacts to Seattle City Light facilities than the Stewart/Olive connection and utility costs are expected to be similar or slightly higher for Pike/Pine compared to Stewart/Olive.

Pike and Pine Streets were included in the Center City Connector LPA and these streets will be included in the more detailed assessment of utilities that will be conducted in the next study phase (see Chapter 5 of the Detailed Evaluation Report for a discussion of the assessment of east-west connections).

Stewart Street/Olive Way, Westlake to 1st Avenue

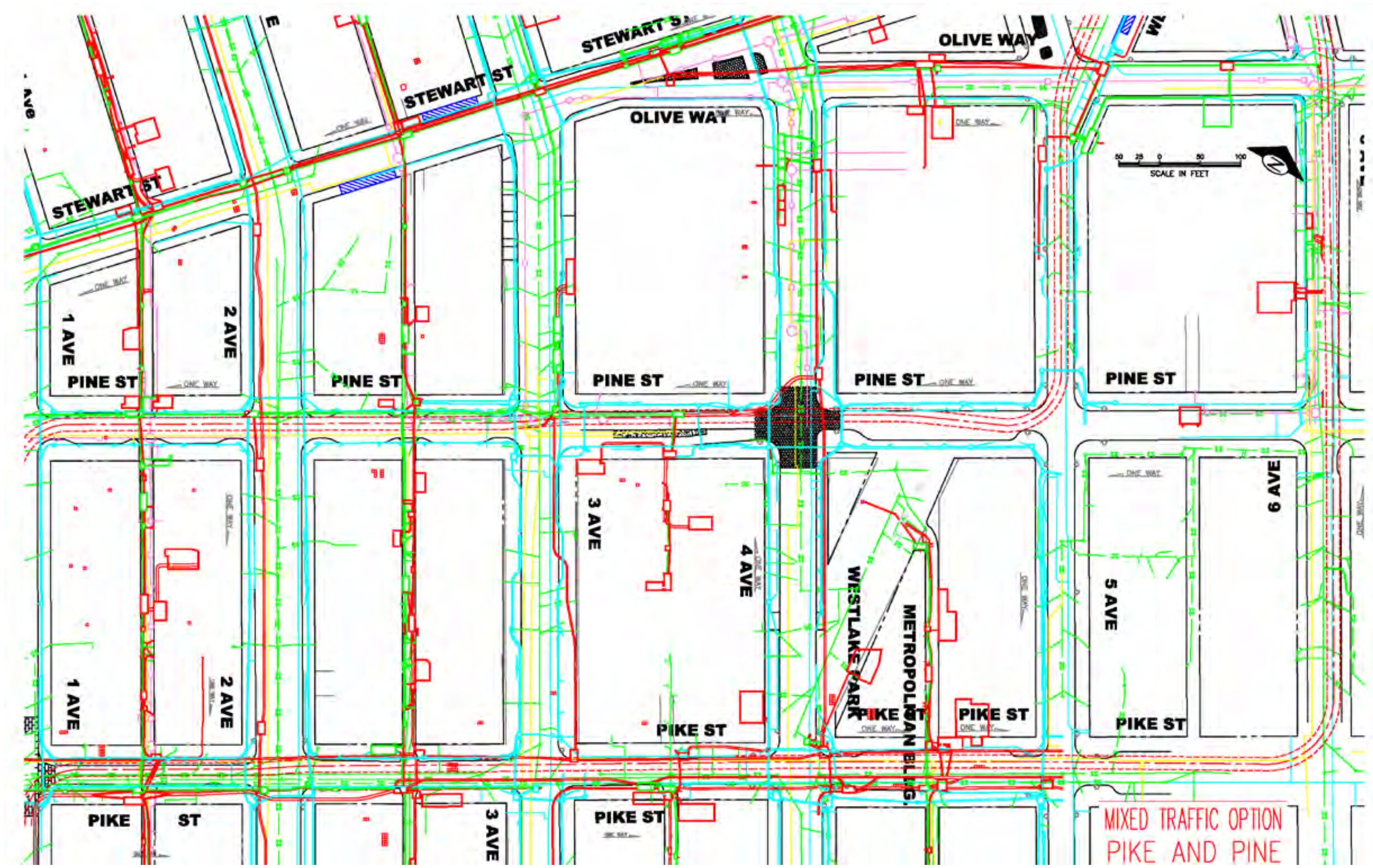
Figure F-8 Preliminary Utility Impacts Assessment, Stewart Street/Olive Way, Westlake to 1st Avenue (Table)

	Mixed Use Option			Exclusive Option		
Utility Type	SB	NB	Size/Notes	SB	NB	Size/Notes
Water - SPU						
- Lines (LF)	88	593	distribution main	15	593	distribution main
- Structures (EA)						
Sewer - SPU						
- Lines (LF)	357	7	18" VC	511	7	18" VC
- Lines (LF)	487	0	24" DIP and RCP	0	0	24" DIP and RCP
- Structures (EA)	4	0	manhole	1	0	manhole
Electric - SCL						
- Lines (LF)	2258	1137		3643	941	
- Structures (EA)	12	4		20	4	
Gas - PSE						
- Lines (LF)	0	458	2" IP	0	458	2" IP
- Structures (EA)						
Steam - Seattle Steam						
- Lines (LF)	0	207	12" low pressure	0	207	12" low pressure
- Structures (EA)	0	7	manhole & vault	0	7	manhole & vault
Fiber Optic - PSE						
- Lines (LF)	0	100		0	100	
- Structures (EA)						

Figure F-9 Preliminary Utility Impacts Assessment, Stewart Street/Olive Way, Westlake to 1st Avenue (Map)

Pike and Pine Streets; 4th/5th/6th Avenues

Figure F-10 Preliminary Utility Impacts Assessment, 1st Avenue – Pike and Pine Streets; 4th/5th/6th Avenues (Map)



APPENDIX G TRAFFIC ANALYSIS

This Appendix[1] describes the traffic analysis for the Tier 2evaluation of alternatives for the Seattle Center City Connector project, supplementing the summary of analysis results included in the Detailed Evaluation Report. The appendix first documents the key assumptions and methodologies used in the traffic analysis, including analysis years, study area limits, travel demand forecasting and modeling methodologies, and operational parameters. It then provides both summary-level and more detailed analysis results.

Introduction

In the Tier 2evaluation, a No-Build alternative and two Build alternatives along 1st Avenue were analyzed using a combination of Synchro (for signal timing information and intersection LOS results) and VISSIM (for multi-modal traffic simulation and detailed traffic operational results) traffic analysis and simulation tools. The two Build alternatives include Mixed-Traffic Streetcar and Exclusive Streetcar operating conditions that were evaluated to inform selection of a Locally Preferred Alternative (LPA). The traffic analysis for Tier 2incorporated roadway, alignment, traffic signal/operations, and streetcar stop location options. In Tier 2, a VISSIM network was constructed to analyze and screen alternatives. Traffic Measures of Effectiveness (MOE's) produced for the Tier 2screening include:

- Intersection LOS and delay
- Auto travel times
- Transit (bus and streetcar) travel times and reliability
- Vehicle and person throughput
- Traffic diversion in downtown street system

The Tier 2Build alternatives in VISSIM incorporated pedestrian, bus, and parking movements. Intersection signal refinements were incorporated into VISSIM. This included separate streetcar signal phases and transit signal priority (TSP) treatments, where appropriate. These design options and treatments were screened to determine an LPA.

In Tier 2, Synchro was used as a basis to establish signal timing parameters and provide intersection LOS and delay while VISSIM directly simulated the interaction of auto, truck, bus, streetcar, and pedestrian modes of travel along the corridor. MOE's from VISSIM include travel time for autos, streetcars, and buses, as well as vehicle and person throughput. Person throughput was created by incorporating ridership estimates with vehicle data. Figure G-1 identifies the model used in the Tier 2analysis.

[1] Prepared by CH2MHill

Figure G-1 Screening Levels of Analysis

Screening Levels	Tier 2Methodology
Type of Analysis	Compare No Build and two Build alternatives and provide impacts of project
Tools	Synchro (for signal timing inputs) & VISSIM (multi-modal simulation)
Measures of Effectiveness	▪ Intersection LOS & delay (from Synchro) ▪ Auto travel time (from VISSIM) ▪ Bus travel time (from VISSIM) ▪ Streetcar travel time and reliability (from VISSIM) ▪ Vehicle & person throughput (from VISSIM) ▪ Level of traffic diversion

Methodology

Analysis Year and Time Period

The traffic analysis for the Tier 2evaluation was developed for both an opening year and a horizon year. The opening year is considered to be 2018 and the horizon year was defined as 2035. The opening year traffic analysis provided detailed information on the streetcar performance and how it affects the operations along 1st Avenue while the horizon year analysis provided the long-term effects of traffic diversion in downtown.

The PM peak hour is considered to be the highest congestion time period in downtown Seattle and therefore was selected for both of the two future year analyses. The traffic forecasts used in the evaluation were based on the information provided in the Alaskan Way Viaduct (AWV) Final Environmental Impact Statement (FEIS).

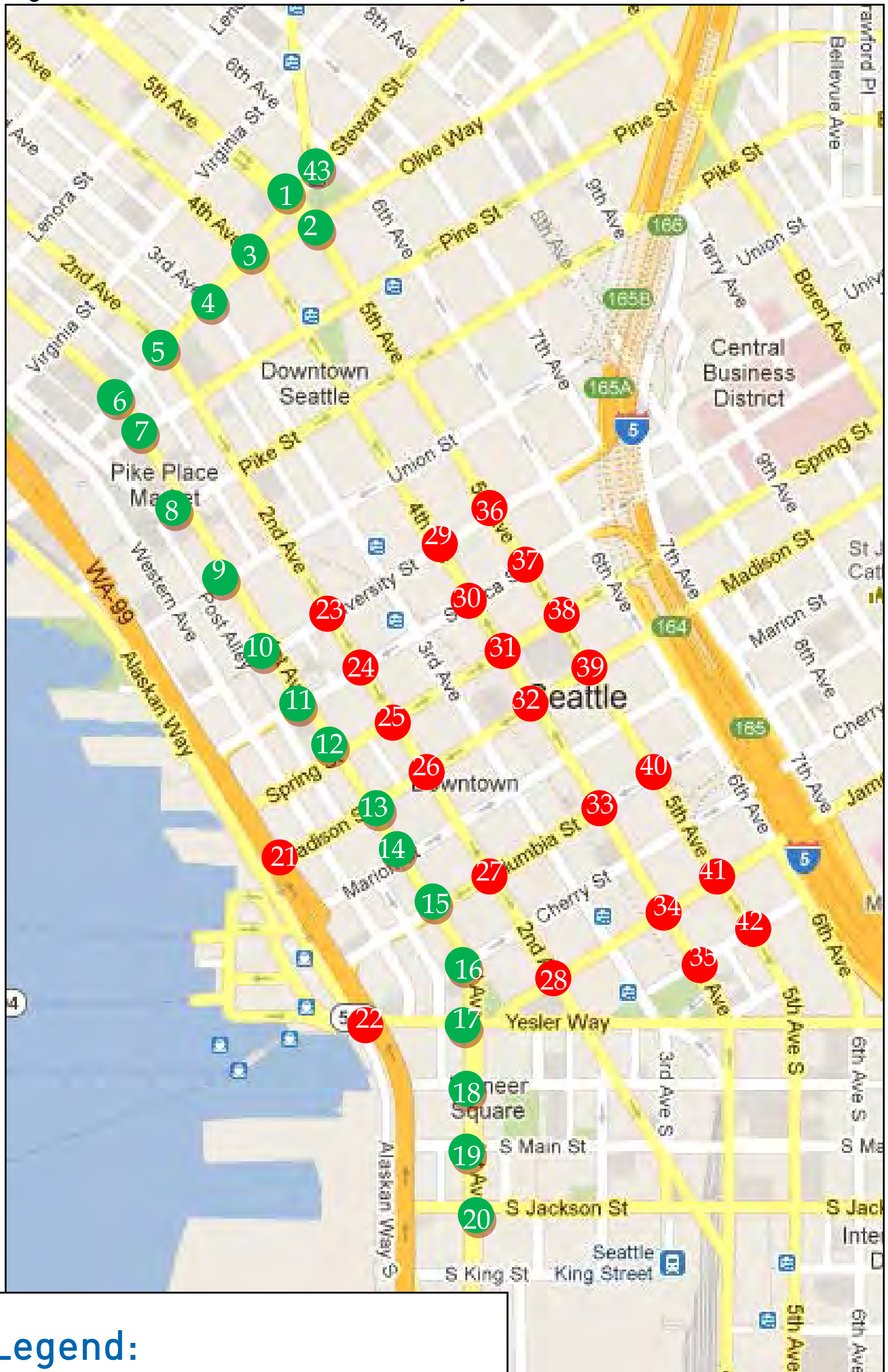
Traffic Study Area Limits

The study area includes up to 43 intersections with 20 intersections along the streetcar route of 1st Avenue and Stewart Street and 22intersections along adjacent corridors for the diversion analysis, as identified in Figure G-2. Figure G-3 shows the location of each study intersection.

Figure G-2 Traffic Study Intersections: 1st Avenue and 4th/5th Avenues

ID #	Intersection	ID#	Intersection
1	5th & Stewart Street	23	2nd Avenue & University Street
2	5th Avenue & Olive Way	24	2nd Avenue & Seneca Street
3	4th Avenue & Stewart Street	25	2nd Avenue & Spring Street
4	3rd Avenue & Stewart Street	26	2nd Avenue & Madison Street
5	2nd Avenue & Stewart Street	27	2nd Avenue & Columbia Street
6	1st Avenue & Stewart Street	28	2nd Avenue & James Street
7	1st Avenue & Pine Street	29	4th Avenue & University Street
8	1st Avenue & Pike Street	30	4th Avenue & Seneca Street
9	1st Avenue & Union Street	31	4th Avenue & Spring Street
10	1st Avenue & University Street	32	4th Avenue & Madison Street
11	1st Avenue & Seneca Street	33	4th Avenue & Columbia Street
12	1st Avenue & Spring Street	34	4th Avenue & James Street
13	1st Avenue & Madison Street	35	4th Avenue & S Jackson Street
14	1st Avenue & Marion Street	36	5th Avenue & University Street
15	1st Avenue & Columbia Street	37	5th Avenue & Seneca Street
16	1st Avenue & Cherry Street	38	5th Avenue & Spring Street
17	1st Avenue & Yesler Way	39	5th Avenue & Madison Street
18	1st Avenue & S Washington Street	40	5th Avenue & Columbia Street
19	1st Avenue & S Main Street	41	5th Avenue & James Street
20	1st Avenue & Jackson Street	42	5th Avenue & S Jackson Street
21	Alaskan Way & Madison Street	43	Westlake Avenue & Stewart Street
22	Alaskan Way & Yesler Way		

Figure G-3 Tier 2Evaluation Study Intersections



Legend:
- 1ST AVE ALTERNATIVE
- PARALLEL CORRIDOR DIVERSION

Operational Analysis Tools and Inputs

Synchro software, version 8, was used for the intersection analysis in Tier 2. Synchro utilizes methods from the Highway Capacity Manual (HCM) 2010. The reported results include the overall intersection LOS from the HCM report for signalized locations. Level of Service (LOS) is a qualitative measurement of intersection operation based on control delay. LOS is reported as letter grades A (low delay per vehicle, favorable traffic progression) through F (extremely high delay per vehicle, could involve long queues). Critical approaches, as defined by LOS F, were reported.

For the Tier 2evaluation, transit signal priority (TSP) was integrated with the streetcar operations through a combination of Synchro and Excel (using a methodology developed and applied through previous studies for SDOT). The TSP levels analyzed for Tier 2provided a bookend (limited vs. more extensive) of potential TSP levels. The limited TSP signal adjustments were applied to the Mixed-Traffic Streetcar operating condition while the more extensive TSP adjustments were applied to the Exclusive Streetcar operating condition. In either of these TSP conditions, side-street green times were not reduced below minimum pedestrian street crossing thresholds and did not skip pedestrian phases. Figure G-4 shows intersection treatments that were assumed for each alternative, including signal phasing, left-turn restrictions on 1st Avenue, and TSP treatments where applicable.

In the Tier 2evaluation, VISSIM software was also utilized to reflect a more detailed modeling of the signal and streetcar operating conditions. VISSIM has the ability to simulate multimodal traffic flows, such as cars, trucks, buses, streetcar/LRT, bicyclists, and pedestrians. The assumptions and parameters used in the Synchro model are shown in Figure G-5. Values in Figure G-5 were developed based on a combination of discussions with City staff, previous City project experience, and default values recommended from the HCM 2010. Figure G-6 identifies the parameters that were used in the VISSIM model.

Figure G-4 Tier 2 Intersection Treatments by Block

		No Build Condition		Mixed-Traffic Streetcar			Exclusive Streetcar		
Through Street	Cross Street	Signal Phasing	Lefts on 1st Allowed?	Signal Phasing	Lefts on 1st Allowed?	TSP Treatment	Signal Phasing	Lefts on 1st Allowed?	TSP Treatment
Stewart St	Westlake Ave	* 2-phase	n/a	* 3-phase: SB Streetcar protected phase	n/a	* None	* 3-phase: SB Streetcar protected phase	n/a	* Cross street reduced up to 18 sec (48%)
Stewart St	5th Ave	* 2-phase	n/a	Same	n/a	* Side street reduced up to 8 sec (20%)	Same	n/a	* Cross street reduced up to 17 sec (48%)
Olive Way	5th Ave	* 2-phase	n/a	Same	n/a	* Side street reduced up to 10 sec (18%)	Same	n/a	* Cross street reduced up to 32sec (60%)
Stewart St	4th Ave	* 2-phase	n/a	Same	n/a	* Side street reduced up to 13 sec (25%)	Same	n/a	* Cross street reduced up to 34sec (65%)
Stewart St	3rd Ave	* 2-phase	n/a	Same	n/a	* None	Same	n/a	* Cross street reduced up to 22sec (51%)
Stewart St	2nd Ave	* 2-phase	n/a	* 3-phase: EB Streetcar with South ped crosswalk; WB LT-TH Protected; SB TH-RT	n/a	* None	* 3-phase: EB/WB Streetcar-only phase; WB LT-TH with crosswalks; SB TH-RT	n/a	* EB Streetcar receives TSP; WB Streetcar receives Pre-emption
1st Ave	Stewart St	* 2-phase	NB Allowed	Same	Same	* Pre-emption for NB & WB Streetcar	Same	Restricted	* Pre-emption for NB & WB Streetcar

		No Build Condition		Mixed-Traffic Streetcar			Exclusive Streetcar		
Through Street	Cross Street	Signal Phasing	Lefts on 1st Allowed?	Signal Phasing	Lefts on 1st Allowed?	TSP Treatment	Signal Phasing	Lefts on 1st Allowed?	TSP Treatment
1st Ave	Pine St	* 2-phase	NB Allowed	Same	Same	* Side street reduced up to 5sec (20%)	* 3-phase: SB Left Prot	Same	* SB Left alt. lead/lag; Side street reduced up to 5sec (18%)
1st Ave	Pike St	* 2-phase (Ped Scramble)	NB Allowed	Same	Same	* None	Same	Restricted	* None
1st Ave	Union St	* 2-phase	NB Allowed	Same	Same	* Side street reduced up to 10 sec (30%)	Same	Restricted	* Side street reduced up to 14sec (40%)
1st Ave	University	* 2-phase (Ped Scramble)	SB Allowed	Same	Same	* None	* 3-phase: SB Left Prot	Same	* SB Left alt. lead/lag
1st Ave	Seneca	* 2-phase	Restricted	Same	Same	* Side street reduced up to 10 sec (28%)	Same	Same	* Side street reduced up to 7 sec (25%)
1st Ave	Spring	* 2-phase	SB Allowed	Same	Same	* None	* 3-phase: SB Left prot	Same	* SB Left alt. lead/lag (switched reg lag left to lead left)
1st Ave	Madison	* 2-phase	Restricted	Same	Same	* Side street reduced up to 8 sec (28%)	* 3-phase: NB Left Prot	NB Allowed	* NB Left alt. lead/lag
1st Ave	Marion	* 2-phase	SB Allowed	Same	Same	* Side street reduced up to 6 sec (20%)	Same	Restricted	* Side street reduced up to 8 sec (27%)

		No Build Condition		Mixed-Traffic Streetcar			Exclusive Streetcar		
Through Street	Cross Street	Signal Phasing	Lefts on 1st Allowed?	Signal Phasing	Lefts on 1st Allowed?	TSP Treatment	Signal Phasing	Lefts on 1st Allowed?	TSP Treatment
1st Ave	Columbia	* 2-phase	NB Allowed	Same	Same	* Side street reduced up to 12sec (30%)	Same	Restricted	* Side street reduced up to 19 sec (48%)
1st Ave	Cherry	* 3-phase: SB Left Perm-Prot; (Ped Scramble)	SB Allowed	* 3-phase; Prot SB Left & Ped Scramble	Same	* Pre-emption for NB & SB Streetcar phase	* 3-phase; SB Left Prot & Ped Scramble	Same	* SB Left alt. lead/lag
1st Ave	Yesler	* 2-phase	Restricted	Same	Same	* Side street reduced up to 7 sec (16%)	Same	Same	* Side street reduced up to 15sec (42%)
1st Ave	Washing-ton	* 2-phase	Restricted	Same	Same	* Pre-emption for NB & SB Streetcar Phases	Same	Same	* Side street reduced up to 10 sec (33%)
1st Ave	Main	* 2-phase	Restricted	Same	Same	* Side street reduced up to 10 sec (30%)	Same	Same	* Side street reduced up to 7 sec (25%)
1st Ave	Jackson	* 2-phase	NB & SB Allowed	* 4-phase; SB Perm-Prot Left; WB Perm-Prot Left	Same	* Pre-emption for SB Left Streetcar; * Protected phase for WB Right Streetcar	* 4-phase; SB Perm-Prot Left; WB Perm-Prot Left	SB Allowed; NB Restricted	* TSP for SB Left Streetcar, alt lead/lag; * Protected phase for WB Right Streetcar

Figure G-5 Synchro Parameters/Assumptions

Parameter	Future Year Assumption
Peak Hour Factor	From 2030 AWV Synchro or count, otherwise 0.92for intersection
Conflicting Pedestrians per Hour	From 2030 AWV Synchro or count, otherwise use 200 peds/hr per crosswalk
Conflicting Bicycles per Hour	From 2030 AWV Synchro or count, otherwise use 20 bicycles/hr
Area Type	CBD
Ideal Saturation Flow Rate (for all movements)	1900
Lane Width	From 2030 AWV Synchro or SDOT paint line sketches, otherwise assume 11'
Percent Heavy Vehicles	From 2030 AWV Synchro or count/current transit service, otherwise use 3% per approach (including trucks and buses)
Percent Grade	From 2030 AWV Synchro, otherwise calculated from field data
Parking Maneuvers per Hour	From 2030 AWV Synchro, otherwise assume 8 maneuvers/hr for two-way streets; assume 16 maneuvers/hr for one-way streets
Bus Blockages	From 2030 AWV Synchro, otherwise from existing transit routes and headways
Intersection Signal Phasing and Coordination	From 2030 AWV Synchro or existing data from SDOT
Intersection Signal Timing optimization limits	From 2030 AWV Synchro or existing data from SDOT (80 sec cycle length)
Minimum Green Time	From 2030 AWV Synchro or existing data from SDOT
Yellow and All-Red Time	From 2030 AWV Synchro or existing data from SDOT, otherwise use: (Y) = 3.5seconds and (R) = 1second
Right Turn on Red	Allow where currently permitted
Speed Limit	30 mph

Figure G-6 VISSIM Parameters/Assumptions (for Tier 2Evaluation)

VISSIM Parameters	Future Year Assumption
VISSIM Version	▪ 5.40-09
Simulation Resolution	▪ 10 time steps/sec
Seeding Time	▪ 15minutes
Recording Time	▪ 1hr
# of Random Seeds	▪ Starting seed of 100, increment of 10; 10 seeds
Driver Behavior, Car Following	▪ Wiedemann 74 ▪ Add. Part of safety distance = 2.00 ▪ Mult. Part of safety distance = 3.00
Traffic Composition	▪ SDOT Data and 2030 AWV Synchro
Vehicle Types	▪ GP Car (vehicle model = Car) ▪ HGV (vehicle model = HGV, length ~ 20-70') ▪ Bus (vehicle model = Bus, length ~ 40') ▪ Streetcar (vehicle model = Tram, length ~50')
Conflicting Pedestrians per Hour	▪ SDOT Data and 2030 AWV Synchro, otherwise assume 200 peds/hr per crosswalk
Parking Maneuvers per Hour	▪ SDOT Data and 2030 AWV Synchro, otherwise 8 maneuvers/hr for two-way streets; assume 16 maneuvers/hr for one-way streets
Grade	▪ From 2030 AWV Synchro, otherwise calculated from field data
Intersection Turning Speed	▪ Right = 11-13 mph; Left = 13-17 mph
Transit Assumptions	▪ Existing Bus Routes (from KC Metro, Sound Transit, and other transit agencies) and stops along Preferred Alignment route were modeled. Data from KC Metro was utilized for boarding/alighting and dwell time at stop locations, otherwise assumed 20 second dwell time and 10 second standard deviation.

VISSIM Parameters	Future Year Assumption
	▪ For future No Build alternative, removal of AWV changes bus routes that cross 1st Avenue at Columbia (outbound from Downtown Seattle to South) and Seneca (inbound from South to Downtown Seattle) to be consolidated to Columbia Street BAT lane, as part of Central Waterfront Program improvement. ▪ For future Build alternatives, KCM Route 99 was assumed to be replaced with streetcar service.
Signal Controller Type	▪ No Build = Pre-timed ▪ Build = Actuated-Coordinated with TSP where warranted
Streetcar Headway	▪ Assume 5minute headways between Westlake and Jackson
Streetcar Signal Operations	▪ TSP to be applied where warranted; TSP parameters to be coordinated with SDOT; Exclusive Streetcar phases required at intersections where route turns across traffic
Signal Phasing, Timing, and Coordination	▪ No Build based on 2030 AWV FEIS Synchro ▪ Build modified where Exclusive Streetcar phases are required or where geometric modifications warrant changes in phasing

Data Collection

Traffic data from other relevant projects, such as Alaskan Way Viaduct (AWV) FEIS, Central Waterfront Project (CWP), and First Hill Streetcar was used to develop the traffic analysis for the Tier 2evaluation. The data from these files, such as traffic volumes, signal timing, and roadway channelization was used to establish the project models for the alternatives.

Year 2035traffic volumes and signal timing data was mainly based on the AWV FEIS Synchro model as it has the greatest coverage of the project's study area. Data gaps were filled in through data obtained from SDOT or other projects (SDOT Central Waterfront Project (CWP) and SDOT First Hill Streetcar project). Existing traffic signal timing and phasing was gathered from SDOT.

Future auto demand volumes were based on the 2017 and 2030 non-tolled scenario forecast developed for the AWV FEIS. This analysis used the AWV FEIS forecasts which were based on a land use estimate for the year 2030. These forecasts, produced in the mid-2000's, do not account for the recent economic recession. Therefore, the forecasts may reflect a future year beyond 2030 that is near 2035. The non-tolled forecasts were utilized since WSDOT is currently in the process of updating the tolling forecasts and these have yet to be finalized or agreed to by stakeholders. In Tier 2, a high-level travel demand forecast was conducted to determine the amount of diversion that is likely to occur from a streetcar operating condition that requires the reduction of general-purpose travel lanes on 1st Avenue.

At intersections where future forecasts are not readily available, the future intersection volumes were estimated using a combination of existing traffic counts, post-processing adjustments, and volume-balancing from nearby intersections where future forecasts are published.

Tier 2 Evaluation Traffic Measures of Effectiveness

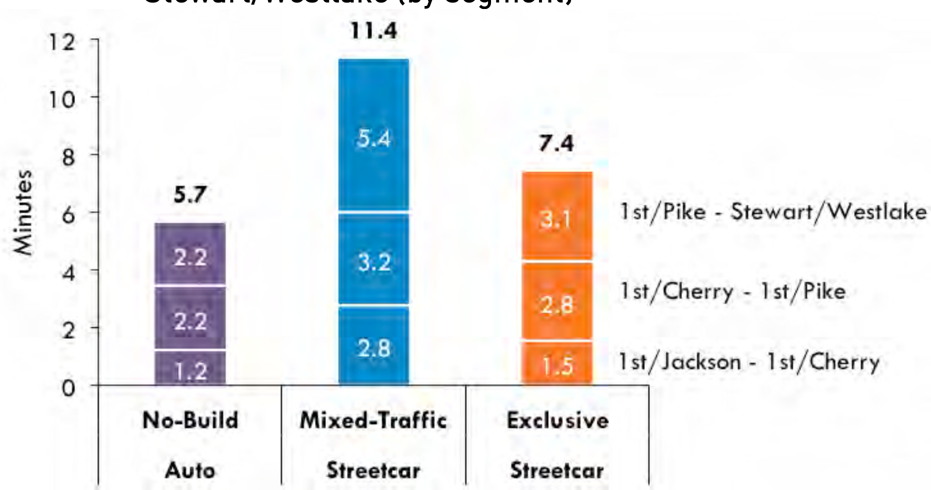
Streetcar Travel Times

Summary

Streetcar travel times were developed for the Mixed-Traffic and Exclusive Streetcar alternatives for the 2018 year of opening condition. These travel times were produced from the VISSIM simulation model. Streetcar travel times in the Exclusive Streetcar alternative (7.4 minutes) would be nearly 30% faster than in the Mixed-Traffic Streetcar alternative (11.4 minutes). Between these two alternatives, about half of the travel time difference occurs between 1st/Pike and Stewart/Westlake intersections. The main difference in travel time in this segment is caused by the different levels of TSP assumed between the two Build alternatives.

The streetcar travel times in the Exclusive Streetcar alternative are also more competitive with auto travel times in the No-Build alternative. Even though the streetcar travel times in the Exclusive Streetcar alternative are 30% longer than the No-Build auto travel time, the streetcar travel time includes the dwell time at stops. Figure G-7 shows the streetcar travel time comparison between each alternative.

Figure G-7 2018 PM Peak Hour Streetcar Travel Times: Jackson/Occidental to Stewart/Westlake (by segment)



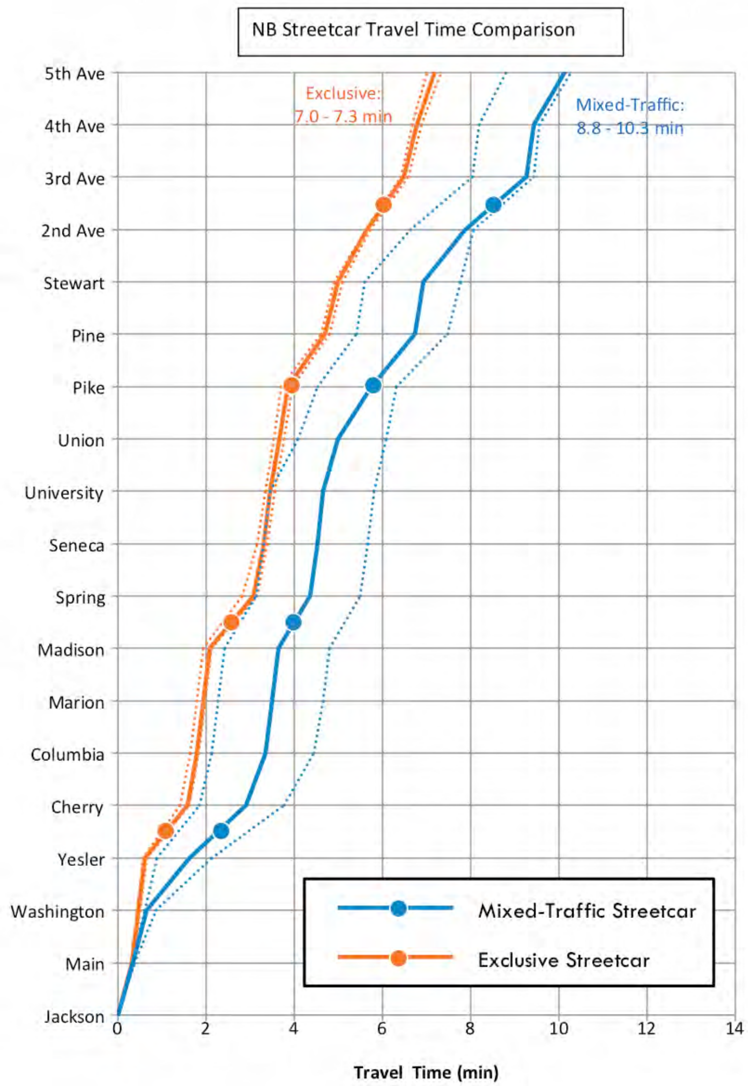
Note: Streetcar travel times include an assumed 20-second dwell time at stations. Travel times are the average of one-way northbound and southbound travel times.

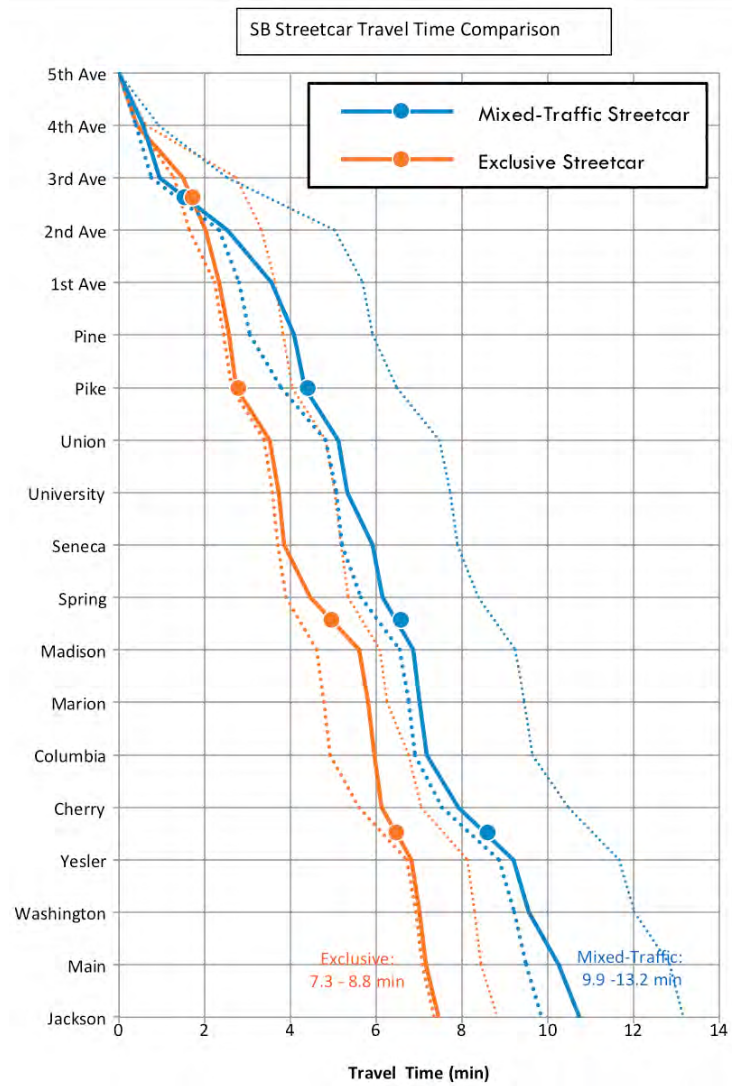
Streetcar Travel Time Reliability

Summary

In addition to streetcar travel times, the reliability of the streetcar was also compared between the two Build conditions. Reliability is measured as the variability of travel times from each streetcar trip along the route during the peak hour. The reliability accounts for delays caused by station stops, signal delay, and queuing. In both travel directions, the Exclusive Streetcar alternative has a higher reliability when compared to the Mixed-Traffic Streetcar alternative. In the Exclusive Streetcar alternative, travel times vary by about 12% in the northbound and southbound travel directions, as seen in Figure G-8. The Mixed-Traffic Streetcar alternative has a lower reliability with travel times varying by 26% during the PM peak hour. The lower reliability caused by a greater variance in travel times with the Mixed-Traffic Streetcar alternative reflects streetcar operations when it is mixed with auto traffic. With traffic congestion projected to increase in the future, the Exclusive Streetcar alternative provides a higher level of reliability for streetcar travel times.

Figure G-8 Streetcar Travel Time Reliability





Auto Performance

In the Tier 2evaluation, auto travel times were also produced for the 2018 year of opening condition and compared between the No-Build, Exclusive Streetcar, and Mixed-Traffic Streetcar alternatives. These travel times were produced from the VISSIM simulation model. In the Mixed-Traffic alternative, auto travel time increases by 8% compared to the No-Build alternative. Auto travel times in the Exclusive Streetcar alternative increase by about 35% from the No-Build alternative. The auto travel time increase in the Exclusive Streetcar alternative primarily occurs along 1st Avenue between the Cherry and Pike intersections where the streetcar has an exclusive travel lane.

Figure G-9 2018 PM Peak Hour Auto Travel Times - Jackson/Occidental to Stewart/Westlake (by Segment)

Note: Travel times are the average of one-way northbound and southbound travel times.

Detailed Analysis Results

Figure G-10 through Figure G-13 provide further detailed information on year 2018 PM peak hour traffic conditions. Figure G-10 and Figure G-11 provide similar information in tabular form to the data already presented in Figure G-7 through Figure G-9.

Figure G-12 provides auto throughput data for the No-Build, Mixed-Traffic, and Exclusive conditions for 2018. Similar to the auto travel time information (Figure G-7), auto throughput is expected to be similar between the No-Build and Mixed-Traffic Streetcar conditions as the streetcar does not reduce auto capacity along 1st Avenue and operates within the existing travel lanes. In the Exclusive Streetcar condition, auto throughput along 1st Avenue is between half to two-thirds of the throughput in the No-Build condition. Similarly, the intersection LOS and queuing information presented in Figure G-13 suggests that the intersection delay between the No-Build and Mixed-Traffic Streetcar conditions would be similar while the average intersection delay in the Exclusive Streetcar condition is about 10 seconds worse than in the No-Build condition along with more intersections expected to have vehicles queued back into them.

Figure G-10 2018 PM Peak Hour Auto and Streetcar Travel Time Summary

Segment	Auto									Streetcar					
	No Build			Mixed-Traffic			Exclusive			Mixed-Traffic			Exclusive		
	NB /EB	SB/ WB	Avg (both dir)	NB/ EB	SB/ WB	Avg (both dir)	NB/ EB	SB/ WB	Avg (both dir)	NB/ EB	SB/ WB	Avg (both dir)	NB/ EB	SB/ WB	Avg (both dir)
Jackson - Cherry	1.0	1.5	1.2	1.9	1.4	1.7	1.8	1.3	1.5	2.8	2.8	2.8	1.6	1.5	1.5
Cherry - Pike	1.8	2.6	2.2	1.7	2.5	2.1	2.5	5.0	3.8	2.7	3.8	3.2	2.3	3.2	2.8
Pike - Westlake	1.6	2.8	2.2	1.7	3.7	2.7	1.5	3.8	2.6	4.2	6.6	5.4	3.3	3.0	3.1
Total =	**4.4**	**6.9**	**5.7**	**5.3**	**7.6**	**6.5**	**5.8**	**10.1**	**7.9**	**9.6**	**13.1**	**11.4**	**7.2**	**7.7**	**7.4**

Figure G-11 2018 PM Peak Hour Auto and Streetcar Travel Speed Summary

Segment	Auto									Streetcar					
	No Build			Mixed-Traffic			Exclusive			Mixed-Traffic			Exclusive		
	NB/ EB	SB/ WB	Avg (both dir)	NB/ EB	SB/ WB	Avg (both dir)	NB/ EB	SB/ WB	Avg (both dir)	NB/ EB	SB/ WB	Avg (both dir)	NB/ EB	SB/ WB	Avg (both dir)
Jackson - Cherry	13.3	9.4	11.4	7.1	11.7	9.4	8.3	8.9	8.6	4.7	6.1	5.4	8.3	8.9	8.6
Cherry - Pike	16.6	11.7	14.1	17.6	12.6	15.1	13.3	9.6	11.5	11.4	8.2	9.8	13.3	9.6	11.5
Pike - Westlake	8.5	7.6	8.1	4.0	5.9	5.0	6.7	7.2	6.9	5.3	3.4	4.3	6.7	7.2	6.9
Average =	**12.9**	**9.6**	**11.2**	**9.5**	**9.2**	**9.3**	**9.1**	**8.5**	**8.8**	**6.8**	**5.3**	**6.1**	**9.1**	**8.5**	**8.8**

Figure G-12 2018 PM Peak Hour Auto Throughput

Road	Segment	No Build		Mixed-Traffic		Exclusive	
		NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB
Stewart Street	Westlake - 1st Avenue	190	710	190	775	195	740
1st Avenue	Stewart - Cherry	1065	680	910	690	540	455
1st Avenue	Cherry - Jackson	890	540	900	625	580	545

Figure G-13 2018 PM Peak Hour Intersection Level-of-Service and Vehicle Queue Results

ID#	Major Street	Cross Street	No Build				Mixed-Traffic Streetcar				Exclusive Streetcar			
			LOS	Delay	NB/EB Queue Spillback	SB/WB Queue Spillback	LOS	Delay	NB/EB Queue Spillback	SB/WB Queue Spillback	LOS	Delay	NB/EB Queue Spillback	SB/WB Queue Spillback
1	Stewart Street	5th Avenue	B	17	n/a	Yes	B	18	n/a	Yes	C	23	n/a	Yes
2	Olive Way	5th Avenue	A	8		n/a	A	8		n/a	A	8		n/a
3	Stewart Street	4th Avenue	B	14			B	17		Yes	C	26		Yes
4	Stewart Street	3rd Avenue	A	9			B	15	Yes	Yes	B	19		Yes
5	Stewart Street	2nd Avenue	B	14	n/a		C	26	n/a	Yes	C	21	n/a	Yes
6	1st Avenue	Stewart Street	B	12			B	20	Yes	Yes	C	22	Yes	Yes
7	1st Avenue	Pine Street	A	4			A	10		Yes	B	15		
8	1st Avenue	Pike Street	A	5			A	7			B	13		
9	1st Avenue	Union Street	B	12			B	11			C	21	Yes	Yes
10	1st Avenue	University Street	A	4		Yes	A	4			C	24		Yes
11	1st Avenue	Seneca Street	B	17		Yes	B	11	Yes		C	27	Yes	
12	1st Avenue	Spring Street	B	15			B	14		Yes	C	31	Yes	
13	1st Avenue	Madison Street	B	13	Yes		B	14		Yes	C	34	Yes	
14	1st Avenue	Marion Street	B	14			A	10			B	18	Yes	
15	1st Avenue	Columbia Street	A	8			B	13			B	20	Yes	Yes
16	1st Avenue	Cherry Street	B	12	Yes		C	24	Yes	Yes	B	18	Yes	
17	1st Avenue	Yesler Way	C	23			C	27	Yes		D	41	Yes	
18	1st Avenue	Washington Street	B	12			B	20	Yes		C	24	Yes	Yes
19	1st Avenue	Main Street	B	15			B	11			B	19	Yes	Yes
20	1st Avenue	Jackson Street	D	47	Yes	Yes	D	41	Yes	Yes	D	52		Yes
43	Stewart Street	Westlake Avenue	C	21	n/a	Yes	C	28	n/a	Yes	D	51	n/a	Yes

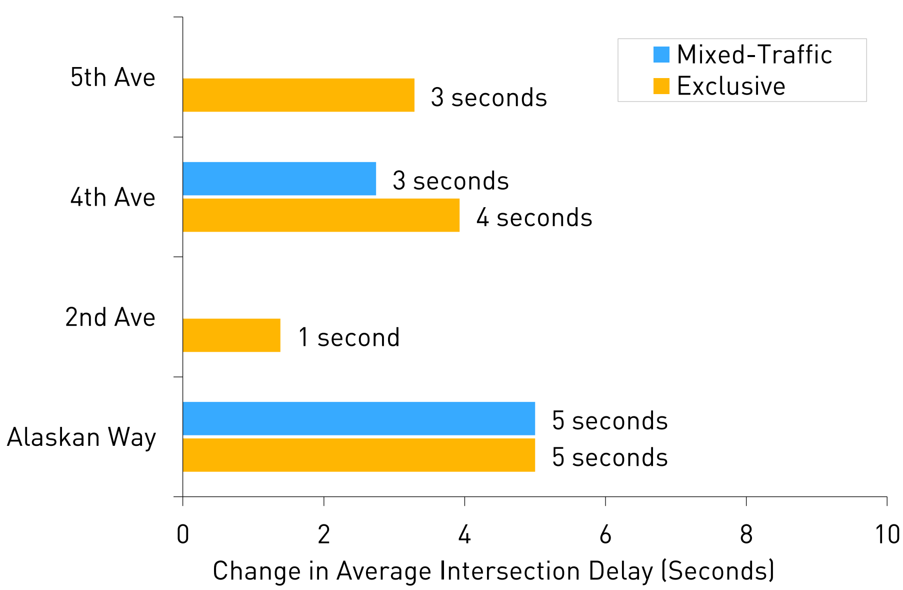
Vehicle Diversion to Parallel Streets

In addition to traffic information presented for the 2018 year of opening condition, vehicle diversion to parallel streets within downtown Seattle was also analyzed for the 2035horizon year with Synchro software.

In the Mixed-Traffic Streetcar alternative, minor traffic diversion from 1st Avenue are expected due to the streetcar operations. Diversion with the Mixed-Traffic Streetcar alternative occurs primarily in the northbound direction as this alternative removes some roadway capacity in this direction. As a result, intersection delays on parallel streets increase slightly by an average of 2seconds. Delay impacts are not noticeable on 2nd Avenue and 5th Avenue.

In the Exclusive Streetcar alternative, up to 50% of the traffic along 1st Avenue is diverted onto parallel streets. With this amount of diversion, parallel streets would experience between a 5-11% increase in volume that creates up to a 13% average increase in intersection delay on parallel streets. Figure G-14 compares the average increase in intersection delay along the parallel corridors between the two Build alternatives. This diversion causes an average delay increase of about 3.5seconds. Figure G-15 and Figure G-16 provide more detailed information.

Figure G-14 Year 2035PM Peak Hour Change in Traffic (Average Intersection) Delay on Parallel Streets



Note: Based on analysis of 20 intersections on Alaskan Way and 2nd, 4th, and 5th Avenues. Mixed-Traffic impacts represent increases of 6% on 4th Avenue and 13% on Alaskan Way. Exclusive alternative impacts represent 9% to 13% increases on parallel corridors relative to No-Build.

Detailed Analysis Results

Figure G-15 through Figure G-17 provide additional information on the traffic diversion analysis. Figure G-15 provides the expected amount of traffic diverted from 1st Avenue to parallel streets. The Mixed-Traffic Streetcar alternative would divert less traffic than in the Exclusive Streetcar alternative as it does not impact as much roadway capacity; capacity is only reduced in the northbound direction. It should be noted that Figure G-15 may not reflect the total amount of traffic diverted off of 1st Avenue and added to the adjacent parallel streets as some of the diverted traffic may use other routes outside of this study area. Figure G-16 and Figure G-17 provide the traffic analysis results from the diversion analysis. Figure G-16 provides corridor-level information while Figure G-17 provides the traffic results by individual intersection.

Figure G-15 Year 2035PM Peak Hour Volume Diversion

Scenario	Alaskan Way				1st Avenue				2nd Avenue		4th Avenue		5th Avenue	
	NB		SB		NB		SB		SB		NB		SB	
	%	Vol.	%	Vol.	%	Vol.	%	Vol.	%	Vol.	%	Vol.	%	Vol.
1st Avenue Mixed-Traffic Streetcar	7%	100	0%	0	-17%	-200	0%	0	0%	0	7%	100	0%	0
1st Avenue Exclusive Streetcar	11%	150	3%	40	-50%	-600	-38%	-300	5%	100	6%	130	7%	120

Figure G-16 Year 2035PM Peak Hour Average Change in Intersection Delay

Scenario	Alaskan Way				1st Avenue				2nd Avenue				4th Avenue				5th Avenue			
	Avg. No-Build Delay (in sec.)	Avg. Build Delay (in sec.)	Avg. Delay Change (in sec.)	%	Avg. No-Build Delay (in sec.)	Avg. Build Delay (in sec.)	Avg. Delay Change (in sec.)	%	Avg. No-Build Delay (in sec.)	Avg. Build Delay (in sec.)	Avg. Delay Change (in sec.)	%	Avg. No-Build Delay (in sec.)	Avg. Build Delay (in sec.)	Avg. Delay Change (in sec.)	%	Avg. No-Build Delay (in sec.)	Avg. Build Delay (in sec.)	Avg. Delay Change (in sec.)	%
1st Ave Mixed- Traffic Streetcar	40	45	5	13%	18	24	6	35%	15	15	0	0%	45	48	3	6%	24	24	0	0%
1st Ave Exclusive Streetcar	40	45	5	13%	18	44	26	152%	15	16	1	9%	45	49	4	9%	24	27	3	13%

Figure G-17 Year 2035PM Peak Hour Intersection Level-of-Service Results

ID#	Major St	Cross St	No Build		1st Ave Mixed-Traffic Streetcar			1st Ave Exclusive Streetcar		
			LOS	Delay	LOS	Delay	Delay Change (vs. No Build)	LOS	Delay	Delay Change (vs. No Build)
Streetcar Route										
1	5th Ave	Stewart St	C	22	C	23	0	C	28	5
2	5th Ave	Olive Way	B	12	B	13	1	B	14	2
3	4th Ave	Stewart St	C	22	C	27	5	C	34	12
4	3rd Ave	Stewart St	A	8	B	12	4	D	41	33
5	2nd Ave	Stewart St	B	19	F	89	70	F	150	131
6	1st Ave	Stewart St	C	21	C	31	11	C	27	6
7	1st Ave	Pine St	A	6	A	9	3	B	11	5
8	1st Ave	Pike St	B	12	C	21	9	E	55	43
9	1st Ave	Union St	A	10	A	8	-2	B	15	5
10	1st Ave	University St	C	21	A	7	-14	C	21	0
11	1st Ave	Seneca St	B	18	B	17	-1	C	33	15
12	1st Ave	Spring St	C	24	B	12	-12	E	56	32
13	1st Ave	Madison St	B	12	B	12	1	C	28	16
14	1st Ave	Marion St	B	16	C	27	12	E	71	56
15	1st Ave	Columbia St	A	10	B	10	1	F	84	75
16	1st Ave	Cherry St	D	39	D	47	9	C	23	-16
17	1st Ave	Yesler Way	C	32	D	39	8	E	71	39
18	1st Ave	Washington St	B	11	A	9	-2	C	23	12
19	1st Ave	Main St	B	16	B	14	-2	C	21	5
20	1st Ave	Jackson St	B	18	D	39	21	E	68	50
Adjacent Corridors										
21	Alaskan Way	Madison St	C	31	D	41	10	D	39	8
22	Alaskan Way	Yesler Way	D	49	D	49	0	D	52	3
23	2nd Ave	University St	C	27	C	25	-2	C	28	2
24	2nd Ave	Seneca St	A	6	A	6	0	A	6	-1
25	2nd Ave	Spring St	B	12	B	12	0	B	15	3
26	2nd Ave	Madison St	B	15	B	15	1	B	17	2
27	2nd Ave	Columbia St	B	11	B	11	0	A	8	-3
28	2nd Ave	James St	B	18	B	18	1	C	23	5
29	4th Ave	University St	C	22	C	20	-2	C	27	5
30	4th Ave	Seneca St	D	37	D	53	16	D	54	17
31	4th Ave	Spring St	B	16	B	15	-1	C	30	14
32	4th Ave	Madison St	E	58	E	65	7	E	70	12
33	4th Ave	Columbia St	D	38	D	38	0	E	55	17
34	4th Ave	James St	B	19	B	18	-1	C	22	4
35	4th Ave	Jackson St	F	122	F	122	0	F	81	-42
36	5th Ave	University St	B	18	B	18	0	C	20	3
37	5th Ave	Seneca St	B	19	B	19	0	C	23	5
38	5th Ave	Spring St	B	16	B	16	-1	B	17	1
39	5th Ave	Madison St	C	29	C	29	0	D	38	9

ID#	Major St	Cross St	No Build		1st Ave Mixed-Traffic Streetcar			1st Ave Exclusive Streetcar		
			LOS	Delay	LOS	Delay	Delay Change (vs. No Build)	LOS	Delay	Delay Change (vs. No Build)
40	5th Ave	Columbia St	B	11	B	11	0	B	11	1
41	5th Ave	James St	B	15	B	15	0	B	17	2
42	5th Ave	Jackson St	E	64	E	64	0	E	67	4

APPENDIX H EVALUATION OF WESTLAKE AND JACKSON PRIORITY TREATMENTS

Overview

The published/scheduled one-way travel time for the South Lake Union Streetcar is currently nearly 11 minutes in the northbound direction and slightly less than 10 minutes in the southbound direction. The Center City Connector (CCC) project team estimates that typical one-way travel times are more likely to be in the 15 to 18 minute range during peak periods and King County Metro streetcar operations staff have indicated that travel times can be as long as 20-25 minutes during heavy congested periods. Improving the performance of the streetcar would be necessary to realize the maximum potential of the Exclusive Streetcar alternative.

To assess the potential for such improvements from priority treatments on the existing/planned lines, the project team evaluated potential design and operational features that could be implemented to improve speed and reliability along the South Lake Union (SLU) Streetcar alignment and the Jackson segment of the First Hill Streetcar alignment. These features were identified based on the team's working knowledge of the streetcar alignments, riding the SLU streetcar with King County Metro streetcar operations staff, input from SDOT staff, and/or public input at the October 29, 2013 Center City Connector open house.

This document[1] identifies a proposed set of improvements. Following initial discussion/review of these improvements with SDOT staff, the project team quantified the potential benefits from these improvements, i.e., shorter or more reliable travel times. These improvements will be incorporated into the refinement of the operating plan for the Center City Connector Exclusive Streetcar alternative in a future design phase.

Methodology

Two alternatives were evaluated along the South Lake Union and First Hill Streetcar routes using a combination of Synchro (for signal timing information and intersection LOS [Level-of-Service] results) and VISSIM (for multimodal traffic simulation and future travel time estimates). The baseline alternative, known as the Mixed-Traffic Streetcar alternative, is

[1] Prepared by CH2MHill, Nelson\Nygaard, and URS

reflective of the current or planned streetcar operations while the build alternative, known as the Exclusive Streetcar alternative, proposes improvements to the streetcar and roadway system to improve streetcar travel times. The analysis assumed 10-minute streetcar headways along both the SLU and First Hill Streetcar lines.

Both the 2030 Alaskan Way Viaduct (AWV) PM FEIS Toll Free Synchro network and 2030 AWV Mercer VISSIM model were used to develop the SLU area streetcar analysis. The 2013 First Hill Streetcar Synchro and VISSIM networks were used to develop the Jackson area streetcar analysis. Traffic data from these files such as volumes, alignments, signal timings, and traffic operations were used to establish the model for the alternatives.

Traffic measures of effectiveness (MOE's) provided for the analysis include vehicle and streetcar travel times, intersection level-of-service (LOS), and delay.

Figure H-1 lists the potential treatment options that were identified based on an initial assessment of the SLU and First Hill Streetcar lines. These treatments were applied to specific locations along the South Lake Union and First Hill Streetcar routes as described in the following sections.

Figure H-1 Potential Priority Treatment Options

Identifier	Priority Treatments	Additional Information
A	Install "Do Not Block Intersection" Signage/Striping	
B	Add Traffic Signal Priority (TSP)	
C	Apply traffic law enforcement	
D	Adjust traffic signal timing	
E	Create exclusive streetcar lane (may be accomplished by various means including removal of parking, access and turn restrictions, track reconstruction, etc.)	
F	Convert lane to Business Access and Transit (BAT) lane	
G	Add part-time illuminated LED signage depicting crossing or parallel streetcar vehicle approaching	See Figure H-2
H	Add signalization to intersection	
I	Add extra measures to clear streetcar lane, e.g., signage, raised pavement markings, and rough pavement treatment	
J	Modify existing Opticom system to provide traffic signal pre-emption or extension of "green time"	
K	Clear upstream merge lane by adding striped gore and signage (allow traffic to re-enter lane after trackway)	
L	Install permanent "No Turn On Red" sign	
M	Delay pedestrian signal to give priority to right turning streetcars when present	
N	Relocate far-side bus stop to near side of intersection	

Figure H-2 Part-Time Illuminated "Streetcar Approaching" Signage

Treatments and Results for South Lake Union Line (Westlake)

Proposed Priority Treatments

Based on the project team's assessment of the SLU streetcar alignment, incorporating staff and public input provided to the project team, Figure H-3 (map) and Figure H-4 (table) identify priority features that could be implemented along the SLU streetcar alignment.

Figure H-3 South Lake Union: Proposed Priority Treatments (Map)

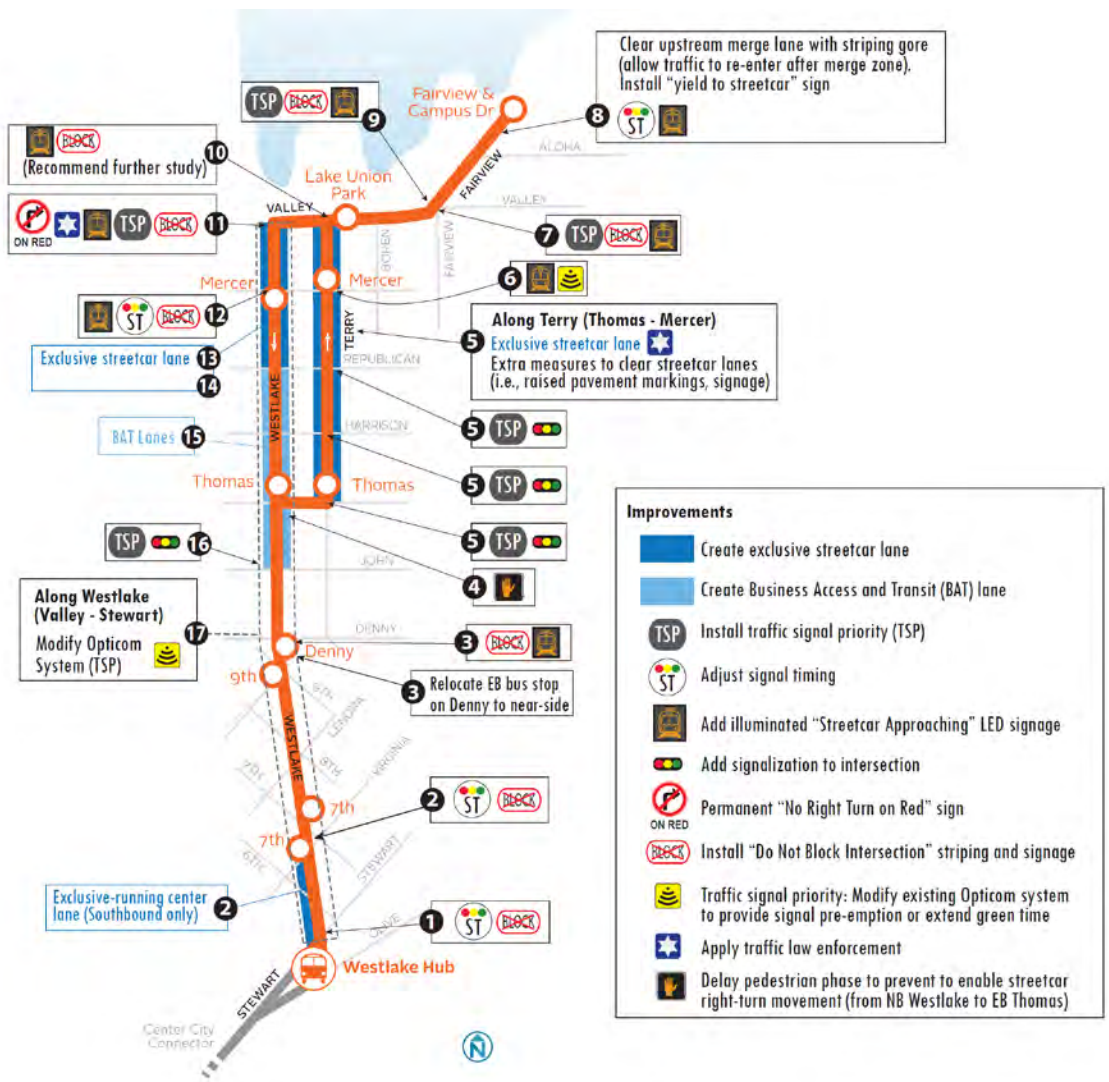


Figure H-4 South Lake Union: Assessment of Delay to Streetcar and Proposed Priority Treatments (Table)

Map Identifier	Location	Reason for Delay to Streetcars	Potential Measures for Improvement	A – Do Not Block Intersection	B – Add TSP	C – Enforcement	D – Adjust signal timing	E –Exclusive Lane	F – Create BAT lane	G –Illuminated Streetcar Approaching Signage	H - Signalization	I –Clear streetcar lane measures	J – Modify Opticom system (TSP)	K – Clear upstream lane treatment	L – No Turn on Red Sign	M - Delay pedestrian signal	N– Relocate far-side bus stop to near-side	Additional Notes/Discussion
1	NB/SB Westlake, Stewart	Traffic blocks intersection at Westlake Station	A,D	✓			✓											
2	SB Westlake, 7th/Virginia	Traffic blocks intersections	A,D,E	✓			✓	✓										
3	NB Westlake, Denny	Traffic blocks intersection	A,D, G,N	✓			✓			✓							✓*	▪ Adjust signal timing so northbound Westlake traffic can proceed through Blanchard and Denny intersections with less delay. (*) Relocation of the far-side bus stop to near-side was initially included as a potential treatment but was not observed as a contributing factor to streetcar delay.
4	NB Westlake, Thomas	Pedestrians in east leg crosswalk delay right turns	M													✓		
5	NB Terry, Thomas to Mercer	Traffic congestion blocks travel lanes	B,C,E,H,I		✓	✓		✓			✓	✓						▪ Creating exclusive lane, Thomas-Valley, e.g., by eliminating west-side parking ▪ Signalize Thomas, Harrison, Republican intersections
6	NB Terry, crossing Mercer	Potential signal detection failures	G,J							✓			✓					

Map Identifier	Location	Reason for Delay to Streetcars	Potential Measures for Improvement	A – Do Not Block Intersection	B – Add TSP	C – Enforcement	D – Adjust signal timing	E –Exclusive Lane	F – Create BAT lane	G –Illuminated Streetcar Approaching Signage	H - Signalization	I –Clear streetcar lane measures	J – Modify Opticom system (TSP)	K – Clear upstream lane treatment	L – No Turn on Red Sign	M - Delay pedestrian signal	N– Relocate far-side bus stop to near-side	Additional Notes/Discussion
7	NB at Valley/Fairview	Traffic blocks intersection	A,B,G	✓	✓					✓								
8	SB at Fairview Terminus	Traffic congestion prevents streetcar from entering lane	D,G,K				✓			✓				✓				
9	SB at Valley/Fairview	Traffic blocks intersection	A,B,G	✓	✓					✓								
10	SB Valley/Terry at parking lot access	Vehicles waiting in driveway block trackway crossing	A,G	✓						✓								▪ Further study recommended of South Lake Union parking lot ingress/egress
11	SB Valley/Westlake	Traffic blocks intersection; WB right turns wait on tracks	A,B,C,G,L	✓	✓	✓				✓					✓			▪ See also #13/14, 17
12	SB Westlake, Mercer	Traffic congestion blocks travel lanes	A,D,G	✓			✓			✓								▪ See also #13/14, 17
13	SB Westlake, Valley to Mercer	Shared travel lane could delay streetcar	E					✓										▪ Block has been operating streetcar only during construction

Map Identifier	Location	Reason for Delay to Streetcars	Potential Measures for Improvement	A – Do Not Block Intersection	B – Add TSP	C – Enforcement	D – Adjust signal timing	E –Exclusive Lane	F – Create BAT lane	G –Illuminated Streetcar Approaching Signage	H - Signalization	I –Clear streetcar lane measures	J – Modify Opticom system (TSP)	K – Clear upstream lane treatment	L – No Turn on Red Sign	M - Delay pedestrian signal	N– Relocate far-side bus stop to near-side	Additional Notes/Discussion
14	SB Westlake, Mercer to Republican	New Amazon parking lots could increase congestion	E					✓										▪ Amazon garage will have a mid-block access on Westlake, as well as access from Republican. Assuming Westlake garage access can be exit only, and "No Right Turn" from EB Mercer to SB Westlake (vehicles would use 9th), streetcar would be exclusive through the Mercer intersection to the stop platform far side of Mercer. Exiting vehicles may need to continue through Westlake/Republican intersection, rather than having a BAT lane at Republican. If so, provide BAT lane at Harrison.
15	SB Westlake, Republican to John	Traffic congestion blocks travel lanes	F						✓									▪ Would require eliminating parking on west side of Westlake ▪ See #16
16	SB Westlake, John	Traffic congestion blocks travel lanes	B,H		✓						✓							▪ See #15
17	SB Westlake, Valley to Stewart	Loss of Opticom priority at intersections	J										✓					

Analysis Results

This section describes analysis results for the South Lake Union Streetcar route between Republican and the northern terminus at Fairview/Yale as well as at the Westlake Avenue and Denny Street intersection. These areas were selected because they represented the most congested part of the corridor and had readily available information to conduct the analysis. Following this discussion is an estimate of the potential travel time improvement for the SLU system between Fairview Avenue and Westlake Center based on the partial VISSIM analysis, field observations, and professional judgment.

Study Intersections and Treatments

Priority treatments at five intersections along the existing South Lake Union Streetcar route were modeled, as shown in Figure H-5 below. As already identified, similar improvements could be considered at other intersections in the South Lake Union Streetcar system.

Figure H-5 South Lake Union: Traffic Study Intersections/Improvements

ID #	Intersection	Improvements
1	Westlake Avenue & Valley Street	▪ No Right Turn on Red ▪ Add TSP ▪ Traffic Law Enforcement ▪ Do Not Block Intersection signage/striping ▪ Illuminated "Streetcar Approaching" signage
2	Westlake Avenue & Mercer Street	▪ Do Not Block Intersection signage/striping ▪ Illuminated "Streetcar Approaching" signage ▪ Signal Timing Adjustments
3	Westlake Avenue & Denny Way	▪ Do Not Block Intersection signage/striping ▪ Illuminated "Streetcar Approaching" signage ▪ Signal Timing Adjustment
4	Valley Street & Fairview Avenue	▪ Add TSP ▪ Do Not Block Intersection signage/striping ▪ Illuminated "Streetcar Approaching" signage
5	Terry Avenue & Mercer Street	▪ Modify Existing Opticom System ▪ Illuminated "Streetcar Approaching" signage

Existing Conditions Travel Time Study

An Existing Conditions travel time study of the entire SLU route was conducted on March 19th, 2014, to help understand the causes of delay to the streetcar. The travel time study was conducted during the PM peak period from 4:00 to 6:00 p.m., with 4 runs completed in each direction and results averaged. Travel time along the route was broken down at each block by run time, station dwell time, signal delay (delay attributable to waiting at a red signal at an intersection), queue delay (delay attributable to waiting in a queue of vehicles caused by downstream congestion), or pedestrian conflict delay (delay attributable to waiting to turn right at intersections across cross walks with high volumes of pedestrians). Streetcar travel time results for Existing Conditions is presented below in Figure H-6 and Figure H-7 for the northbound and southbound directions, respectively.

In the northbound direction, the streetcar experiences approximately four minutes of queue and signal delay along Westlake Avenue between 9th Avenue/Blanchard Street and Denny Way. At the Westlake Avenue and Denny Street intersection, existing observations of the streetcar in the northbound direction on Westlake Avenue between 7th Avenue and Denny Way revealed signal coordination that caused noticeable streetcar delays. The signal timings along Westlake Avenue between 9th Avenue/Blanchard Street and Denny Way is such that when the northbound approach at Denny Way is green, the eastbound approach at 9th Avenue/Blanchard Street is green. This results in the northbound approach of 9th Avenue/Blanchard Street receiving a green signal when the northbound approach of Denny Way is receiving a red signal. KC Metro Route 40 uses Blanchard Street to travel northbound and turn left onto northbound Westlake Avenue, while Sound Transit Route 554 uses northbound Blanchard Street to turn right onto southbound Westlake Avenue. A few other KC Metro routes were observed using Blanchard Street to either return to their base or start a new route.

In the southbound direction, the streetcar experiences approximately four minutes of delay at the intersection of Valley Street/Fairview Avenue. The delay is caused by vehicle queues spilling back from the intersection of Mercer Street and Fairview Avenue. An additional 35 seconds of queue delay was observed at the intersection of Westlake Avenue/Mercer Street.

Figure H-6 South Lake Union: Existing Conditions Northbound Travel Time Results, PM Peak

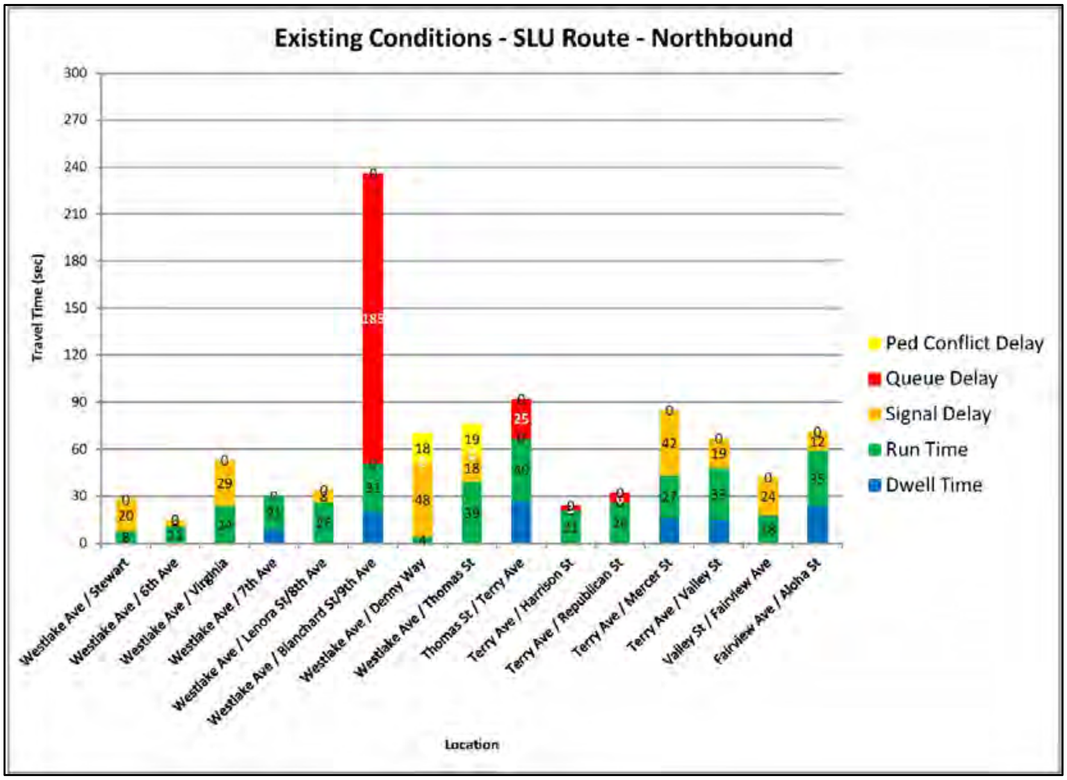
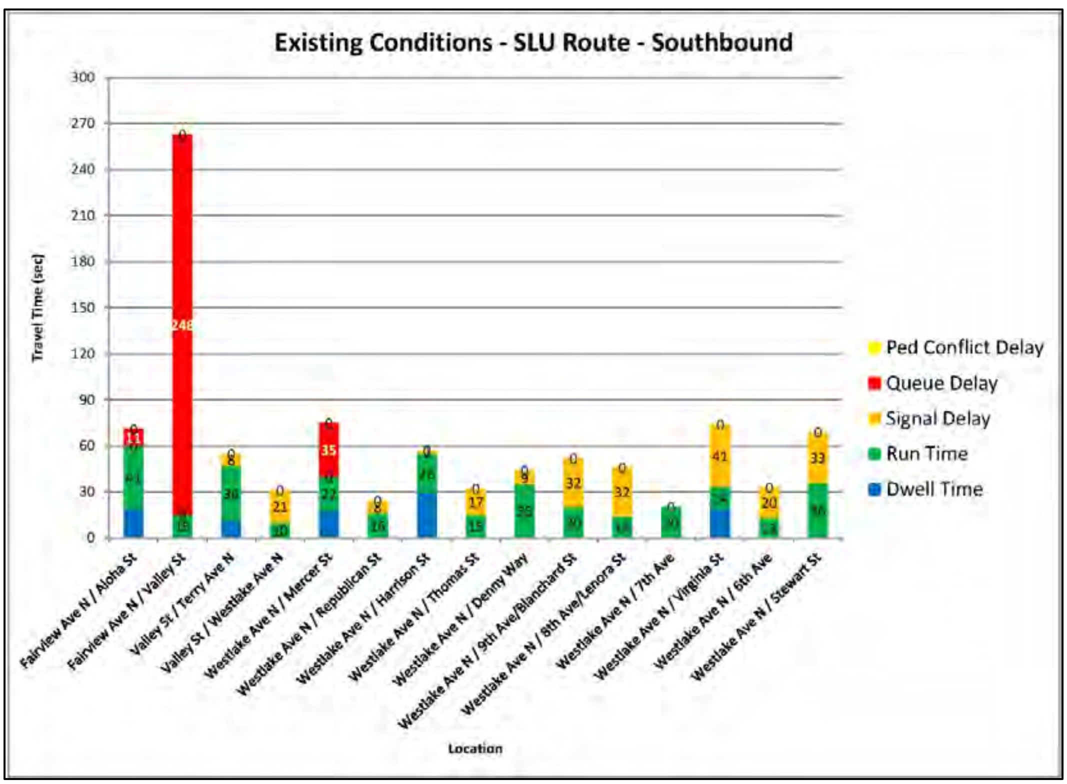


Figure H-7 South Lake Union: Existing Conditions Southbound Travel Time Results, PM Peak



Intersection LOS

Figure H-8 compares the year 2030 intersection Level of Service (LOS) of the Mixed-Traffic Streetcar alternative with the Exclusive Streetcar alternative. Overall, average vehicle delay at the intersections is similar between the Mixed-Traffic and Exclusive Streetcar alternatives.

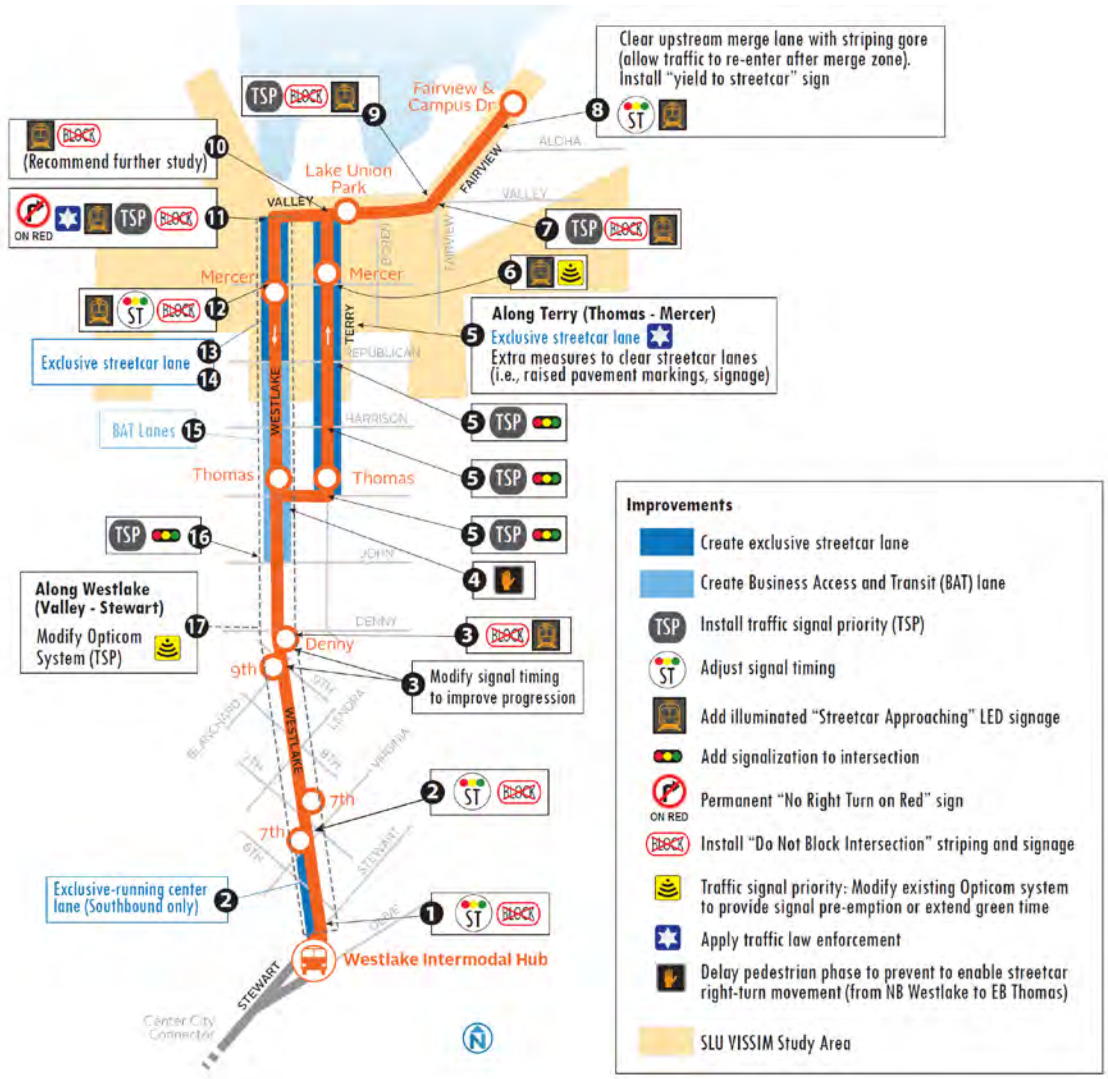
Figure H-8 South Lake Union: 2030 Synchro LOS and Delay (Seconds), PM

ID#	Major Street	Cross Street	2030 Mixed-Traffic Streetcar		2030 Exclusive Streetcar	
			LOS	Delay (in sec.)	LOS	Delay (in sec.)
1	Westlake Avenue	Valley Street	F	80	F	81
2	Westlake Avenue	Mercer Street	F	156	F	156
3	Westlake Avenue	Denny Way	F	121	F	121
4	Fairview Avenue	Valley Street	E	67	E	72
5	Terry Ave	Mercer Street	C	34	C	30
	Average Intersection Delay		**N/A**	**87.6**	**N/A**	**88.0**

Streetcar Travel Time Results

Northbound and southbound streetcar travel times between the Mixed-Traffic Streetcar and Exclusive Streetcar alternatives were compared using VISSIM. The study area for the VISSIM modeling is shown below in Figure H-9. Northbound streetcar travel time was measured from the intersections of Republican Street/Terry Street to Fairview Avenue/Aloha Street, while southbound streetcar travel time was measured from the intersections of Fairview Avenue/Aloha Street to Westlake Avenue/Republican Street.

Figure H-9 South Lake union: Study Area (Map)



With the Exclusive Streetcar alternative, the proposed improvements resulted in about a two minute travel time savings for the northbound direction, with most of the savings occurring along Terry Ave between Republican Street and Mercer Street where TSP is provided. In the southbound direction, a majority of streetcar savings (about three minutes) is along Westlake Avenue where TSP and an exclusive streetcar lane are provided to prevent general traffic from blocking the streetcar. Figure

H-10 shows the average travel time savings between the Mixed-Traffic Streetcar and Exclusive Streetcar alternatives.

Figure H-10 South Lake Union: 2030 PM Peak Hour Northbound Streetcar Travel Time Comparison

Travel Time (Min)	Northbound Streetcar			Southbound Streetcar		
Road Segment	Mixed	Exclusive	Delta	Mixed	Exclusive	Delta
1) Republican Street to Valley Street	4.8	2.8	-2.0	2.0	1.2	-0.8
2) Valley Street to Fairview Turnaround	2.2	2.1	-0.1	9.1	7.0	-2.1
Total =	7.0	4.9	-2.1	11.1	8.1	-2.9

At the Westlake Avenue and Denny Street intersection, existing observations of the streetcar in the northbound direction on Westlake Avenue between 7th Avenue and Denny Way revealed poor signal progression which caused noticeable streetcar delays. A VISSIM model of the two intersections along Westlake Avenue between Denny Way and 9th Avenue/Blanchard Street was created to analyze the proposed signal timing adjustments. Modifying the signal timing between these two intersections would likely result in a streetcar travel time savings of up to three minutes in the northbound direction, with minor delays on the eastbound approach of Blanchard Street.

Auto Travel Time and Throughput

Auto travel times along Mercer Street were compared between the two alternatives to understand if the proposed streetcar improvements would affect traffic flow in the study area. Figure H-11 shows the estimated auto travel time along Mercer Street. East and westbound trips continue to experience congestion but the proposed streetcar improvements do not noticeably impact the auto travel time. Figure H-12 shows the estimated auto vehicle throughput comparison for Mercer Street and Westlake Avenue. For both roads, the auto throughput is the similar between the two alternatives.

Figure H-11 South Lake Union: 2030 PM Peak Hour Mercer Street Auto Travel Time

Travel Time (Min)	Eastbound		Westbound	
Segments of Mercer Street	Mixed	Exclusive	Mixed	Exclusive
1) I-5 Off-Ramp to Terry	0.9	0.8	2.4	2.8
2) Terry to Dexter	1.7	1.5	2.5	1.6
Total =	2.6	2.3	4.8	4.4

Figure H-12 South Lake Union: 2030 PM Peak Hour Auto Vehicle Throughput

Road Segment	Mixed-Traffic Streetcar		Exclusive Streetcar	
	NB/EB	SB/WB	NB/EB	SB/WB
Mercer Street - Westlake Ave to Fairview Ave	1861	1612	1947	1670
Westlake Avenue - Valley St to Mercer St	1080	190	1073	208

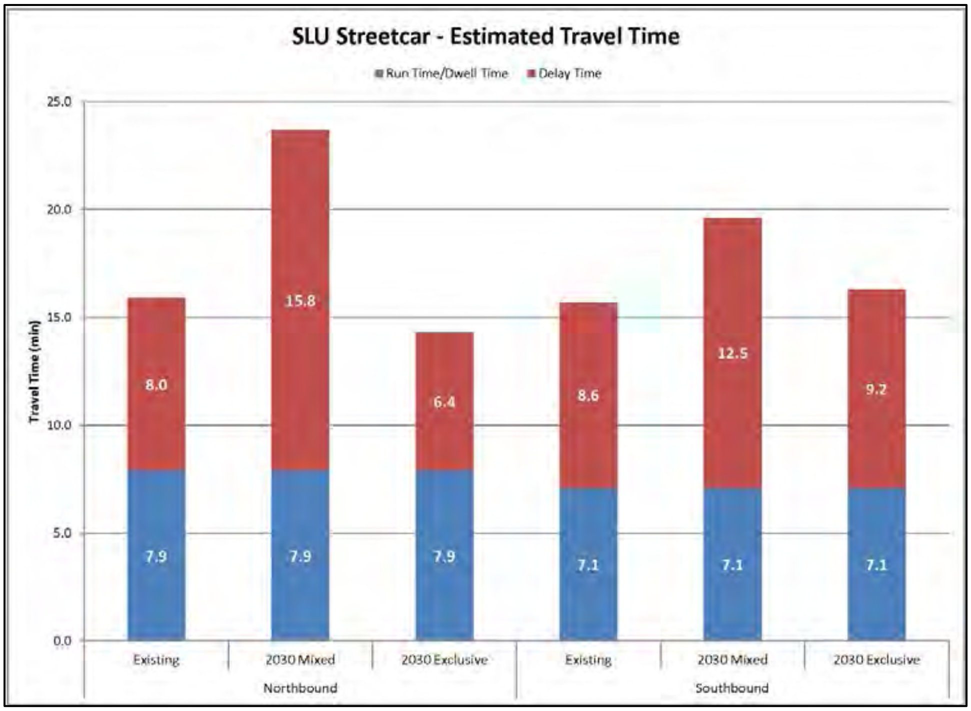
Preliminary Estimate of Full SLU Corridor Travel Time Improvements

This section provides an estimate of potential travel time improvement throughout the entire SLU area based on the VISSIM analysis, field observations, and application of the analysis results based on professional judgment. The streetcar travel time through the SLU area for the 2030 Mixed-Traffic Streetcar alternative was estimated from the existing streetcar travel time determined from field observations with an estimate of the additional delay in the future based on the VISSIM modeling of the 2030 Streetcar Mixed-Traffic alternative. The travel time for the 2030 Exclusive Streetcar alternative was estimated by utilizing the same run time and station dwell time from the existing streetcar field observations and estimating the travel time savings from the countermeasures analyzed at specific locations in the VISSIM modeling in the northern part of the study area and applying them throughout the SLU corridor.

The travel times for the Existing Condition, 2030 Mixed-Traffic Streetcar, and 2030 Exclusive Streetcar alternatives are presented below in Figure H-13. In the northbound direction, the delay experienced by the streetcar is estimated to be reduced approximately 60% (from about 16 to about 6.5 minutes) with the proposed countermeasures. This would reduce the total northbound streetcar travel time from about 24 minutes in the 2030 Mixed-Traffic alternative to slightly less than 15 minutes in the 2030 Exclusive alternative, which would be a slightly lower than existing streetcar travel time. The locations that would experience the most benefit in the northbound direction include Westlake Avenue between 9th Avenue/Blanchard Street and Denny Way (due to proposed signal timing adjustments) and Terry Avenue between Thomas Street and Mercer Street (due to new signals along Terry Avenue and TSP at the Mercer Street/Terry Avenue intersection).

In the southbound direction, the delay experienced by the streetcar would be reduced by approximately 25% (from about 12.5 to about 9 minutes). This would reduce the total southbound streetcar travel time from slightly less than 20 minutes in the 2030 Mixed-Traffic Streetcar alternative to about 16 minutes in the Exclusive Streetcar alternative, which would be within 1 minute of the existing streetcar travel time. The locations that would experience the most benefit in the southbound direction include Fairview Avenue between Aloha Street and Valley Street (due to signal timing adjustments, TSP and “Don’t Block Box” restrictions), Westlake Avenue between Valley Street and Republican Street (due to TSP and an exclusive streetcar lane), and Westlake Avenue between Virginia Street and Stewart Street (due to an exclusive streetcar lane).

Figure H-13 South Lake Union: Estimated Travel Time Results



Treatments and Results for First Hill Line (South Jackson Street)

Proposed Priority Treatments

The First Hill Streetcar line is currently under construction with service on South Jackson Street scheduled to begin in 2014. As such, there are no specific locations currently identified as needing improvements to improve the streetcar performance. However, traffic models developed during the First Hill Streetcar project design anticipate peak hour congestion on Jackson Street. The project team identified several potential measures that could be applied on Jackson, as shown in Figure H-14 and Figure H-15 below:

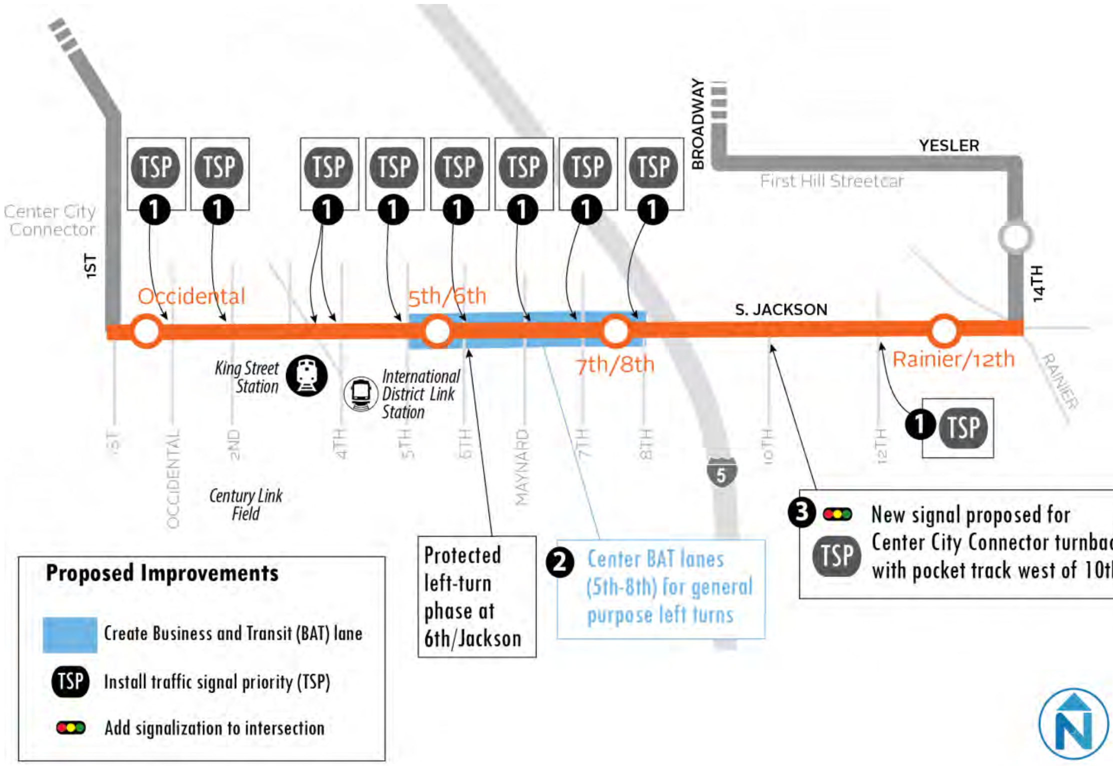
- Adding TSP via Opticom at all signalized intersections would provide signal pre-emption and/or extend "green time"
- Designating the center lanes between 5th and 8th Avenues as BAT lanes would reserve the center travel lanes on Jackson for transit and left-turning vehicles only

Figure H-14 First Hill (S. Jackson Street): Proposed Priority Treatments (Table)

Map Identifier	Cross-Streets	Purpose of Treatment	Potential Measures for Improvement	B – Add TSP	F – Create BAT lane	G - Signalization	Additional Notes/Discussion
1	Occidental – 12th	TSP and/or signal timing to reduce delay to streetcar	B	✓			
2	5th-8th	Center BAT lanes to reduce delay to streetcar	F	✓	✓		
3	10th	New signal for streetcar turnback and storage	B, G	✓		✓	Turnback with storage is required for Hub-to-Hub Center City Connector operating scenario.

Note: It is assumed that signal timing on South Jackson would be adjusted in conjunction with opening of the First Hill Streetcar.

Figure H-15 First Hill (South Jackson Street): Potential Priority Treatments



Analysis Results

This section describes analysis results for the portion of the First Hill Streetcar route along South Jackson Street. The traffic analysis focused on the orange-highlighted area shown in Figure H-15. The 1st Avenue/ South Jackson Street intersection that was included in the Center City Connector Tier 2 evaluation is not included in this analysis.

Study Area, Intersections and Assumptions

The area considered for improvements along the First Hill Streetcar route includes South Jackson Street between 1st Avenue and 12th Avenue. VISSIM models previously developed for the First Hill Streetcar route were used to evaluate the proposed improvements on South Jackson Street.

Streetcar and auto travel time results are provided along South Jackson Street between 2nd Avenue and 10th Avenue, while intersection analysis was conducted at four study intersections, as seen in Figure H-16. The Seattle Center City Connector route along 1st Avenue was also integrated into the First Hill Streetcar VISSIM model with a turnaround signal located at South Jackson Street/10th Avenue for streetcars just carrying passengers between Jackson Street and Westlake Hub. Streetcars using the Center City Connector route were assigned ten minute headways and travelled between 1st Avenue and the turnaround at 10th Avenue, while streetcars traveling the First Hill route were also assigned ten minute headways but were offset from the Center City Connector route by 5 minutes. This results in an effective headway of 5 minutes on South Jackson Street west of 10th Avenue and a 10 minute headway east of 10th Avenue.

Figure H-16 First Hill (S. Jackson Street): Traffic Study Intersections and Exclusive Alternative Improvements

ID #	Intersection	Exclusive Alternative Improvements
9	S Jackson Street & 2nd Avenue	▪ Add TSP ▪ BAT Lane
7	S Jackson Street & 4th Avenue	▪ Add TSP ▪ BAT Lane
8	S Jackson Street & 5th Avenue	▪ Add TSP ▪ BAT Lane
6	S Jackson Street & 6th Avenue	▪ Add TSP ▪ BAT Lane ▪ Add Protected Left-Turn Phase

Intersection LOS

Figure H-17 provides an intersection LOS comparison between the Mixed-Traffic Streetcar alternative and the Exclusive Streetcar alternative. Three of the four study intersections along South Jackson Street (2nd Avenue, 4th Avenue, and 5th Avenue) operate at LOS C or better under either alternative, while South Jackson Street / 6th Avenue experiences deterioration from LOS C in the Mixed-Traffic Streetcar alternative to LOS E in the Exclusive Streetcar alternative. The increase in average delay at South Jackson Street / 6th Avenue in the Exclusive Streetcar alternative is caused by a combination of the high volume of westbound left-turns and the eastbound through and right-turning vehicles consolidated into one shared travel lane. The protected westbound left-turn phase assumed in the Exclusive Streetcar alternative takes green time away from vehicles traveling north and south on 6th Avenue.

Figure H-17 First Hill (S. Jackson Street): 2030 Synchro LOS and Delay

			2030 Mixed-Traffic Streetcar		2030 Exclusive Streetcar	
ID#	Major St	Cross St	LOS	Delay (in sec.)	LOS	Delay (in sec.)
9	Jackson St	2nd Ave	B	14	B	14
7	Jackson St	4th Ave	C	26	C	26
8	Jackson St	5th Ave	B	16	C	21
6	Jackson St	6th Ave	C	24	E	56
	Average Intersection Delay		N/A	20	N/A	29

Streetcar and Auto Travel Times

Figure H-18 shows the travel time summary for both auto vehicles and streetcar. The streetcar would experience a 15% savings in travel time in the Exclusive Streetcar alternative compared to the Mixed-Traffic Streetcar alternative with little change in travel time for auto vehicles. Figure H-19 shows the average speed for both autos and streetcar on South Jackson Street. As with travel time, average speed for streetcar vehicles would increase by 17% in the Exclusive Streetcar alternative compared to the Mixed-Traffic Streetcar alternative with a small change to auto speeds.

Figure H-18 First Hill (S. Jackson Street): 2030 Travel Time Summary (Minutes)

Segment of Jackson	Auto							Streetcar						
	Mixed-Traffic Streetcar			Exclusive Streetcar				Mixed-Traffic Streetcar			Exclusive Streetcar			
	EB	WB	Avg (both dir)	EB	WB	Avg (both dir)	% Change from Mixed-Traffic	EB	WB	Avg (both dir)	EB	WB	Avg (both dir)	% Change from Mixed
2nd to 6th Ave	2.2	2.2	2.2	2.3	1.9	2.1	-5%	3.0	3.2	3.1	2.3	2.4	2.4	-23%
6th to 10th Ave	1.2	1.3	1.3	1.2	1.3	1.3	0%	1.7	2.4	2.1	1.9	2.1	2.0	-5%
Total =	**3.4**	**3.5**	**3.5**	**3.5**	**3.2**	**3.4**	**-3%**	**4.7**	**5.6**	**5.2**	**4.2**	**4.5**	**4.4**	**-15%**

Figure H-19 First Hill (S. Jackson Street): 2030 Average Speed Summary (mph)

Segment of Jackson	Auto							Streetcar						
	Mixed-Traffic Streetcar			Exclusive Streetcar				Mixed-Traffic Streetcar			Exclusive Streetcar			
	EB	WB	Avg (both dir)	EB	WB	Avg (both dir)	% Change from Mixed-Traffic	EB	WB	Avg (both dir)	EB	WB	Avg (both dir)	% Change from Mixed-Traffic
2nd to 6th Ave	8	8	8	8	10	9	6%	6	6	6	8	8	8	32%
6th to 10th Ave	16	15	16	16	15	16	-1%	12	8	10	10	9	10	-1%
Average =	**11**	**11**	**11**	**11**	**12**	**11**	**3%**	**8**	**7**	**7**	**9**	**8**	**9**	**17%**

Auto Throughput

Figure H-20 shows vehicle throughput on Jackson Street between 2nd Avenue and 6th Avenue. Vehicle throughput is similar between the Mixed-Traffic Streetcar and Exclusive Streetcar alternatives.

Figure H-20 First Hill (S. Jackson Street): 2030 Vehicle Throughput

Segment of Jackson	Mixed-Traffic Streetcar		Exclusive Streetcar	
	EB	WB	EB	WB
2nd Ave to 6th Ave	506	738	503	748

BAT Lane Conflict with Curbside Bus Stops

The proposed BAT lane on South Jackson Street between 5th Avenue and 8th Avenue could create a potential conflict between autos and buses. The proposed BAT lane would be intended for transit vehicles (bus and streetcar) only and autos turning left at intersections. KC Metro currently has two curbside bus stops on South Jackson Street in each direction between 5th Avenue and 8th Avenue. When buses are stopped at these curb-side bus stops they would block autos from traveling through on South Jackson Street. This could potentially cause autos to weave into and use the BAT lane to drive around the stopped buses. In addition, buses with stops on South Jackson Street between 5th Avenue and 8th Avenue (such as routes 1, 7, 14, 36, 49, 99, and 984) may avoid using the BAT lane so they can stay in the right-side curb lane to arrive at their bus stop. This potential vehicle-bus conflict would need to be evaluated and designed further.

Key Findings

Figure H-21 summarizes estimated travel time improvements from the South Lake Union Streetcar line and the South Jackson Street segment of the First Hill Streetcar line for a 2030 analysis year.

Figure H-21 Average One-Way Travel Time by Direction with/without Modeled Treatments

Line (Segment)	Direction	Before Improv. (Min)	With Improv. (Min)	Improv. (Min)	% Change (Improv.)
South Lake Union (Westlake Station to Fairview Turnaround)	NB	23.7	14.3	-9.4	-40%
	SB	19.6	16.3	-3.3	-17%
	Average 1-Way	21.7	15.3	-6.4	-29%
	Total Round Trip	43.3	30.6	-12.7	-29%
First Hill (South Jackson Street from 2nd Avenue to 10th Avenue)	EB	4.7	4.2	-0.5	-11%
	WB	5.6	4.5	-1.1	-20%
	Average 1-Way	5.2	4.4	-0.8	-16%
	Total Round Trip	10.3	8.7	-1.6	-16%

South Lake Union:

- The streetcar would experience about a 17-40% improvement in travel time between Fairview Avenue/Valley Street and Republican Street, or an average of approximately six minutes per direction.
- Auto trips on Mercer Street would see no change in east-west travel time or vehicle throughput as a result of the Exclusive Streetcar alternative.
- The proposed signal adjustments along Westlake Avenue at Denny Way and 9th Avenue/Blanchard Street would result in a travel time savings of three minutes in the northbound direction.
- In the future, without improvements, SLU streetcar peak period travel times are expected to typically range from 20 to 24 minutes. The estimated benefit from the proposed treatments would reduce average streetcar travel time to approximately 14 to 16 minutes,

which would be similar to the current operating travel times typically experienced in the peak period.

First Hill (South Jackson Street):

- The streetcar would experience about a 10% to 20% improvement in travel time between 2nd and 10th Avenues, or slightly less than one minute per direction.
- There seems to be sufficient auto capacity on South Jackson Street to handle TSP and a BAT lane. Therefore, only minimal impacts to auto performance (travel time and throughput) are expected. A potential vehicle conflict that would require further evaluation is autos that may use the BAT lane to pass buses stopped at the existing curbside stops.
- The analysis showed the Jackson Street/6th Avenue intersection is at capacity and would degrade to LOS E with the exclusive scenario. This is caused by high turning volumes that take signal time away from through movements. Further evaluation of this intersection would be required, however creating small north and south-bound turn pockets on 6th Avenue could help offset the increased delay. This would require trimming curb bulbouts on 6th Avenue (similar to the existing curb bulbs that are being trimmed on Jackson Street as part of First Hill Streetcar construction). Some parking spaces may need to be eliminated near the intersection. Another possibility would be to restrict some left-turns during peak periods.

Next Steps

The results of this analysis will be incorporated into traffic analysis and refinements to the streetcar operating plan in the subsequent design and environmental phase of the Center City Connector Project.

APPENDIX I PARKING AND LOADING IMPACTS ASSESSMENT

Note: This appendix provides additional details on the Tier 2 parking and loading impact analysis, which was summarized in Chapter 7 of the Detailed Evaluation Report.[1]

Introduction

This appendix describes the methodology used for the Tier 2 assessment of potential parking, loading zone, and driveway impacts of alternatives for the Center City Connector. This assessment was conducted based on preliminary conceptual designs for the Mixed-Traffic and Exclusive Streetcar alternatives as well as a No-Build alternative. Final parking and loading impacts will be determined during preliminary engineering and final design.

Approach/Methodology

Existing conditions were initially evaluated through a visual survey of the project corridor using Google Street View. This approach allowed for a quick survey of the study area without requiring a site visit. Limitations of the imagery, however, such as obstructed views or blurry signs, necessitated certain assumptions and estimations which are described below. A follow-up field survey was conducted to fill in gaps in the web-based visual survey.

Counts for the two alternatives describe the number of spaces that would be retained or created under each alternative. It was assumed that parking spaces and loading zones would be retained under the Mixed-Traffic Streetcar alternative except on blocks where the alignment runs in the curbside lane. For the Exclusive Streetcar alternative, it was assumed that spaces would only be retained as shown in the project design. It was assumed that the No-Build alternative would have the same parking, loading, and driveway configuration as current conditions.

Parking

Parking spaces were inventoried including any spaces which are available for parking for any duration of time and during any period of the day. For blocks without delineated parallel parking spaces, the space available for parking was divided into twenty-foot long parking spaces. In some cases the length of parking zones was estimated due to obstructions in the Street View imagery that made it difficult to delineate the edges of parking zones.

[1] Prepared by URS and Nelson\Nygaard

Loading Zones

Curb spaces were counted as loading zones if they were identified by signage or curb painting; yellow-painted curbs indicate general loading zones and white-painted curbs indicate loading zones. Each vehicle space was counted as one loading zone, so a single signed or painted zone with space for two vehicles was counted as two zones. Many of the loading zones are also general parking zones during off-peak hours. In a few instances, obstructed views required estimation of loading zone boundaries.

Driveways

Driveways were counted if they served as unique in/out access points, which did not include all curb cuts. One alleyway curb cut was counted as a driveway because it fed directly into a surface parking lot. It was assumed that driveway access would not be affected by either alternative.

Field Verification

The Google Street View imagery for the project alignment was captured in June 2011, while the Seattle City Center Connector parking analysis was performed in October 2013. Due to the more than two-year time lapse, there was the potential that parking and loading locations and restrictions had changed since the imagery was originally captured. In addition, obstructed views of curbs and signs made it difficult to determine with certainty the parking status of various points along the project alignment. To account for these uncertainties, a field check of the parking and loading assessment was conducted on foot along 1st Avenue between S Jackson Street and Pine Street. Parking and loading area counts were updated accordingly.

Assessment

Figure I-1, Figure I-2, and Figure I-3 provide detailed parking and loading zone analysis results in tabular form. Figure I-4 and Figure I-5 present the parking and loading zone impacts graphically.

Figure I-1 All Day Parking Summary

1st Avenue All Day Parking		West Side/ North Side (Stewart Blocks)			East Side/ South Side (Stewart Blocks)			Total Spaces		
Block #	Block Name	Existing	Mixed	Exclusive	Existing	Mixed	Exclusive	Existing	Mixed	Exclusive
1	Jackson - Main	0	0	0	0	0	0	0	0	0
2	Main - Washington	0	0	0	0	0	0	0	0	0
3	Washington - Yesler	0	0	0	0	0	0	0	0	0
4	Yesler - Cherry	0	0	0	0	0	0	0	0	0
5	Cherry - Columbia	0	0	0	0	0	0	0	0	0
6	Columbia - Marion	0	0	3	0	0	0	0	0	3
7	Marion - Madison	0	0	0	0	0	0	0	0	0
8	Madison - Spring	0	0	0	0	0	0	0	0	0
9	Spring - Seneca	0	0	0	0	0	0	0	0	0
10	Seneca - University	5	5	5	0	0	0	5	5	5
11	University - Union	0	0	5	0	0	0	0	0	5
12	Union - Pike	0	4	0	0	0	0	0	4	0
13	Pike - Pine	0	0	0	0	0	0	0	0	0
14	Pine - Stewart	0	0	0	0	0	0	0	0	0
15	Stewart/1st - 2nd	7	3	3	9	3	3	16	6	6
16	Stewart/2nd - 3rd	0	0	0	0	0	3	0	0	3
17	Stewart/3rd - 4th	0	0	0	0	0	0	0	0	0
18	Stewart/Olive/4th - 5th	0	0	0	6	0	0	6	0	0
19	Stewart/Westlake/ 5th - 6th	0	0	0	0	0	0	0	0	0
	Total # of Parking Spaces:	**12**	**12**	**16**	**15**	**3**	**6**	**27**	**15**	**22**

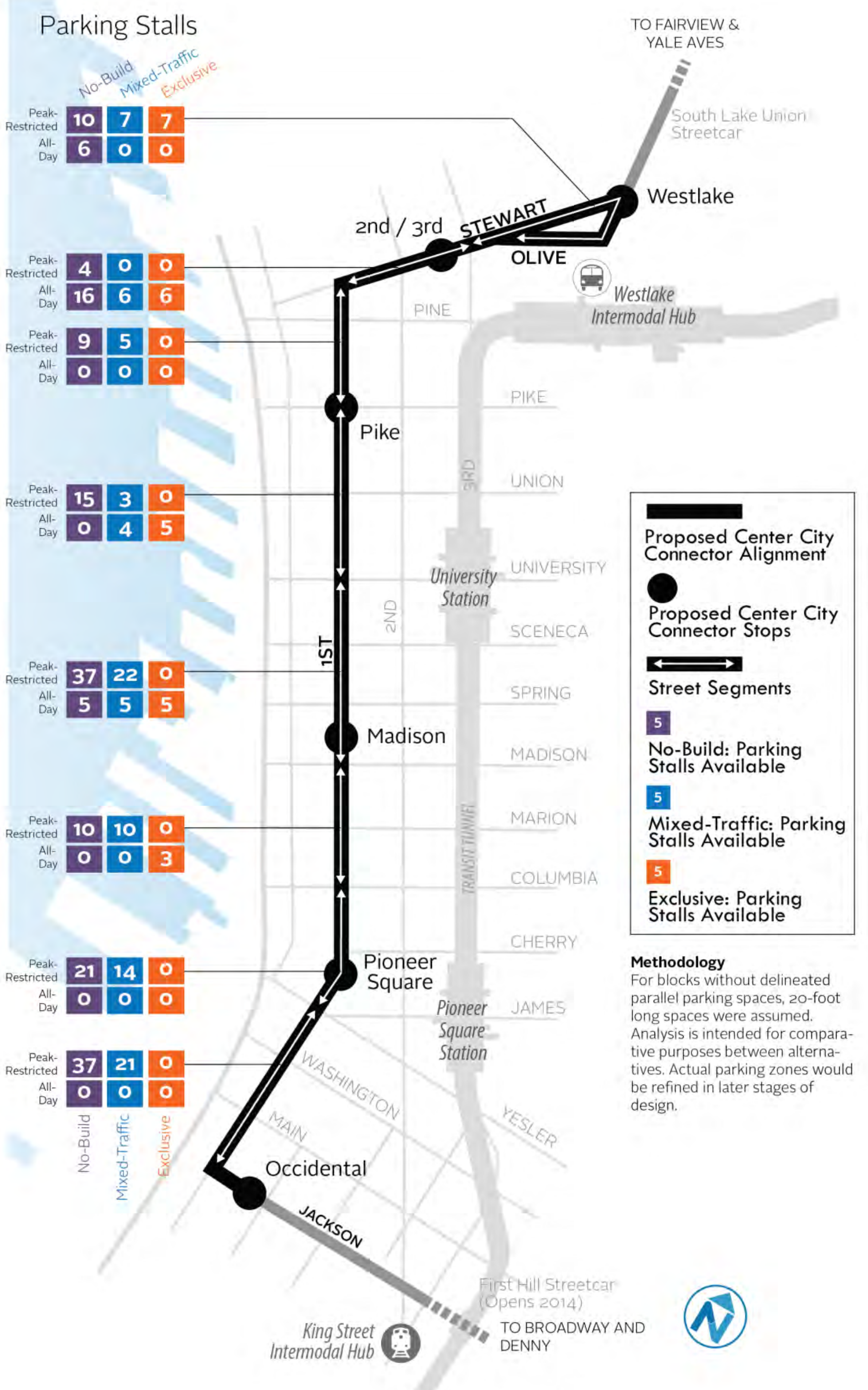
Figure I-2 Peak-Restricted Parking Summary

1st Avenue Peak-Restricted Parking		West Side/ North Side (Stewart Blocks)			East Side/ South Side (Stewart Blocks)			Total Spaces		
Block #	Block Name	Existing	Mixed	Exclusive	Existing	Mixed	Exclusive	Existing	Mixed	Exclusive
1	Jackson - Main	5	0	0	3	3	0	8	3	0
2	Main - Washington	9	9	0	9	9	0	18	18	0
3	Washington - Yesler	3	0	0	8	0	0	11	0	0
4	Yesler - Cherry	7	0	0	0	0	0	7	0	0
5	Cherry - Columbia	6	6	0	8	8	0	14	14	0
6	Columbia - Marion	4	4	0	6	6	0	10	10	0
7	Marion - Madison	0	0	0	0	0	0	0	0	0
8	Madison - Spring	5	0	0	6	0	0	11	0	0
9	Spring - Seneca	9	9	0	9	7	0	18	16	0
10	Seneca - University	0	0	0	8	6	0	8	6	0
11	University - Union	0	0	0	4	0	0	4	0	0
12	Union - Pike	7	3	0	4	0	0	11	3	0
13	Pike - Pine	0	0	0	5	5	0	5	5	0
14	Pine - Stewart	0	0	0	4	0	0	4	0	0
15	Stewart/1st - 2nd	0	0	0	0	0	0	0	0	0
16	Stewart/2nd - 3rd	0	0	0	4	0	0	4	0	0
17	Stewart/3rd - 4th	0	0	0	0	0	0	0	0	0
18	Stewart/Olive/4th - 5th	10	7	7	0	0	0	10	7	7
19	Stewart/Westlake/ 5th - 6th	0	0	0	0	0	0	0	0	0
	Total # of Parking Spaces:	**65**	**38**	**7**	**78**	**44**	**0**	**143**	**82**	**7**

Figure I-3 Loading Zone Summary

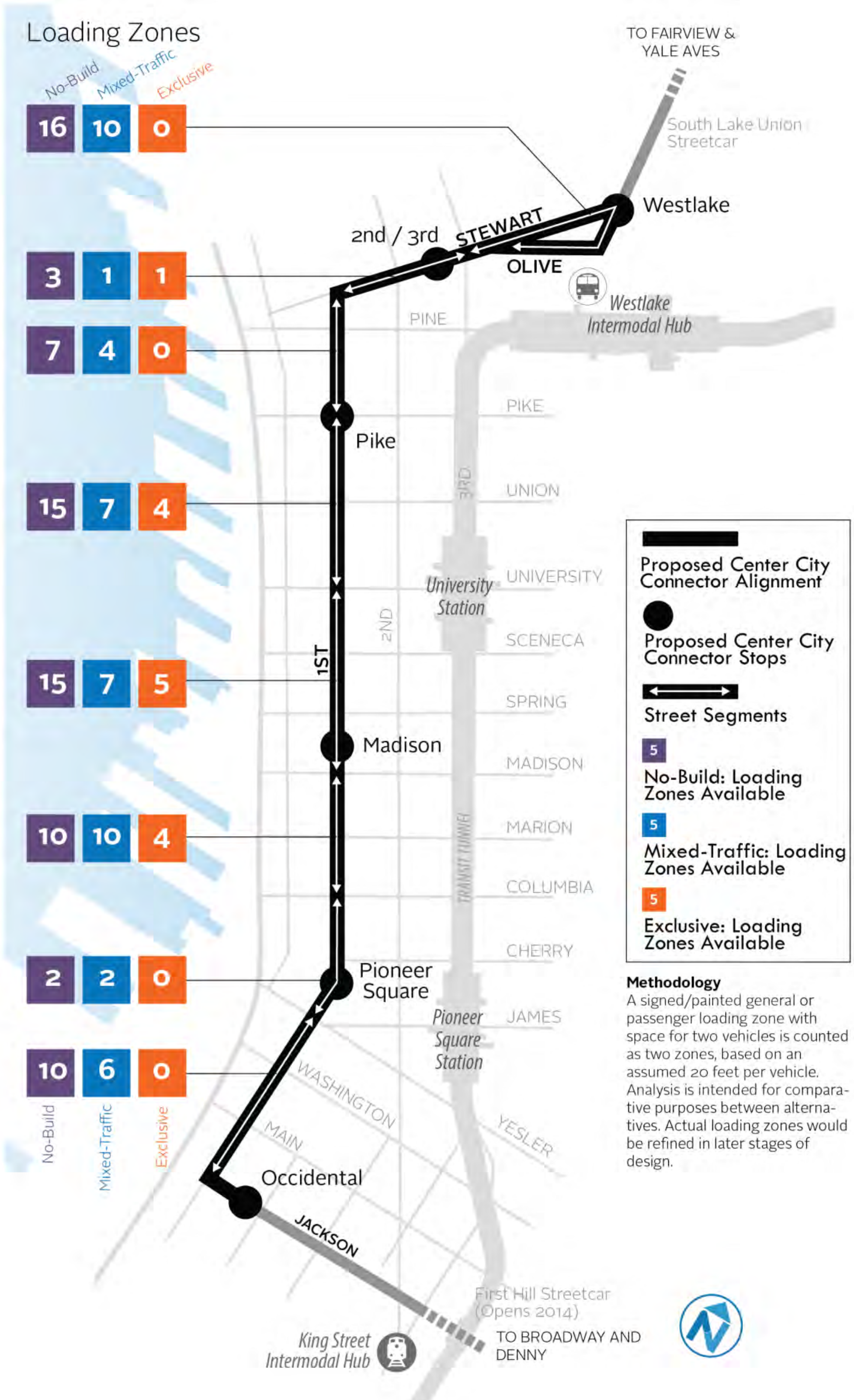
1st Avenue Loading Zones		West Side/ North Side (Stewart Blocks)			East Side/ South Side (Stewart Blocks)			Total Loading Zones		
Block #	Block Name	Existing	Mixed	Exclusive	Existing	Mixed	Exclusive	Existing	Mixed	Exclusive
1	Jackson - Main	1	1	0	2	2	0	3	3	0
2	Main - Washington	1	1	0	2	2	0	3	3	0
3	Washington - Yesler	2	0	0	2	0	0	4	0	0
4	Yesler - Cherry	0	0	0	0	0	0	0	0	0
5	Cherry - Columbia	2	2	0	0	0	0	2	2	0
6	Columbia - Marion	2	2	0	3	3	0	5	5	0
7	Marion - Madison	2	2	2	3	3	2	5	5	4
8	Madison - Spring	4	0	0	4	0	0	8	0	0
9	Spring - Seneca	2	2	0	0	0	0	2	2	0
10	Seneca - University	3	3	5	2	2	0	5	5	5
11	University - Union	3	3	0	3	3	0	6	6	0
12	Union - Pike	4	0	1	5	1	3	9	1	4
13	Pike - Pine	4	3	0	2	1	0	6	4	0
14	Pine - Stewart	0	0	0	1	0	0	1	0	0
15	Stewart/1st - 2nd	1	1	1	2	0	0	3	1	1
16	Stewart/2nd - 3rd	0	0	0	0	0	0	0	0	0
17	Stewart/3rd - 4th	0	0	0	0	0	0	0	0	0
18	Stewart/Olive/4th - 5th	2	2	0	8	8	0	10	10	0
19	Stewart/Westlake/ 5th - 6th	0	0	0	0	0	0	0	0	0
	Total # of Loading Zones:	33	22	9	39	25	5	72	47	14

Figure I-4 Parking Impacts



Methodology
For blocks without delineated parallel parking spaces, 20-foot long spaces were assumed. Analysis is intended for comparative purposes between alternatives. Actual parking zones would be refined in later stages of design.

Figure I-5 Loading Impacts



Methodology
A signed/painted general or passenger loading zone with space for two vehicles is counted as two zones, based on an assumed 20 feet per vehicle. Analysis is intended for comparative purposes between alternatives. Actual loading zones would be refined in later stages of design.

APPENDIX J BUS OPERATIONS ANALYSIS

This appendix describes the methodology used to assess impacts to transit operations as part of the Tier 2 evaluation of alternatives for the Center City Connector. The Tier 2 evaluation of impacts to transit operations focused on potential bus vehicle delay resulting from the Mixed-Traffic and Exclusive Streetcar alternatives for the Stewart Street/Olive Way east-west connection between 1st Avenue and Westlake Avenue.

Alternatives Analyzed

The Tier 2 bus operations analysis was conducted only for the Stewart Street/Olive Way connection alternative, which was the east-west connection alternative that was included in the Tier 2 evaluation.

It is assumed that the 1st Avenue alignment would have minimal impacts to transit service since there is currently only one route operating on 1st Avenue (Route 99) with only two trips per hour during peak periods; moreover, this route would likely be restructured if a 1st Avenue streetcar alignment is developed, as was assumed in the Tier 2 traffic analysis.

Additional east-west connection options using Pike and Pine Streets will be analyzed in the environmental and design phase, including impacts to bus operations. Impacts on other bus services using portions of 1st Avenue will also be assessed.

Tier 2 Analysis Methodology

Study Area and Bus Volumes

The bus delay analysis conducted for the Tier 2 evaluation assessed impacts to bus routes operating on Stewart and Olive on weekdays between 5:00 and 6:00 p.m. Stewart Street and Olive Way are used by King County Metro, Community Transit, and Sound Transit buses. Bus volumes were obtained using these agencies' route alignments and published schedules as of Summer 2013. The analysis is for the 2018 opening year and therefore did not include any routes currently operating in the DSTT that may be routed on surface streets if buses are moved out of the DSTT in the future.

Stewart Street is one-way westbound between 1st Avenue and 3rd Avenue; mid-block between 3rd and 4th Avenues, Stewart Street (westbound) becomes a one-way couplet with Olive Way (eastbound). Westbound buses turn from Stewart Street onto either 3rd or 2nd Avenues.

All downtown Seattle-bound Community Transit routes use a significant portion of Stewart in either the AM or PM peak, depending on the route's downtown travel direction. A small number of King County Metro local routes and several suburban routes use portions of

Stewart and Olive. Sound Transit currently only uses Stewart between 5th and 6th Avenues and Olive between 4th and 5th Avenues.

Total bus volumes for buses operating on Stewart and Olive between 1st Avenue and 6th Avenue are shown in Figure J-1 and Figure J-2.[1]

[1] Volume data was compiled for the AM period however only the PM period was analyzed in Tier 2 (corresponding to the traffic analysis period); the AM period could also be evaluated in a future study phase.

Figure J-1 Stewart St./Olive Way AM Peak Hour Bus Volumes (7-8 AM)

	Block	25	64	66	70	111	114	150	152	177	178	190	192	212	214	215	250	252	257	260	265	268	308	311	355	402	405	410	412	413	415	416	417	421	422	424	425	435	510	511	513	545	578	590	592	594	595	Total
		BUS ROUTES																																														
WB	Stewart 5th-6th	1	4	2	4												2	4	2	2	3	1	1	4		7	2	3			3		2			1		3	5	4	1	7						68
	Stewart 4th-5th	1		2	4																		1			7	2	3			3		2			1		3										29
	Stewart 3rd-4th	1		2	4																		1			7	2	3			3		2			1		3										29
	Stewart 2nd-3rd																						1			7	2	3			3		2			1		3										22
	Stewart 1st-2nd																																															
EB	Olive 4th-5th	1		2		3	1		2	3	3			6	4	2	2								4				3	5		3		2			2		2	4		7		11	4		3	79
	Olive 3rd-4th	1		2																					4																							7
	Total	5	4	10	12	3	1		2	3	3			6	4	2	4	4	2	2	3	1	4	4	8	28	8	12	3	5	12	3	8	2		4	2	12	7	8	1	14		11	4		3	234

Note: Provided for reference; the AM peak period was not evaluated in this study phase.

Figure J-2 Stewart St./Olive Way PM Peak Hour Bus Volumes Trips (5-6 PM)

	Block	BUS ROUTES																																												Total
		25	64	66	70	111	114	150	152	177	178	190	192	212	214	215	250	252	257	260	265	268	308	311	355	402	405	410	412	413	415	416	417	421	422	424	425	435	510	511	513	545	578	590	592	594	595	
WB	Stewart 5th-6th	1		3	6					2	3	2	1												2				2	3		2		2			1		2	4		6						42
	Stewart 4th-5th	1		3	6					2	3	2	1												2				2	3		2		2			1											30
	Stewart 3rd-4th	1		3	6					2	3	2	1												2				2	3		2		2	1		1											31
	Stewart 2nd-3rd									2	3	2	1																2	3		2		2			1											18
	Stewart 1st-2nd																																															
EB	Olive 4th-5th	1	2	3								3					2	2	2	1	2	2		3		5	1	2			3		1		1	1		2	6	3	1	9	2	2		2		64
	Olive 3rd-4th	1		3																																												4
	Total	5	2	15	18					8	12	11	4				2	2	2	1	2	2		3	6	5	1	2	8	12	3	8	1	8	2	1	4	2	8	7	1	15	2	2		2		189

Bus Vehicle Delay Results

Inputs and Calculations

Bus Vehicle Travel Time and Delay by Block

Average travel time and delay per bus vehicle in the PM peak hour was obtained by block from VISSIM traffic analysis results for 2018. The inputs from the VISSIM model are shown in Figure J-3 for the No-Build, Mixed-Traffic Streetcar, and Exclusive Streetcar conditions.

Figure J-4 shows the conceptual right-of-way design for each streetcar alternative. In the westbound direction on Stewart Street, the Mixed-Traffic streetcar uses the middle lane, shifting to a stop on the northern curb west of 3rd Avenue. In the Exclusive Streetcar alternative, the streetcar uses a transit-only lane shared by buses and streetcar. The design concepts are similar in the eastbound direction.

The analysis indicates that both streetcar alternatives reduce bus travel time slightly relative to the No-Build condition. This is attributed to transit signal priority and improved signal timing coordination in both alternatives.

However, comparing the two streetcar alternatives, the Exclusive Streetcar alternative increases bus travel times slightly (by two seconds) compared to the Mixed-Traffic Streetcar alternative. The analysis shows that, compared to the Mixed-Traffic configuration, the Exclusive configuration has slightly lower bus travel times between 5th and 4th Avenues, but slightly higher bus travel times between 3rd and 2nd Avenues.

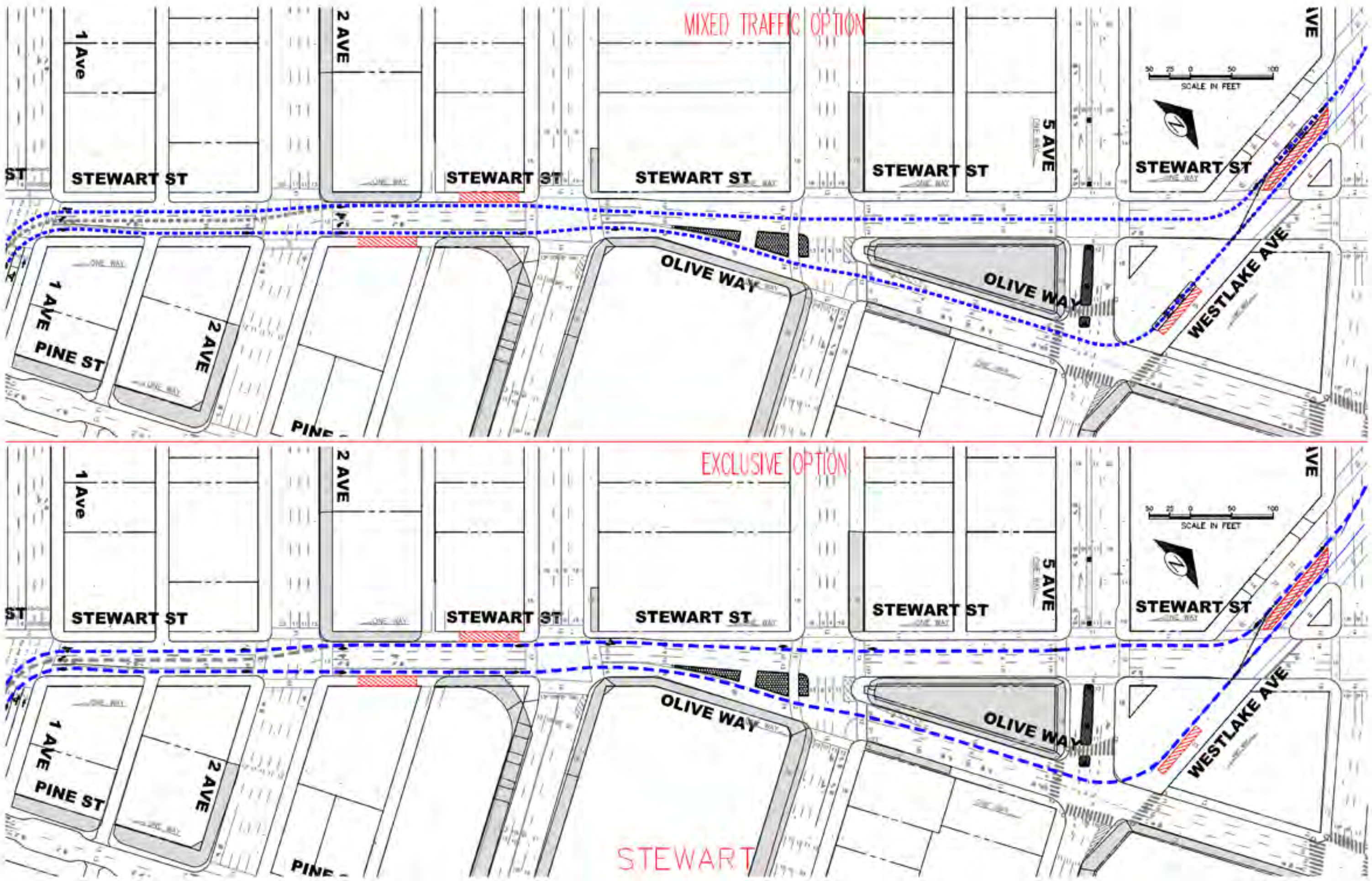
The travel time calculations include dwell time at the Stewart/4th Avenue bus stop for westbound routes that use this segment of Stewart and dwell time for the bus stop at Olive/4th Avenue for eastbound routes that operate on this segment.

Figure J-3 Stewart/Olive Bus Travel Times (sec/veh), 2018, PM Peak

					No Build		Mixed		Exclusive	
Roadway	From	To	Direction	Free-Flow Travel Time	Travel Time	Delay	Travel Time	Delay	Travel Time	Delay
Stewart	Westlake	5th Ave	WB	4	11	7	5	1	7	3
Stewart	5th Ave	4th Ave	WB	9	28	19	34	25	25	16
Stewart	4th Ave	3rd Ave	WB	9	65	56	43	43	44	35
Stewart	3rd Ave	2nd Ave	WB	9	15	6	31	31	38	29
				Total =	119	88	113	82	115	84
				Average =	30	22	28	21	29	21

					No Build		Mixed		Exclusive	
Roadway	From	To	Direction	Free-Flow Travel Time	Travel Time	Delay	Travel Time	Delay	Travel Time	Delay
Olive Way	3rd Ave	4th Ave	EB	6	86	80	85	79	85	79
Olive Way	4th Ave	5th Ave	EB	9	64	55	54	45	54	45
				Total =	*150*	*135*	*140*	*125*	*140*	*125*
				Average =	*75*	*68*	*70*	*62*	*70*	*62*

Figure J-4 Stewart/Olive Conceptual Right-of-Way Design, Mixed-Traffic and Exclusive Streetcar Alternatives



Aggregate Bus Delay Results

Aggregate bus delay was calculated to account for the number of bus trips utilizing each block of the Stewart/Olive alignment. Delay per bus vehicle for each block within this study area was multiplied by the number of PM peak hour bus trips for each route utilizing that block, resulting in an estimate of net bus vehicle delay for each route during the PM peak. Figure J-5 provides aggregate bus delay results for all routes.

These results indicate that both streetcar alternatives slightly reduce aggregate bus delay, and therefore do not appear to have overall adverse impacts on bus operations.

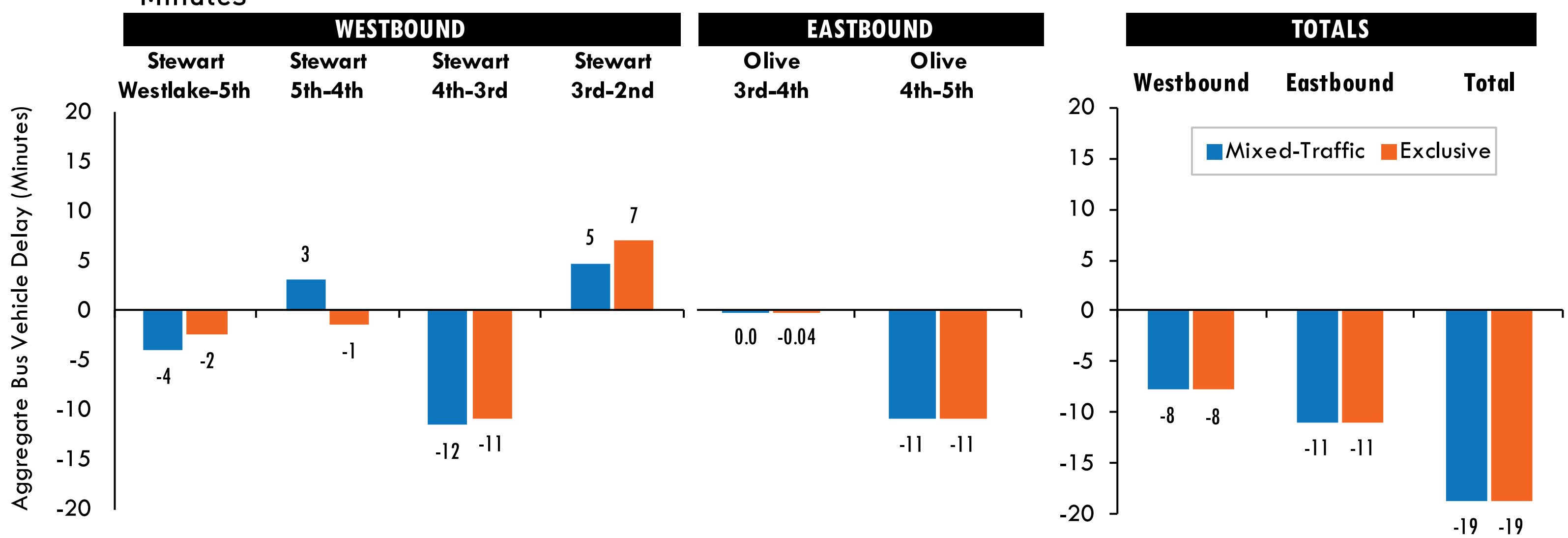
Figure J-6 illustrates both the overall result and where the change in bus delay occurs by direction and block. In the Mixed-Traffic condition, aggregate westbound bus delay increases between 5th and 4th Avenues and between 3rd and 2nd Avenues, but decreases in other blocks. In the Exclusive condition, aggregate westbound bus delay increases between 3rd and 2nd Avenues, but decreases in other blocks. Both alternatives would reduce net aggregate bus delay by about 19 minutes in the PM peak hour.

Figure J-5 Aggregate Bus Delay, 2018, PM Peak Hour

	Peak-Hour Bus Volumes		Total Travel Delay (Min)			Aggregate Bus Delay (Min)			Change in Aggregate Bus Delay (Min)	
	AM Total 1	PM Total	No Build	Mixed-Traffic	Exclusive	No Build	Mixed-Traffic	Exclusive	Mixed-Traffic	Exclusive
WESTBOUND										
Stewart Westlake-5th	68	42	11	5	7	7.7	3.6	5.2	-4.0	-2.5
Stewart 5th-4th	29	30	28	34	25	14.1	17.2	12.6	3.1	-1.5
Stewart 4th-3rd	29	31	65	43	44	33.6	22.0	22.8	-11.6	-10.8
Stewart 3rd-2nd	22	18	15	31	38	4.5	9.3	11.5	4.8	7.0
Total	**148**	**121**	**119**	**113**	**115**	**60**	**52**	**52**	**-7.7**	**-7.8**
EASTBOUND										
Olive 3rd-4th	7	4	86	85	85	5.7	5.7	5.7	0.0	-0.04
Olive 4th-5th	79	64	64	54	54	68.7	57.9	57.9	-10.9	-10.9
Total	**86**	**68**	**150**	**140**	**140**	**74**	**64**	**64**	**-10.9**	**-10.9**
OVERALL TOTAL										
Overall Total						**134**	**116**	**116**	**-18.7**	**-18.7**

Notes: (1) AM peak hour volumes are listed for reference. Delay for the AM period was not quantified for this study.

Figure J-6 Change in Aggregate Bus Vehicle Delay, Streetcar Build Alternatives Compared to No-Build, PM Peak, 2018, Minutes



APPENDIX K ECONOMIC DEVELOPMENT ASSESSMENT

1. Introduction

This document[1] provides information related to the Center City Connector Project and its performance relative to the Federal Transit Administration (FTA) evaluation criteria for economic development and transit-supportive land use.

The Center City Connector Project Goal statement includes the following goal:

Develop: Support local and regional economic development goals.

The following Project Objectives relate to this goal:

- Provide transit capacity to support and attract residential and commercial growth.
- Support small and local businesses in Center City business and retail districts.
- Support local and regional goals to foster compact and mixed-use development.

The FTA's New and Small Starts Policy Guidance document[2] provides project justification criteria related to economic development and transit-supportive land use, including the following criteria:

- Transit-Supportive Corridor Policies
- Supportive Zoning Near Transit
- Tools to Implement Transit-Supportive Plans and Policies
- Performance of Transit-Supportive Plans and Policies
- Potential Impact of Transit Project on Regional Development
- Plans and Policies to Maintain or Increase Affordable Housing in Corridor

Economic development criteria were assessed in the Tier 1 screening of 4th/5th Avenue (couplet) and 1st Avenue alignments. The Tier 2 evaluation focused on more detailed development of the 1st Avenue alignment and did not specifically assess economic development criteria. However, substantial land use and economic development planning has been done in the corridor and ample documentation of existing local plans and policies are available for addressing the FTA topic areas.

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[1] Prepared by Via Architecture and Nelson\Nygaard

[2] FTA, "New and Small Starts Evaluation and Rating Process Final Policy Guidance," August 2013, http://www.fta.dot.gov/documents/NS-SS_Final_PolicyGuidance_August_2013.pdf

This appendix provides FTA guidelines for rating the economic development effects of a project and summarizes applicable local plans and policies that should be submitted to the FTA for future evaluation and rating of the Project's economic development effects.

FTA Criteria

Each project requesting FTA New or Small Starts funding is evaluated on a number of criteria including Economic Development Effects. The FTA provides policy guidance for assessing how well a project meets these criteria.[3] Projects are rated either "high", "medium," or "low" on each criterion or topic area. Figure K-1 describes what is needed to achieve a "high" rating for each economic development-related topic area[4] and summarizes the local policies and plans that demonstrate how the Project meets FTA objectives for maximizing economic development and transit supportive development policies. The remainder of this document describes these plans and policies in more detail.

[3] In addition, an assessment of existing affordable housing units in the study area can be found in Appendix L.

[4] Associated with the Small Starts Construction Grant Agreement (SSGA) and Full Funding Grant Agreement (FFGA) project development phases; separate breakpoints are associated with the Engineering phase. The policy guidance document also provides breakpoints for low and medium ratings.

Figure K-1 FTA Guidelines and Assessment Criteria for Economic Development Effects

Topic Area	FTA Guidelines for High Rating	Applicable Local Plans and Policies
Transit-Supportive Corridor Policies	▪ Conceptual plans have been developed for the corridor and station areas. ▪ Comprehensive and/or small area plans adopted/revised in most or all station areas. ▪ Development patterns proposed in conceptual plans and plan revisions are strongly supportive of a major transit investment.	▪ 2.1 Seattle Urban Center/Urban Village Strategy ▪ 2.2 Seattle Comprehensive Plan Transit Communities Element ▪ 2.3 Context-based Area Plans and Urban Design Frameworks ▪ 2.4 Parking Policies
Supportive Zoning Near Transit	▪ Local jurisdictions have adopted zoning changes that strongly support a major transit investment in most or all transit station areas.	▪ 3.1 Downtown ▪ 3.2 South Lake Union ▪ 3.3 International District – Pioneer Square – SODO ▪ 3.4 Design Standards (Urban Center/Urban Villages and Downtown)
Tools to Implement Transit-Supportive Plans and Policies	▪ Transit/regional agencies are working proactively with local jurisdictions, developers, and the public to promote transit-supportive planning and station area development. ▪ Transit agency has established a joint development program and identified development opportunities ▪ Agencies have adopted effective regulatory and financial incentives to promote transit-oriented development.	▪ 4.1 State Environmental Protection Act SEPA /Planned Action Ordinance ▪ 4.2 Multifamily Tax Exemption ▪ 4.3 Seattle Housing Levy, Acquisition and Opportunity Loan Program ▪ 4.4 Neighborhood Equitable TOD (NET) Initiative ▪ 4.5 Benefit Assessment District: Landscape Conservation and Local Infrastructure Program

Topic Area	FTA Guidelines for High Rating	Applicable Local Plans and Policies
	▪ Public and private capital improvements are being programmed in the corridor and station areas which implement the local policies and which leverage the Federal investment in the proposed major transit investment corridor.	▪ 4.6 Growing Transit Communities Partnership (GTC)
Performance of Transit-Supportive Plans and Policies	▪ A significant number of development proposals are being received for transit supportive housing and employment in station areas. ▪ Significant amounts of transit-supportive development have occurred in other, existing transit corridors and station areas.	▪ 5.1 Terry Avenue, Westlake Avenue, and Amazon.com Headquarters ▪ 5.2 Yesler Terrace, Seattle Housing Authority Redevelopment ▪ 5.3 New Holly HOPE VI / Othello Light Rail Station Stop ▪ 5.4 Stadium North Lot/Stadium District/King Street Station ▪ 5.5 Capitol Hill TOD LINK Light Rail Station
Potential Impact of Transit Project on Regional Development	▪ A significant amount of land in station areas is available for new development or redevelopment at transit-supportive densities. ▪ Local plans, policies, and development programs, as well as real estate market conditions, strongly support such development.	▪ See Section 6 graphics
Plans and Policies to Maintain or Increase Affordable	▪ Comprehensive affordable housing plans have been developed and are being implemented that identify and address the current and prospective housing affordability needs along the corridor. The plans include efforts to preserve existing	▪ 7.1 City of Seattle, Office of Housing, Housing Levy ▪ 7.2 Consolidated Plan ▪ 7.3 Incentive Zoning

Topic Area	FTA Guidelines for High Rating	Applicable Local Plans and Policies
Housing in Corridor	affordable housing (both legally binding affordability restricted housing and market-rate affordable housing.) The plans also explicitly address the housing affordability and quality needs of very- and extremely-low income households. ▪ Financing commitments and/or sources of funding and robust financial incentives are secured and available at the local and/or regional level and along the proposed corridor to support affordable housing acquisition (including acquisition of land and/or properties intended to be converted to affordable housing), development and/or preservation consistent with adopted plans and policies. These commitments may include early phase or acquisition financing as well as permanent financing. ▪ Local policies and zoning codes support and encourage significant affordable housing development in transit corridors. ▪ Developers are actively working in the corridor to secure priority development sites and/or maintain affordability levels in existing housing units.	▪ 7.4 Transferable Development Rights Potential (TDP)

2. Transit-Supportive Corridor Policies

Background

Seattle first implemented policies related to Transit Oriented Development to prepare for Sound Transit's Central Link light rail.[5] From 1998-2001, the Department of Planning and Development (DPD) in collaboration with the Seattle Department of Transportation (SDOT) crafted a series of Station Area Overlay Districts (SAODs) that were adopted alongside Neighborhood Plans in the Rainer Valley, First Hill, Capitol Hill and the University District. Applicable to mixed-use zones within a quarter-mile of light rail stations (excluding single-family zoned parcels), SAODs support transit by prohibiting uses such as drive-through businesses and non-residential stand-alone parking, and by permitting some limited up-zoning.

In the decade following the opening of Central Link, Seattle experienced rapid growth as well as fluctuating real estate market cycles. In response to this uneven development—particularly in station locations in the Rainier Valley—the City has reviewed the performance of its transit-related policies, mapped opportunities, and produced a more coherent transit oriented development strategy.[6] The changes are particularly suited to support the success of the Center City Connector Project, major forthcoming public investment in light rail expansion, as well as prioritization of a citywide Frequent Transit Network. The following sections summarize core elements of Seattle's transit supportive policies.

2.1 Seattle Urban Center/Urban Village Strategy

Seattle's planning framework is derived from statewide growth management (Growth Management Act RCW 36.70A, adopted 1990) and mandated comprehensive planning. The 1994 Comprehensive Plan Urban Village/Urban Center (UV/UC) strategy is still Seattle's most critical growth management tool. Urban Centers are regionally defined as the city's most dense areas, while Urban Villages are locally defined as residential, commercial or manufacturing hubs. The UV/UC policy describes a series of connected neighborhoods with diverse housing and employment growth, and sufficient densities to take advantage of significant investment in public transportation infrastructure. The Center City Connector touches on or passes through ten adjacent Urban Centers (see Figure K-3).

Seattle's Comprehensive Plan establishes housing and employment targets to accommodate projected future growth. As of 2013, 58% of future housing and 73% of employment

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[5] Council Resolution 29867 adopted in 1998 established the goals and strategies to promote transit-oriented development in light rail stations.

[6] Seattle Planning Commission, "Seattle Transit Communities: A Citywide Strategy to Integrate Neighborhoods with Transit," March 2013. http://www.seattle.gov/planningcommission/docs/STC_report_to_Council_vers3.pdf

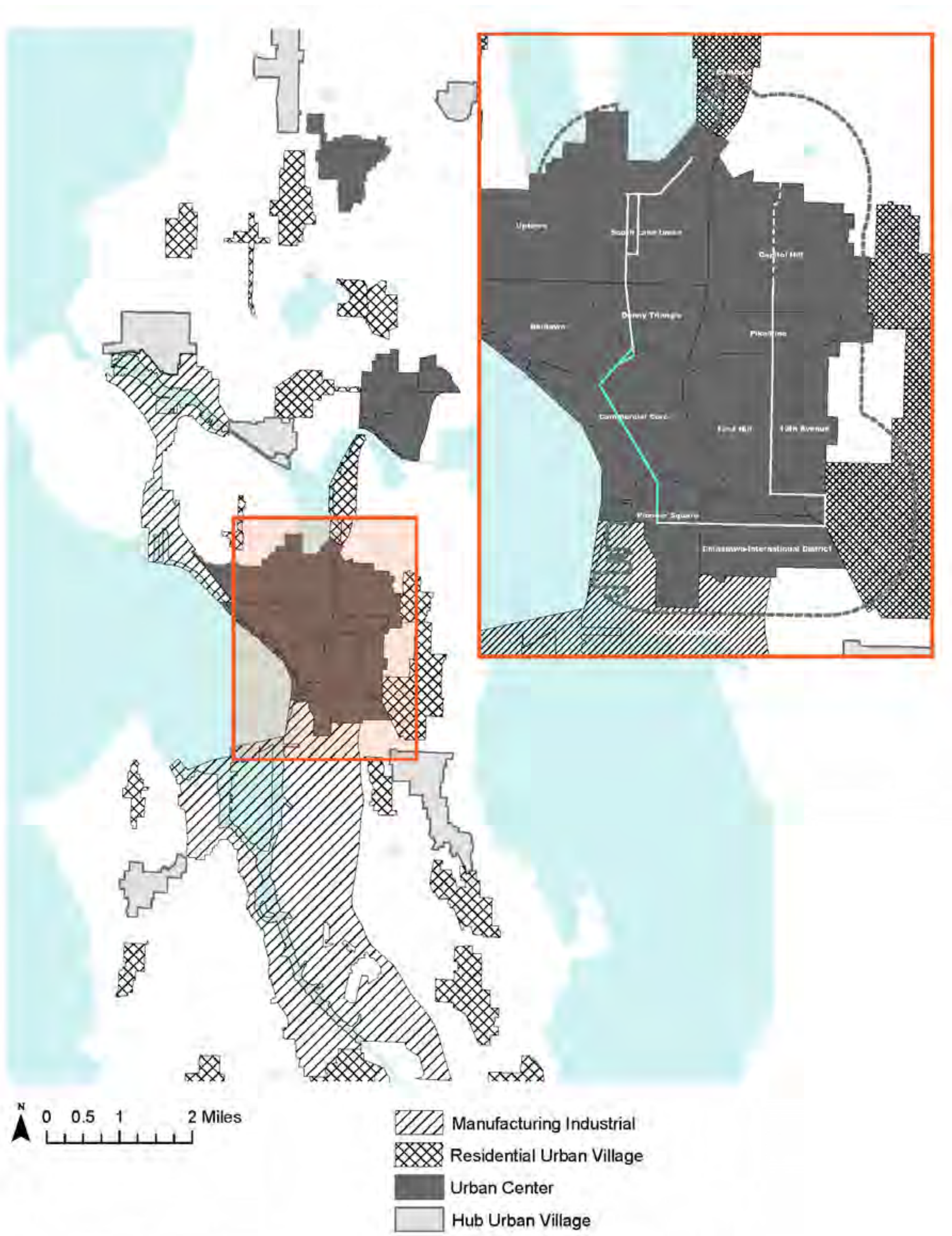
growth is aimed within the boundaries of UV/UCs, with the greatest percentage of that growth directed at the Urban Centers of Greater Downtown. Downtown Urban Centers are projected to account for over 44% of overall population growth and 63% of overall job growth between 2008 and 2030, with residential densification occurring in adjacent neighborhoods, particularly Belltown, Capitol Hill, Yesler Terrace and South Lake Union. Seattle is on track or exceeding growth targets in its Urban Centers (see Figure K-2).

Figure K-2 Urban Center/Urban Village Residential Growth[7]

	New Net Units		Progress Towards Targets (as of 3rd quarter 2013)	
Urban Center	Growth target 2005-2013	Growth Target 2005-2024	% of Target met (constructed)	% of Target met (permitted)
Downtown Urban Center	5,365	10,000	54%	89%
First Hill/ Capitol Hill Urban Center	3,322	3,500	95%	123%
South Lake Union	2,295	8,000	29%	41%

[7] Department of Planning and Development, Data Warehouse, 10-3-2013. http://www.seattle.gov/dpd/cs/groups/pan/@pan/documents/web_informational/dpdd017580.pdf

Figure K-3 Urban Village/Urban Center Locations



Source: Via Architecture

2.2 Seattle Comprehensive Plan Transit Communities Element

The 2013 Seattle Comprehensive Plan "Transit Communities" Element underscores the mutually reinforcing benefits that arise from mixed-use, compact land use patterns when combined with accessible, frequent transit. A "Transit Community" (usually overlapping with UV/UC's) is envisioned as "A place where a neighborhood is integrated with transit, where coordinated public and private investments improve neighborhood quality, and where proactively planning for change can create or enhance a place where people of all ages and income levels can live in a complete community and access frequent, reliable transit."[8]

This policy framework is coordinated with recommendations in the Transit Master Plan (TMP, 2012) and Seattle Transit Plan (2005) for a network of high-capacity transit and bus priority corridors. The Center City Connector was included in the TMP as a priority transit investment. Figure K-4 shows the frequent transit network outlined in the Seattle Transit Communities Report.

2.3 Context-based Area Plans and Urban Design Frameworks

Seattle has 38 Neighborhood Plans that steer the placement, scale and intensity of future development. As of 2009, Seattle Ordinance #122799 directed DPD to prioritize Plan updates where transit stations are proposed and where significant new population and business growth is expected.[9] In transit locations, Neighborhood Plans are accompanied by Urban Design Frameworks (UDF), Station Area Plans (SAP), and Corridor Plans to distill a shared vision of urban form and vet potential future alternatives. Together these plans provide recommendations for street design and network characteristics, potential redevelopment catalyst sites, short- and long-term actions for neighborhood growth, as

Figure K-4 Seattle Frequent Transit Network Map

Source: Seattle Transit Communities Report, 2010

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8 City of Seattle, Seattle Comprehensive Plan, Towards a Sustainable Seattle, Land Use Element 2013

9 In anticipation of light rail commencing service in Seattle in 2009, Ordinance #122799 prioritizes the review and update of Neighborhood Plans where transit stations are proposed and where significant new population and business growth is expected. The Neighborhood Plan Update process for the North Beacon Hill, North Rainier, and MLK Jr. and Holly station areas began in fall 2008. http://www.seattle.gov/neighborhoods/npi/updates.htm

well as partnerships between the community and stakeholders. Greater Downtown has benefited from organized planning efforts that tie land use with significant transit access. Recent plans relevant to the Center City Connector project are:

- **South Lake Union:** South Lake Union Urban Design Framework/Implementation Plan, South Lake Union Height and Density Study, Uptown Urban Center Plan (currently active)
- **South Downtown:** South Downtown Livable Plan, King Street Station Area Plan (Currently Active), Stadium District Plan
- **Center City:** Downtown Neighborhood Plan, the Pike/Pine Corridor Study, Downtown Waterfront Vision and Plan
- **First Hill/Capitol Hill:** Capitol Hill Urban Design Framework/ Development Agreement

2.4 Parking Policies

The City of Seattle is a national leader in parking and mobility strategies for parking provision in growth areas. Excess parking can be an impediment to community goals and can impact project design and feasibility, while too little parking affects market viability and may result in spillover parking problems. As a result, SDOT in coordination with DPD has implemented programs to encourage station areas in particular to develop as "places"—synergistic communities of people, jobs, retail, and other amenities—and avoid accommodation of large quantities of parking at Link stations. Furthermore there are no minimum residential parking requirements in Urban Centers, Urban Villages and Station Overlay areas. Parking policies applicable in the Center City area include:

- Residential permit parking zones
- On-street priced parking
- No parking minimums in Urban Centers, and parking maximums for residential and commercial uses
- Design standards for parking in "pedestrian overlay areas" and commercial districts to mitigate the impact of parking on the quality of the street environment
- Pass programs (ORCA business[10]) for employers to provide a financial incentive for employees to use transit
- Unbundling parking spaces from residential and commercial leases

Within the Downtown Core, on-street spaces are also subject to resource management. SDOT's parking approach is to "price and manage parking to support healthy business districts and transit use and manage curb space to recognize the importance of principle

[10] https://www.orcacard.biz/ERG-Seattle-Institution/ProgramsRedirect.do

arterials in moving people, goods and services." Commercial-area curb space is to be used first for transit, then loading, short-term parking, shared-vehicle parking, and, lastly, for ordinary private-car parking.

3. Supportive Zoning Near Transit

The Center City Connector includes the city's most intensive land use districts, many of which have recently undergone revision to meet policy objectives identified in Seattle's Comprehensive and Neighborhood Plans. These areas already exhibit many of the qualities that support transit use, including walkable block lengths, interesting and comfortable streetscapes, a mix of uses, and many popular destinations. The following sections provide an overview of zoning within the Center City area.

Downtown

In 2006, the City adopted land use code changes to "create more vibrant neighborhoods, encourage affordable housing, stimulate job growth, support transit, encourage urban sustainability, and support historic preservation." Under the revised code, downtown zones can make use of incentives that allow for higher floor area ratio (FAR) and/or building height than the base zoning allows in exchange for meeting LEED standards or providing project components such as affordable housing, public open space, or pedestrian connections.

Figure K-5 provides an overview of the land use code in Downtown Seattle. The Downtown land use code also relies upon location-specific overlays to regulate street level uses and building design attributes such as transparency requirements, property line façade locations, and pedestrian and green street standards. Seattle's Design Review program contributes to achieving high-quality buildings and pedestrian-friendly qualities.

Figure K-5 Downtown Seattle Land Use Code Overview

<table>
<tr><th>Zone</th><th>Base FAR</th><th>Maximum FAR</th><th>Public Amenity Incentive Program</th><th>Parking Requirements</th></tr>
<tr><td>Downtown Mixed Commercial (DMC)
65' -400'</td><td>3</td><td>10*</td><td rowspan="4">Incentive system includes a bonus ratio of 5:1 (up to 5 sq. ft. granted for 1 sq. foot of bonus amenity) for various urban park and public open space amenities. Urban plazas, commercial or residential parks, Green Street improvements, Public atriums and pedestrian connections such as Hill climbs. A bonus amenity also addresses Transit Station Access for a maximum gain of 1.0 FAR.</td><td rowspan="5">Downtown zones require no parking, either long- or short-term. Parking is limited to 1 space per 1,000 sq ft of residential gross floor area. No surface parking is allowed.
A Transportation Demand Management program is in place in the Downtown Urban Centers for new structures that contain more than 10,000 sq ft of space.
A transportation coordinator, ridesharing, and carpooling are encouraged. A subsidized transit pass program is also available.</td></tr>
<tr><td>Downtown Office Core (DOC) 1</td><td>6</td><td>20</td></tr>
<tr><td>Downtown Office Core (DOC) 2
500/300-500</td><td>5</td><td>14</td></tr>
<tr><td>Downtown Retail Core (DRC) 85/150</td><td>3</td><td>5</td></tr>
<tr><td>PMM (Pike Place Market Mixed) 100/100-130</td><td>7</td><td>7</td><td>No amenity program applicable. This area is addressed by Special Review and/or Historic District regulations.</td></tr>
</table>

*Capacity depends on zoned height limitations, maximums range from 4-10 FAR.

South Lake Union

From 1990 to 2010, SLU has grown at an average annual rate of 18% a year.[11] In 2006, a public-private partnership created a Local Improvement District to help fund the initial leg of the Seattle streetcar system, which opened in 2007 with ten stations. The area now houses Amazon.com headquarters, University of Washington (UW) Medical Center, Fred Hutchinson Cancer Research Center, and REI's flagship store as well as new parks and major infrastructure investments.

A legislative package adopted in 2012 was the result of a decade-long, communitywide discussion about Seattle's increasingly urban future. The rezoning included in this package introduced a "Seattle Mixed" zone to create a pedestrian-friendly environment and ensure a workable mix of both residential and non-residential uses (Figure K-5). The zoning regulations include targets for over 11,000 additional housing units and 22,000 jobs by 2031. Of the 11,000 housing units, 4,000 of the housing units are targeted to be affordable to households earning 0-80% of the area median income (AMI).[12]

The revised zoning supports transit use by allowing added height and FAR as an incentive to provide neighborhood amenities and includes amendments that encourage compact, vertical growth. This rezoning is complemented by the South Lake Union Mobility Plan (2011) and a series of major public sector investments to improve mobility throughout the district. The South Lake Union rezone accomplished the following:

- Reclassified remaining Industrial Commercial (IC) zoned properties in the neighborhood to Seattle Mixed (SM) to promote development of a balanced variety of land uses including additional residential development
- Expanded the City's incentive zoning program, creating opportunities for affordable housing and community infrastructure
- Better addressed design, size, and shape of buildings relative to the site
- Emphasized strong, pedestrian-oriented building forms with flexibility to allow a broad range of uses
- Provided parking standards to reinforce the City's transportation goals of balanced mobility

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[11] City of Seattle, Office of Housing and Economic Development, "Public and Private Investments in South Lake Union," July 2012, p.6.
http://www.seattle.gov/EconomicDevelopment/pdf_files/SLU%20Public%20Private%20Report%20Final%202012_0703_small.pdf

[12] City of Seattle Department of Planning and Building, Housing: South Lake Union, 2012 Update.
http://www.seattle.gov/dpd/cms/groups/pan/@pan/@plan/@proj/documents/web_informational/dpdp022279.pdf

Figure K-6 South Lake Union Land Use Code Overview

Zone	Base FAR	Maximum FAR	Public Amenity Incentive Program	Parking requirements
Seattle Mixed (Heights variable 65-400')	4.5 -5.0	Up to 7 - 10 in some zones	Provisions for increased floor plates, height and density tied to affordable housing as first priority, as well as open space and mid-block corridors, etc.	No parking minimums in Seattle Urban Centers. Parking for non-residential uses maximum 1:1000 gross sq. ft. Maximums also apply for non-residential uses. Surface parking prohibited throughout most SM zones.

3.3 International District – Pioneer Square – SODO

The First Hill Streetcar, currently under construction, will operate from Pioneer Square to Capitol Hill. The City rezoned five neighborhoods of South Downtown in 2011: Pioneer Square, Little Saigon, Chinatown, Japan Town, and SODO. Much of the South Downtown area was built out during the city's founding years and contains a number of significant historic buildings and landmarks. The "Livable South Downtown Plan" sought to balance preservation of historic sites while also increasing housing to attract more residents and stimulate economic development. Figure K-7 provides an overview of the 2011 zones in this area. The updated standards also sought to reduce vacancy and promote new affordable housing. The rezone included the following elements:

- Reclassified areas in the International District from Industrial Commercial (IC) zoning to Downtown Mixed-Use (DMU)
- Provided a supplementary bonus system for building heights to increase to up to 150' in some cases
- Prioritized residential uses, open space, street improvements, and affordable housing through the incentive zoning program
- Provided regulatory standards to break down larger blocks, and identified a series of "green streets"

Figure K-7 South Downtown Land Use Code Overview

<table>
<tr><th>Zone</th><th>Base FAR</th><th>Maximum FAR</th><th>Public Amenity Incentive Program</th><th>Parking requirements</th></tr>
<tr><td>PSM (Pioneer Square Mixed)
100-120'</td><td>NA</td><td>NA</td><td>Historic Transfer in Density Rights program in place. Programs are also focuses on the provision of residential use, specifically low income.</td><td>No parking required</td></tr>
<tr><td>IDM (International District Mixed)
75-150'</td><td>3 (6 for hotels)</td><td>3 except 6 for hotels</td><td>Focus in the amenity program on providing affordable housing.</td><td rowspan="2">No parking required except for theaters and other entertainment uses in the International District.</td></tr>
<tr><td>IDR (International District Residential)</td><td>1</td><td>Up to 2 with 50% residential use</td><td>Focus in the amenity program on providing affordable housing.</td></tr>
</table>

3.4 Design Standards

Seattle has a variety of context-sensitive and area-based design standards that help to maintain the quality of the street environment in most of Seattle's Urban Centers / Urban Villages and in all of the Downtown Zones. Design standard overlays contribute to land use patterns that engage pedestrians and provide comfort and safety at the street-level through weather protection, entrances, and lighting. Standards also identify modal priorities. Overlays include the following elements:

- Street Level Use
- Property Line Façade requirements
- Overhead weather protection
- Green Street standards
- Pedestrian street standards
- Parking uses permitted, etc.

In addition, the Seattle Green Factor is a unique performance-based, point-based program that increases overall livability and comfort in Seattle's mixed-use zones by requiring creative provision of green landscaped areas and low impact development.

4. Tools to Implement Transit-Supportive Plans and Policies

4.1 State Environmental Protection Act SEPA /Planned Action Ordinance

Washington state law allows for a plan-level review of impacts through an upfront State Environmental Policy Act (SEPA) process designed to eliminate SEPA appeals (SEPA, RCW 43.21C). The planned action ordinance process allows one in-depth Environmental Impact Statement (EIS) evaluation for the entirety of a plan area. If a project proposal falls within the scope of the planned action, the City is not required to make a threshold determination and is not allowed to require any further environmental review.[13]

Combining a planned action ordinance with an area plan and rezone is an increasingly popular tool for cities seeking to adapt station locations, downtowns, and regional centers to changing circumstances and to facilitate infill redevelopment. In 2010, a version of the planned action ordinance (PAO, Planned Action Transit Infill II) was tailored specifically to promote transit–friendly land use actions and expedite TOD. Tacoma adopted the first Transit Infill PAO in 2013. In April 2011, the City of Seattle adopted a Planned Action Final EIS for Yesler Terrace, a Seattle Housing Authority-led TOD redevelopment adjacent to the First Hill Streetcar, the first application of this approach in Seattle.

4. 2 Multifamily Tax Exemption

The Multifamily Tax Exemption program (MFTE) is a component of a financing package for multifamily development, available for use in all of Seattle's existing light rail station areas. To participate, the program requires that 20% of all units be made affordable for up to 12 years, with a range of affordability levels tied to different unit types.[14] According to Seattle City Council member Richard Conlin, "The MFTE program is one of the few tools provided by the legislature to the City to encourage the private sector to build housing that is affordable to the 'in-between households'—those who make too much to be served by low-income housing programs but make too little to be served by market-rate developers." [15]

Two recent unsubsidized projects, the Station at Othello Park and GreenHouse in Columbia City, both near light rail stations, were developed using the City of Seattle's MFTE program.

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[13] Eckert, Jeremy, "Using SEPA to Encourage Economic Development and Sustainable Communities," Foster Pepper, 2012

[14] City of Seattle Office of Housing website, 11-05-2013, http://www.seattle.gov/housing/incentives/mfte.htm

[15] Conlin, Richard, "Why does Seattle have a Multifamily Tax Exemption" blogpost 06-16-2011page viewed 11-05-2013, http://conlin.seattle.gov/2011/06/16/why-does-seattle-have-a-multi-family-tax-exemption-program/

The Station and GreenHouse are offering affordability for middle-income households (80-90% AMI) for 96 of 476 total units.

4. 3 Seattle Housing Levy, Acquisition and Opportunity Loan Program, Seattle Office of Housing

This program provides short-term loans to help make strategic purchases of buildings or land for long-term affordable housing units. The program prioritizes "projects that produce or preserve low-income housing located in a high-capacity transit station area or a high-frequency transit service area." The Acquisition and Opportunity Loan program is funded at $6.5M through a 2009 voter approved seven-year tax on property values, called the Seattle Housing Levy. Another program funded through the Housing Levy, the Rental Preservation and Production Program, also prioritizes the preservation of affordable housing in high-capacity transit areas.

4. 4 Neighborhood Equitable TOD (NET) Initiative

Seattle's Neighborhood Equitable TOD (NET) initiative is a new, three-year $8.9 million program that will produce and support affordable housing as well as commercial and community space. The NET initiative aims to ensure that new development around transit stations benefits rather than displaces existing communities in the Rainier Valley. As part of the NET initiative, the City of Seattle Office of Housing established the Equitable TOD Loan Pilot Program to provide up to $7 million to support transit-oriented development. The Program makes available up to $3 million in City of Seattle Office of Housing funds, up to $1.2 million in HUD Community Challenge Grant funds, and up to $2.8 million from funding partners. A TOD Combined Funders Group has also formed to advise and participate in the deployment of Program funds. This group is composed of representatives from:

- Seattle Office of Housing
- Rainier Valley Community Development Fund
- Impact Capital
- Enterprise Community Loan Fund Inc.

The first program loans were planned for 2013 to provide financing to secure potential development sites near Link Light Rail stations for mixed-income housing, preferably in combination with commercial uses. The TOD NET initiative funds seek to allow developers to take advantage of low acquisition prices, secure sites that present a strategic use of funding relating to transit access, and/or provide significant permanent financing leverage. Capital funds for property acquisition are the program's top priority.

This program will generate new models of mixed-income housing production, minimizing public gap subsidy. Creation of affordable workforce housing (affordable to 30-80% AMI) is a top program priority. However, some units affordable to households at or below 30% AMI are allowed. A minimum of 20% of all units affordable to households making at or below 50% AMI, or 40% of all units affordable to households at or below 60% AMI, are required in every funded project. Units must be made affordable for a minimum of 50 years. Additional program priorities include mixed-use and family size housing.

4.5 Benefit Assessment District: Landscape Conservation and Local Infrastructure Program (South Lake Union /Downtown)

According to a King County press release, the Landscape Conservation and Local Infrastructure Program (LCLIP) program was developed by the City of Seattle, King County, and the environmental organization Forterra.[16] It is the first to be developed under 2012 state legislation that enables cities to access a portion of incremental county property tax gains from new development, when a certain percentage of the new development results from the use of transferable development rights (TDRs). TDRs are created by the permanent protection from future development of the region's working forest and farmlands. Under the program, a portion of incentive zoning (5% in Downtown and 33% in South Lake Union) would be gained through the purchase of regional TDRs. In exchange, the City will receive a portion of future county property tax revenue from new development occurring in the area for up to 25 years. In this case it is estimated that Seattle will receive 17.4% of the property tax revenue from new development occurring in the Local Infrastructure Project Area, resulting in $27.5M in infrastructure investments over 25 years. The program would support future transit-oriented development by providing a new revenue stream to fund local infrastructure improvements, including new sidewalks, parks, and potentially a community center in the South Lake Union neighborhood.

4.6 Growing Transit Communities Partnership (GTC)

In the coming decades, the central Puget Sound region will be making a voter-approved $15 billion investment in regional rapid transit. The Puget Sound Regional Council and a variety of organizations, institutions and municipalities developed the Growing Transit Communities Partnership (GTC) in 2010. Funded by a grant from the federal Partnership for Sustainable Communities, the GTC focuses on developing policies and tools applicable to key transit nodes within the region's long-range light rail corridors.

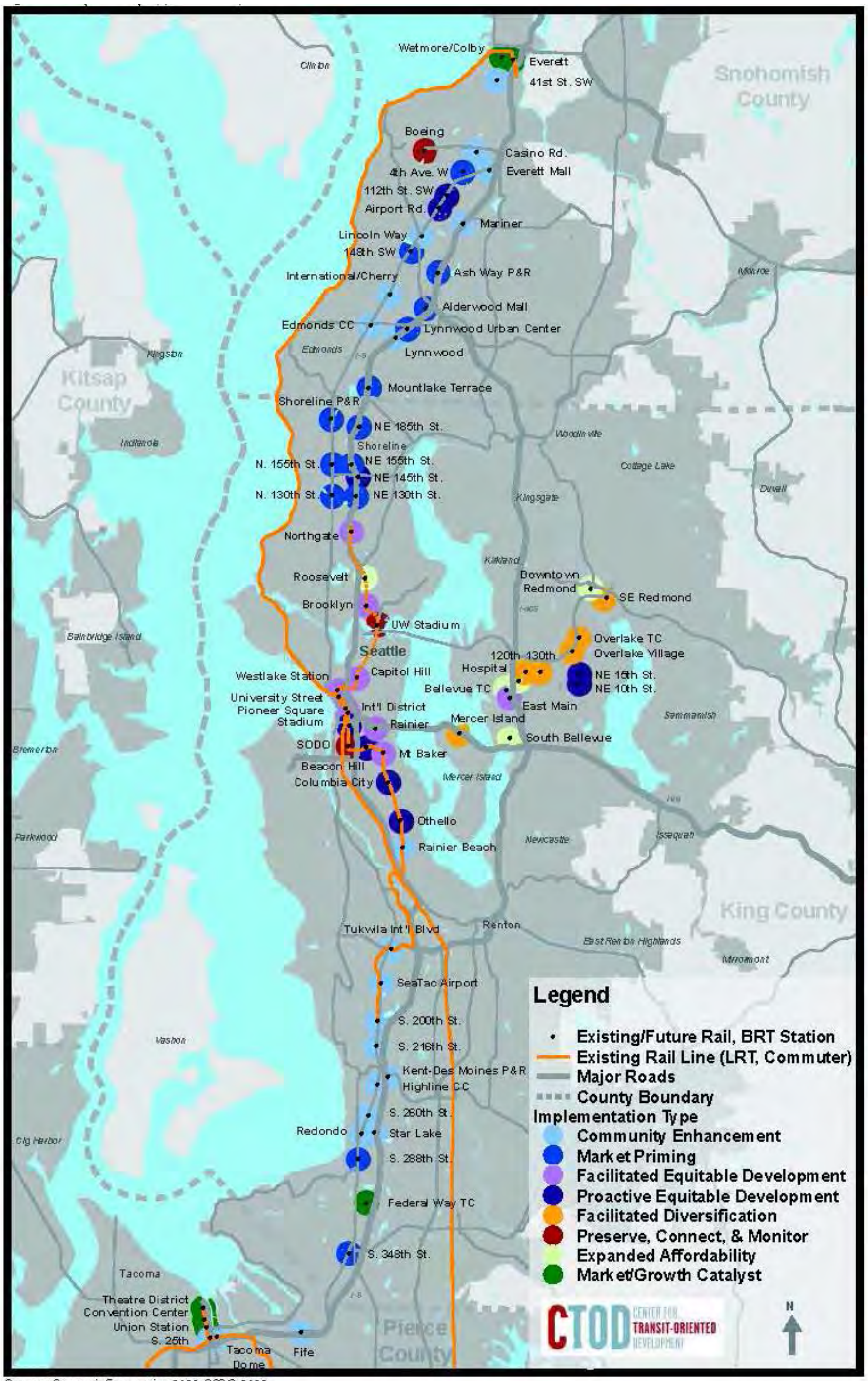
The GTC has been a resource for transit-related infill redevelopment efforts by providing research, demonstration projects, catalyst projects, and extensive outreach. A GTC- initiated Typology Framework released in 2013 provides technical support for the numerous study areas including Capitol Hill, Westlake Station, University Street, Pioneer Square,

[16] http://www.kingcounty.gov/exec/news/release/2012/July/23_partnerships.aspx

International District, and Stadium District, shown in Figure K-8. [17] The report helps to shape actionable strategies and prioritizes improvements and programming needed to achieve equitable transit communities.

[17] Strategic Economics, Center for Transit Oriented Development Prepared for PSRC, Growing Transit Communities Partnership "Implementing Equitable Transit Communities: Regional and local recommendations for the central Puget Sound region," January 2013

Figure K-8 Growing Transit Communities Project Map



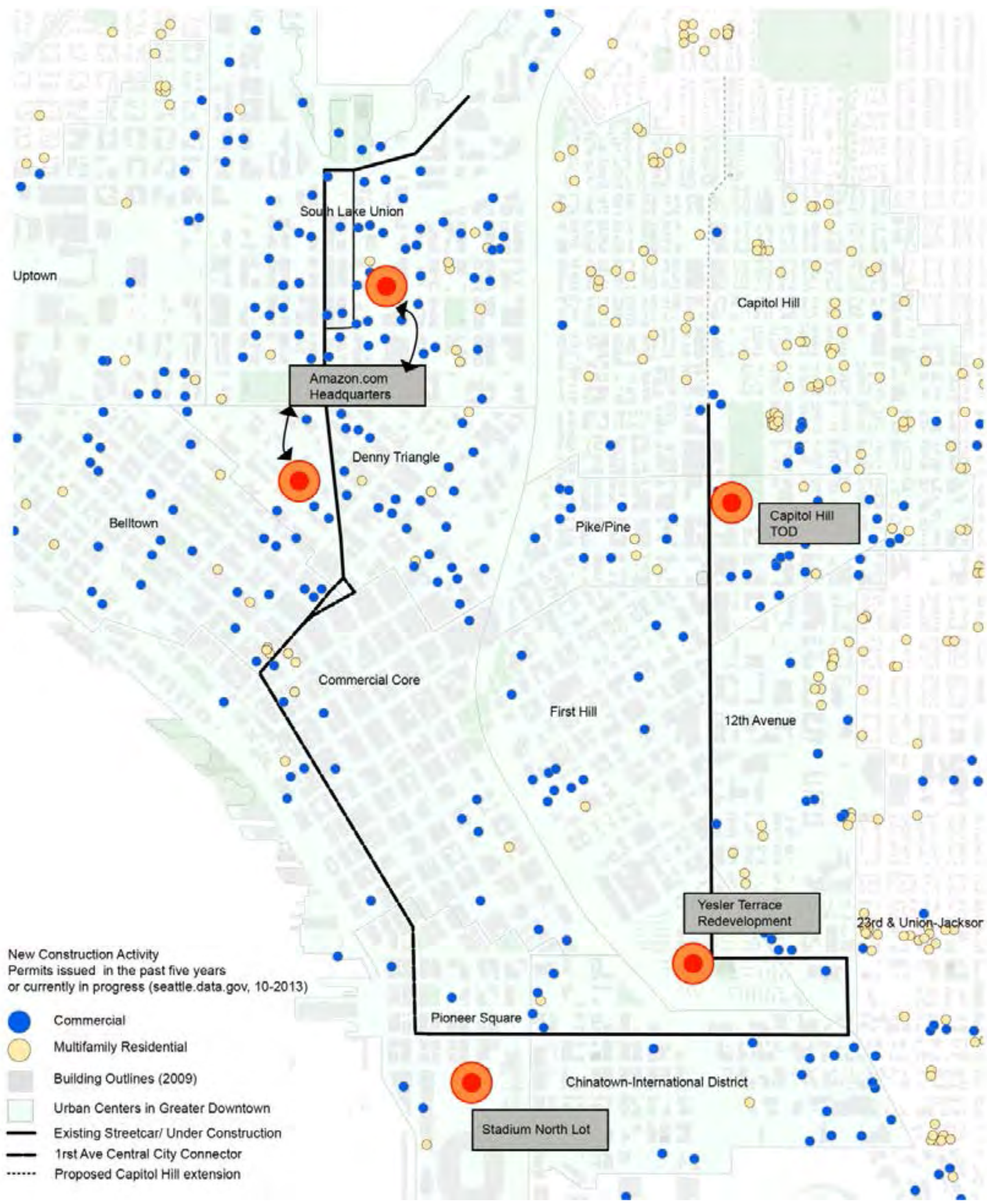
Sources: Strategic Economics, 2012; PSRC, 2012

Source: GTC Implementing Equitable Transit Communities Report

5. Performance of Transit-Supportive Plans and Policies

Figure K-9 shows development activity in the Center City study area by development permits issued for commercial and multifamily residential buildings in the past 5 years. The following sections highlight several TOD projects, also shown on the map, and evaluate their performance.

Figure K-9 Development Activity and Permits in Center City



Source: Via Architecture

5.1 Terry Avenue, Westlake Avenue, and Amazon.com Headquarters

The redevelopment of South Lake Union includes several projects that are pedestrian-oriented, relate well to streetcar stations, achieve generous open space requirements, or use historic TDRs help to preserve and enhance the public realm. One recent example is the headquarters of Amazon.com, which included three office towers with nearly 3.3 million sq. ft. of office space and 66,000 sq. ft. of commercial space on three blocks near to the Westlake/ 7th Avenue streetcar stop. As part of the Amazon.com headquarters public benefits package, the developer agreed to fund $5.5 million in enhanced South Lake Union Streetcar service, including the purchase of a fourth streetcar and enhancements to streetcar stops. This will results in increased frequencies, and trains that will come every ten minutes, twelve hours a day. Amazon's headquarters complex will also provide access to Zipcar, electric-car charging stations, bike storage rooms, and showers in each building. Additionally, the project features wayfinding for transit routes and streetcar stops and midblock pedestrian walkways. The public benefits package provides for planning and construction of a cycle track along 7th Avenue in downtown Seattle and the extension of pedestrian boulevard treatments on Westlake Avenue.

5.2 Yesler Terrace, Seattle Housing Authority Redevelopment

Seattle Housing Authority has spent the past eight years working to replace Yesler Terrace's aging public housing buildings with a new mixed-income community, in partnership with a private sector master developer. The thirty-acre site is located adjacent to a station on the First Hill Streetcar alignment. The site offers opportunities for a mixed-use, mixed-income community well-served by transit, increased affordable housing, and a high level of sustainability and urban design. Seattle City Council passed supportive implementing agreements, including the Cooperative Agreement between the City and Seattle Housing Authority, the Land Use Code amendment and rezone ordinance, the Street Vacation Petition, and the Planned Action Ordinance in 2012.[18] Under the adopted rezone the existing 561 homes will be replaced by:

- 661 units serving people with incomes below 30% AMI, consisting of 561 units to replace those currently there and 100 additional units developed with partners
- 290 additional low-income units affordable for 30-60% AMI
- 850 workforce housing serving people with incomes below 80% AMI
- 1,200-3,200 market-rate housing units

[18] http://www.seattle.gov/council/issues/yesler_terrace.htm

- 16 acres of park and open space
- Up to 900,000 square feet of office, medical services, and lodging
- Up to 150,000 square feet of retail and services

The first private sector project broke ground in June of 2013. The a six-story workforce- and transit-oriented project has a fifth of the units set aside for households earning up to 50% AMI ($34,700 for a family of two). The remaining units will be for households earning up to 85% AMI, or nearly $52,600 for a two-person family.

5.3 New Holly HOPE VI / Othello Light Rail Station Stop (not shown)

Othello Station is one of 12 stations built during the first segment of the Central Link light rail, completed in 2009. The City of Seattle, Sound Transit, and the Seattle Housing Authority began working to prepare this site for light rail when the station was initially selected in the late 1990's. Developer-community conversations facilitated by the Othello Station Community Advisory team were supported by Small Sparks and Small and Simple Grants.

- The urban town center features a 7.6 acre park, and a culturally diverse small business district.
- Seattle Housing Authority leveraged local and federal funding sources to build 1,400 units of mixed-income rental and affordable housing. Funding for the New Holly project came from the Federal HOPE VI program.
- TOD developer Othello Partners constructed 351 units of market-rate apartments in a 6-story mixed-use project bordering the station and a new park (Othello Park). The project opened in 2012. There are only 200 parking spaces in the building, leased separately.

According to PSRC's TOD Fund Report, "Over the five year period between when construction began on Central Link in 2004 and it was completed in 2009, the values of the mixed-use zoned parcels in Othello station's vicinity rose by 585 percent […] This was a period of active growth in the larger real estate market, as commercial land in all of south Seattle appreciated by 180 percent over the same time period, but the appreciation in the Othello Station area was more than 400 percent higher." [19]

[19] PSRC, A Regional TOD Fund, Ensuring that Transit Communities Grow Equitably, September 2012, p.12. http://www.psrc.org/assets/8674/TODFundWhitePaperReport12-17-12.pdf

5.4 Stadium North Lot/Stadium District/King Street Station

Directly to the south of the proposed 1st Avenue streetcar corridor at Jackson Street near 2nd Avenue, Stadium Place is a mixed-use, transit-oriented development under construction on the largest piece of previously undeveloped land (3.85 acres) in Seattle's urban core. The lot is arguably the most transit-rich location in the city. It is located on a former parking lot adjacent to the King Street Station/International District Multimodal Hub and north of CenturyLink Field. When all phases of Stadium Place are complete, it will feature up to 740 residential units, 170,000 square feet of office space, 50,000 square feet of retail space, and a 297-room hotel and conference center.

The $517 million development's first tower is a 10-story building with 109 apartments. It is part of 1.5 million square feet of residential, office, retail and hotel space that eventually will cover two square blocks. This action is in direct response to the rezone of the South Downtown area and Livable South Downtown Plan, which encourages greater density and mixed-use development and enhancements of the public realm.

A Stadium District Plan for the area surrounding the north lot was released in 2012. The plan represents actions taken by the private sector development community to improve and intensify the area, using transit as a key strategy. The District plan guides development to ensure it is complementary to the public interest and a catalyst for economic development.

5.5 Capitol Hill TOD LINK Light Rail Station

Sound Transit has been working collaboratively with the community and the City of Seattle since 2008 on an Urban Design Framework for the Capitol Hill station area to carefully consider the opportunities and constraints for future redevelopment. Sound Transit and City staff have negotiated a development agreement term sheet to provide land use guidance for future development. Released in April 2013, the TOD plans outline design and use goals for five sites adjacent to the station, with 100,000 sq. ft. of planned development. Building heights were increased to 85 feet, with less parking than typical developments nearby. This agreement also represents the first time the City of Seattle has established a parking maximum for a site—set at a unit to parking ratio of 0.7. Developers will ultimately be responsible for building on the sites, estimated at 400 apartments, 36% of which will be affordable (up to 50% AMI). A developer Request for Qualifications will be initiated by the City in 2014. Nearby, SRM and RD Merrill are currently building a 235 unit apartment building on the block next to the Capitol Hill station. Three blocks north of the station Avalon Bay is planning a project that will feature 380 apartments and 12,000 square feet of retail.

6. Potential Impact of the Center City Connector Project on Regional Development

As part of the Center City Connector Tier 1 screening process (analyzing 1st Avenue and 4th/5th Avenue streetcar alignments), preliminary economic development analysis was conducted to understand how well the 1st Avenue Streetcar corridor would promote new development. This analysis considered the capacity for new investment, potential for transit to influence future development, and connections to jobs and housing. Figure K-10 highlights assets and opportunities within a half-mile of the Seattle Streetcar alignment, including the Center City Connector, South Lake Union, and First Hill Streetcar alignments.

A qualitative property assessment of economic and property characteristics, including average building and parcel size, building age and quality, and percent of space built or renovated since 1990 within a half-mile of the proposed 1st Avenue corridor alignment was also completed. Existing development capacity and distance from other transit service create the potential for transit investment to influence development. Figure K-11 illustrates recent investment or reinvestment along the corridor and Figure K-12 identifies vacant or redevelopable parcels, including older or low quality buildings, vacant lots, or surface parking.[20]

However, the greater impact of a 1st Avenue Streetcar on the region will be its status as a connecting link between employment centers, and as a tool to resolve constraints on downtown economic expansion resulting from congestion, and limited options for north-south travel. The 1st Avenue Streetcar alignment leverages existing City and regional partner investments by linking existing transportation termini at the north and south ends of downtown (Westlake and King Street Intermodal Hubs). This is consistent with the long-term economic development strategies for the City and the region. The Seattle Jobs Plan for 2012 calls for connecting "Seattle's neighborhoods with high capacity transit, including rail, to provide residents and businesses with an affordable, reliable way to get around (the) city."[21]

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[20] SDOT, Center City Connector Transit Study Tier 1 Screening Report, July 2013 (Appendix N of Detailed Evaluation Report).

[21] Seattle Jobs Plan, 2012, p. 6. http://www.seattle.gov/mayor/jobsplan/

Figure K-10 Seattle Streetcar Assets and Opportunities

1 **Mercer Corridor**: A major realignment of Mercer is underway to alleviate congestion, reduce conflict, and improve east-west connections.

2 **Not your Typical Substation**: To keep pace with the needs of high-tech and biotech businesses, Seattle is investing in reliable, clean electricity. The design of the substation will also be designed to meet community goals.

3 **Amazon.com Headquarters**: Amazon's planned campus shifts south into the Denny Triangle with three new high rise towers now under construction.

4 **Gates Foundation:** A $38 billion endowment helps to supports Seattle's high tech and biotech investments and brings approximately 1,200 - 2,000 jobs as a new a visitor center.

5 **Waterfront For All**: together these plans aim to redesign and open up 26 waterfront blocks. Plans also include measures to imporve surface connections between 1rst avenue and the waterfront.

6 **3rd Ave Design Upgrades**: The City, King County and the DSA will collaborate to improve 3rd Ave, including more outreach, support services, and infrastructure improvements.

7 **King Street Station Renovation:** WSDOT and Amtrak recently completed a $55 million dollar renovation of the busiest train station in the Pacific Northwest.

8 **Hotels + Visitors:** The downtown contains the greatest share of Seattle's visitors and tourist attractions. There are 54 hotels within the 1/2 radius from the streetcar alignment and 11,924 rooms. An estimated 15.1 million visits to local attractions take place annually.

9 **Heath Care:** Seattle's largest hospitals: Harborview Medical Center, Swedish Medical Center and Virginia Mason Medical Center and 70 percent of Seattle's Health Care jobs are located on First Hill.

10 **Arts and Culture**: The Arts is a $447 million dollar industry in Seattle, bringing in more than 10,000 jobs. Arts and Cultural Districts in both Capitol Hilll and Pioneer Square will be connected to major arts destinations in the Commercial Core and South Lake Union.

Source: Via Architecture

Figure K-11 Recent Investment/Reinvestment

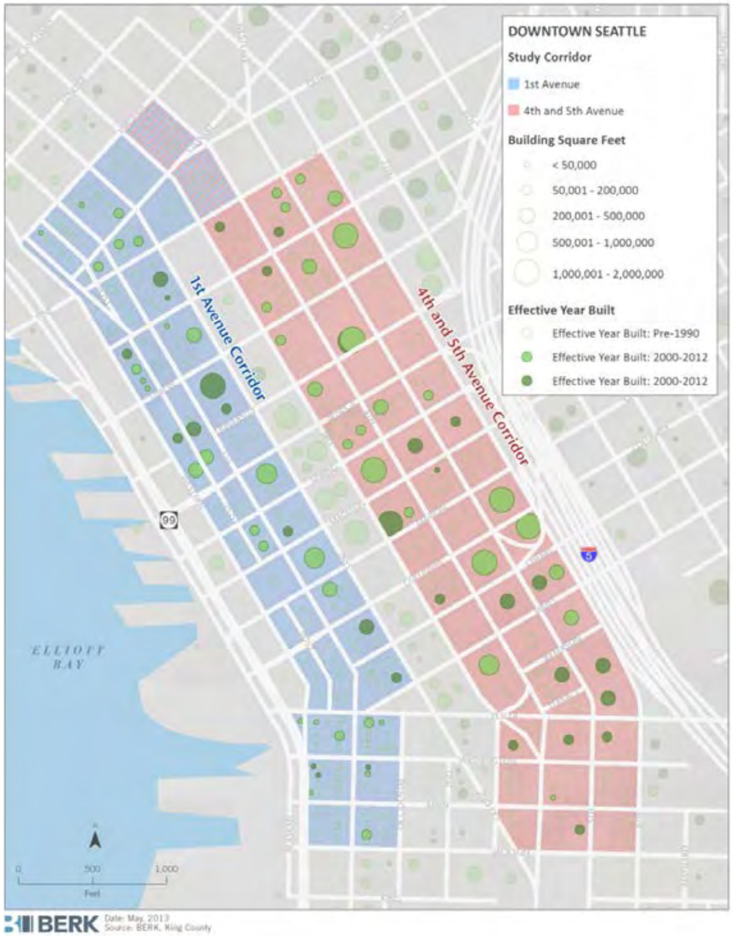
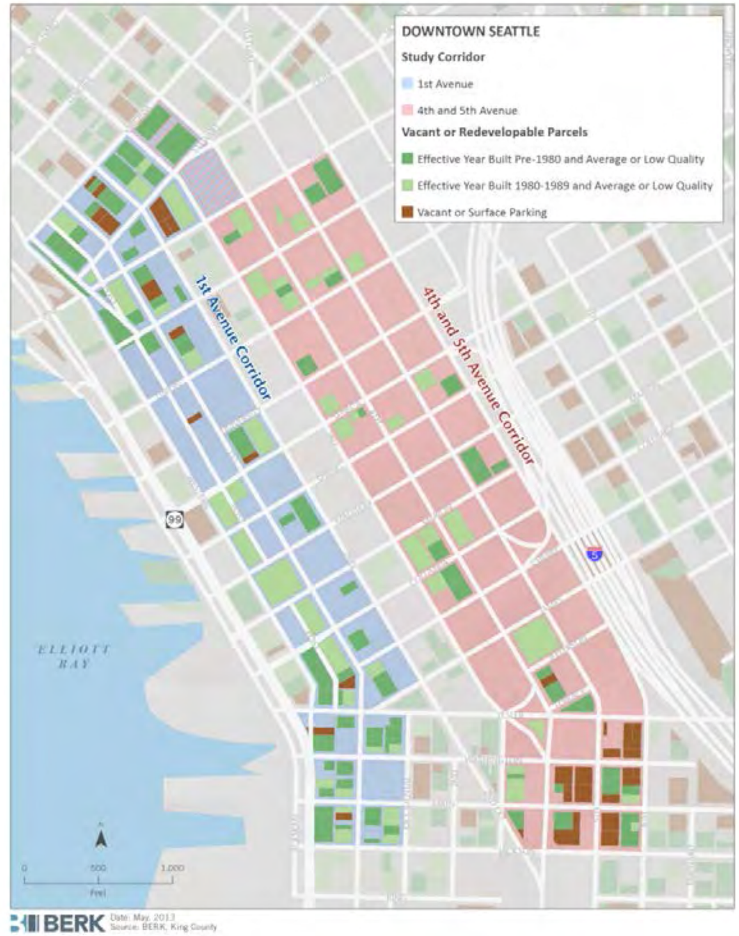


Figure K-12 Vacant and Redevelopable Parcels



7. Plans and Policies to Maintain or Increase Affordable Housing in Corridor

Seattle has a range of plans and policies in place related to support affordable housing, using both public and private market tools. Seattle's Comprehensive Plan Housing element identifies policies and goals for supplying a variety of housing addressing a variety of income levels, and promotes the use of incentives, financial assistance, and other tools. A few key goals and policies are highlighted below.

- Comprehensive Plan Policy H34(a) indicates that Seattle plans for at least 25% of the housing supply in the city to be affordable to households who have very low incomes (up to 50% of AMI).
- Comprehensive Plan Policy H30 contains affordable housing production targets for three income categories (0-50% AMI, 50-80% AMI, and 80-120% AMI) tied to the City's overall housing growth target. Affordable housing production targets for the first two of these AMI income categories were adopted into Seattle's Comprehensive Plan based on specific policy direction in Countywide Planning Policies.
- Additionally, a fundamental affordable housing goal in Seattle's Comprehensive Plan, HG12, is to reduce the number of low-income households in need of housing assistance.
- In line with these policies and goals, Comprehensive Plan policies H37-H44 calls for using a combination of tools—including local discretionary housing subsidy resources, partnerships, and public funds—to encourage the preservation, rehabilitation and development of affordable housing.

The Planning Commission's 2011 Housing Seattle report provides recommendations to tailor the Comprehensive Plan policies listed above to current housing needs. In particular, the Commission recommends "linking housing affordability to transportation costs," a recognition that low- and very low-income households are more likely to be transit dependent. As such, the City is working to create new policy goals that will direct the vast majority of new affordable housing into transit communities, with frequent and reliable transit.

Seattle's Regulatory Reform legislation adopted in 2012 addresses housing affordability. This legislation does the following:

- Streamlines regulatory requirements in Urban Centers and station areas.
- Provides greater ability to mix residential uses on the ground floor of commercial zones
- Expands opportunities for accessory dwelling units such as backyard cottages

In addition to City policy, there are a variety of efforts underway to alleviate the lack of affordable housing in Seattle. Programs that provide funding to subsidize affordable housing, such as the Seattle Housing Levy, Incentive programs and Seattle Housing Authority housing assistance are described in the following sections.

7.1 City of Seattle, Office of Housing, Housing Levy

In 2013, the City of Seattle's Office of Housing (OH) directed $34.8 million towards affordable housing through the City's Rental Housing Program. Much of this funding is generated by Seattle's voter-approved, seven-year Housing Levy. Passed in 2009 for a fifth time, the levy generates $145 million for programs to create and preserve affordable housing, provide homebuyer assistance, rental assistance, and acquisition and opportunity loans. The Seattle Housing Levy Report (2012) details accomplishments, some of which are shown in Figure K-13. From 2005-2015 the Housing Levy (and other City sources) helped to develop a total of 3,671 rental units.

Figure K-13 Seattle Housing Levy Goals and Outcomes

Levy program	Housing Produced Levy Goals 2010-2016	Housing Outcomes 2010-2012
Rental Production and Preservation	1,670 rental units	1,371
Acquisition and Opportunity	175 housing units	225
Operating and Maintenance	220 rental units	71
Homebuyer Assistance	180 homes purchased	74
Rental Assistance	3,025 households (over five years)	554 (one year)

7.2 Consolidated Plan

The City's Consolidated Plan (2009-2012) is in the process of being updated.[22] This plan implements the Comprehensive Plan and includes a detailed strategic plan outlining priorities for the City's housing and community development programs for the US Department of Housing and Urban Development (HUD). The Office of Housing (OH) uses federal CDBG (Community Development Block Grant) and HOME funds to provide

[22] 2014-2018 Consolidated Plan For Housing and Human Development 9-5-2013 http://www.seattle.gov/HumanServices/community_development/conplan/Draft_Consolidated_Plan.pdf

for the preservation and development of affordable housing, assistance to qualifying homeowners in need of home repairs, and assistance benefiting qualifying homebuyers.

7.3 Incentive Zoning

Seattle allows additional residential or non-residential floor area beyond base height or FAR limits to be achieved in certain zones. SMC 23.58A (Incentive Provisions) is Seattle's primary land use code chapter guiding incentive zoning (IZ). Generally, residential developers opting to seek additional floor area in IZ-eligible zones with maximum height limits < 85' must include a percentage of units as affordable to households with incomes up to 80% of AMI (rental) or 100% of AMI (ownership). Non-residential and high rise residential developers also have the option of making a cash contribution (in-lieu fee) to the City to contribute to a low-income housing fund.

The City is currently undertaking a review of its affordable housing incentive zoning program.[23]

7.4 Transferable Development Rights Potential (TDP)

This option helps Seattle maintain a more variable building scale by allowing density to be moved from one site to another.[24] Excess development rights from a certified TDP site can be sold to developers needing residential floor area beyond a base height or floor area ratio (FAR) limit. The proceeds of TDP sales are used for preservation of priority uses. The TDR Agreement includes covenants that will run with the land including 50 years of affordable housing primarily affordable to households with incomes up to 50% of AMI.

> Appendix L provides an estimate of affordable housing currently available in the Center City area.

[23] http://www.seattle.gov/council/issues/affordablehousing/default.html

[24] http://www.seattle.gov/housing/incentives/TDPbonus.htm

APPENDIX L AFFORDABLE HOUSING ASSESSMENT

Introduction

This document[1] summarizes a preliminary assessment of affordable housing supply in the Center City. The housing supply assessment was prepared during the Tier 1 stage of evaluation based on the data available at the time (2013). This assessment is related to Project Goals and Objectives that address affordable housing. The Project goal statement includes the following goal:

Thrive: Strengthen downtown and Center neighborhood.

The following Project Objectives relate to this goal:

- Increase access to affordable housing and social services.
- Improve transportation options for Seattle's most vulnerable residents.

The FTA's New and Small Starts Policy Guidance document[2] includes project justification criteria related to affordable housing (within the Economic Development Effects topic area). Additional review of plans and policies related to preserving and increasing affordable housing is included in Appendix K.

Affordable Housing Supply

Citywide Affordable Housing

Subsidized affordable housing units typically have eligibility requirements based on the percentage of Area Median Income (AMI) the household earns. The city of Seattle has approximately 24,000 subsidized rental units citywide, with roughly 16,000 serving households with incomes of up to 50% AMI. More than 12,000 of these units are available only to households with extremely low incomes (0-30% AMI).[3] The Seattle Planning Commission's 2011 Housing Seattle report contained several findings regarding housing and transit service:

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[1] Prepared by Nelson\Nygaard and VIA Architecture

[2] FTA, "New and Small Starts Evaluation and Rating Process Final Policy Guidance," August 2013, http://www.fta.dot.gov/documents/NS-SS_Final_PolicyGuidance_August_2013.pdf

[3] Seattle Planning Commission, Housing Seattle, 2011 http://www.seattle.gov/documents/departments/seattleplanningcommission/housingseattlereport/housingseattleweb.pdf

- Urban Centers and Urban Villages contain 40% of the total housing units in Seattle and more than half of the city's rental units.
- Because of higher concentrations of rental and multifamily units, housing is generally more affordable in areas with frequent transit service and in Urban Centers and Urban Villages.
- Almost three-quarters of market-rate rentals in complexes with 20 or more units are near frequent transit service.[4]

Center City Affordable Housing

The Center City Connector Tier 1 screening included an assessment of subsidized (income-restricted) affordable housing supply in the Center City. The Center City area includes the neighborhoods of Uptown, South Lake Union, Capitol Hill, Belltown, Denny Triangle, Pike/Pine, Downtown Commercial Core, First Hill, Pioneer Square, and the Chinatown/International District. This analysis was comparative, intended to evaluate 4th/5th Avenue and 1st Avenue Streetcar alignments based on the project goals and objectives related to affordable housing.

The analysis was based on the existing data sources available to the project team. It is anticipated that this analysis would be updated in the future based on more recent and comprehensive data that may be available. The data was provided by the City of Seattle for all City-funded and other income-restricted housing. Multiple inventories were synthesized to develop the estimate.

Figure L-1 shows the total Center City affordable housing supply, including income-restricted units and non-restricted units in buildings that contain both subsidized and market-rate units. There are nearly 9,000 income-restricted units in the Center City, representing a large share of the city's overall affordable housing supply.

Figure L-1 Estimate of Total Center City Income-Restricted Housing Supply, 2012

Income-Restricted Units	Unrestricted Units	Total Units
8,972	1,317	10,289

Data sources: (1) Seattle Office of Housing survey of all project-based affordable housing (conducted in 2009) and supplemented with housing funded by the Office of Housing through 2011. (2) Inventory of all affordable rental housing that the City has funded as of early 2013.

[4] Seattle Planning Commission, Seattle Housing Needs, 2011, p. 19 http://www.seattle.gov/planningcommission/docs/HousingSeattle.pdf

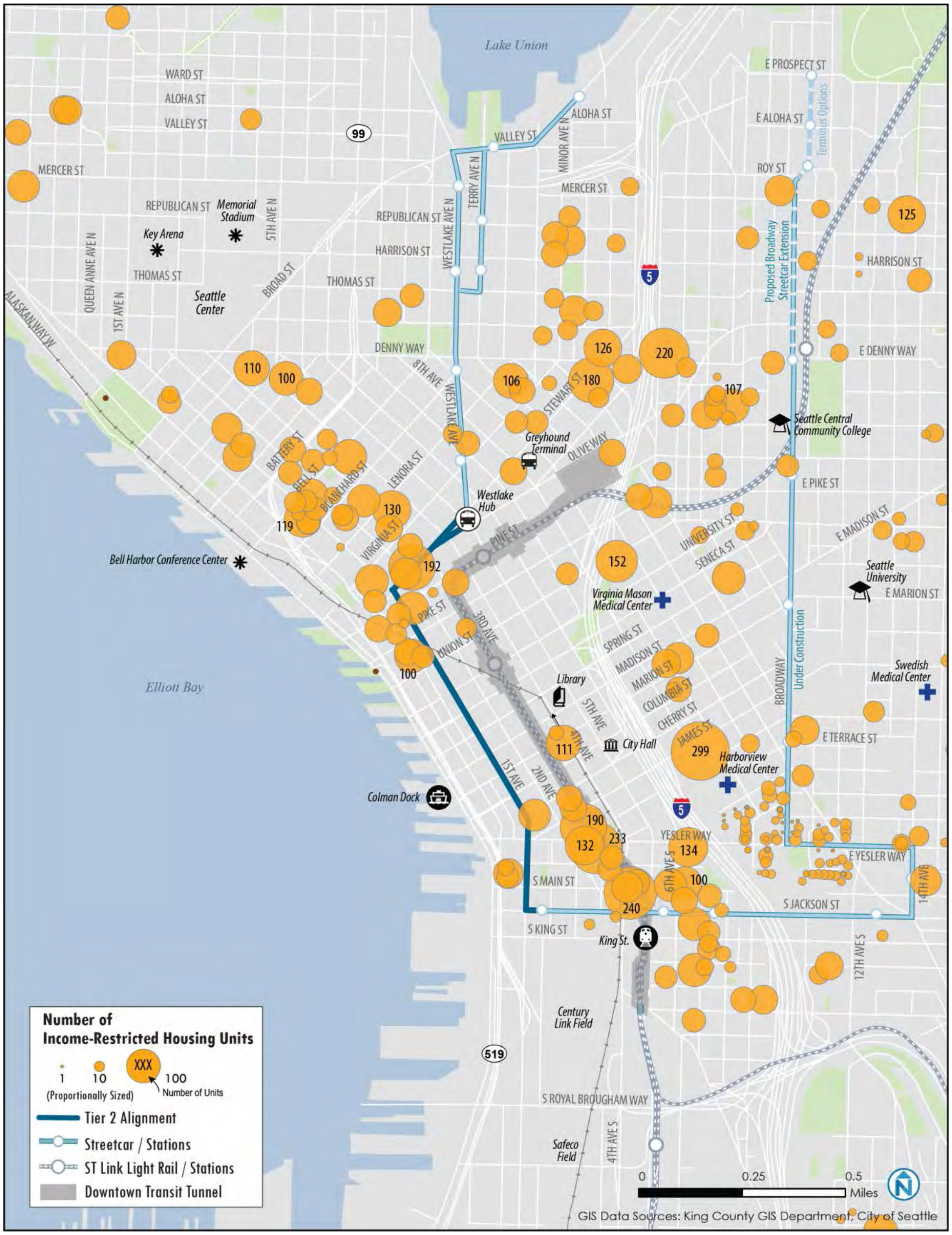
Figure L-2 shows the number of units for each AMI category. More than half of units (54%) are limited to very low income households (earning up to 30% of AMI). Nearly three-quarters of income-restricted units are available to households earning up to 50% of AMI; nearly 90% are limited to households with incomes of 60% of AMI or less.

Figure L-2 Number of Center City Units by Income Restriction, 2013

	30% AMI	40% AMI	50% AMI	60% AMI	65% AMI	70% AMI	80% AMI	Total
TOTAL	4,811	199	1,590	1,287	13	55	1,017	8,972
% of income-restricted	54%	2%	18%	14%	0%	1%	11%	100%
Cumulative %	54%	56%	74%	88%	88%	89%	100%	

Figure L-3 shows the location of buildings with income-restricted units that were identified in the analysis and the number of income-restricted units in each building. For the most part, affordable housing is located at either end of the Center City Streetcar alignment, in Pioneer Square or Belltown.

Figure L-3 Center City Income-Restricted Housing Locations



APPENDIX M INITIAL SCREENING

This appendix provides additional detail regarding the initial screening of mode and alignment alternatives for the Seattle Center City Connector based on the Project Purpose and Need.

Initial Screening Methodology

The Center City Connector Project evaluation framework defined several key questions to be addressed in the initial screening of alternatives with the aim of removing alternatives that clearly do not meet the stated Project Purpose and Need from further consideration. Figure M-1 describes the evaluation process and data sources used to support the evaluation.

Figure M-1 Initial Screening Criteria

Criteria	Quantitative Data or Data Sources
Consistency with local and regional plans	Qualitative assessment based on: ▪ Seattle Transit Master Plan (TMP), 2012 ▪ Seattle Comprehensive Plan, written in 2005, last updated in 2009 ▪ Seattle Streetcar Network Development Report, 2008 ▪ Seattle Transportation Strategic Plan (TSP), 2005 ▪ Seattle Bicycle Master Plan (BMP), 2005 ▪ Seattle Center City Circulation Strategy Report, 2004 ▪ Seattle Center City Access Strategy, 2003
Meets identified needs (mobility/connectivity): ▪ Significant existing population and employment and projected growth in the Seattle Center City ▪ Growth in demand for Center City circulation trips ▪ Constraints on expansion of Center City transportation	Quantitative assessment based on: ▪ Total population and employment; population and employment density[1] ▪ Projected 2030 total population and employment; 2030 population and employment density ▪ Physical constraints (e.g., impacting directness, conflicts with other

Criteria	Quantitative Data or Data Sources
capacity ▪ Special mobility needs of tourists, visitors, and casual users in the Center City ▪ Affordable transportation access to key social and human services located in the Center City ▪ Connections for low-income workers who live in the Center City to jobs in the Center City ▪ Reduction in greenhouse gas (GhG) emissions from private vehicle travel and traffic congestion	modes) ▪ Number of landmarks/attractions[2] and number per alignment mile ▪ Number of social service sites and number per alignment mile ▪ Number and density of low-income workers who live and work in Center City (home and work locations) Qualitative assessment based on: ▪ Physical constraints (e.g., impacting directness, conflicts with other modes)
Serves key destinations and anchors	Qualitative assessment
Public and stakeholder support	Qualitative assessment based on stakeholder interviews and open house #1 feedback
Transit capacity	Qualitative assessment (mode screening only)
Reduction in GhG emissions	Qualitative assessment (mode screening only)

Notes: (1) Density evaluated based on a 1/8 mile buffer of each alignment. (2) As identified in the Project Purpose and Need statement.

Initial Screening Results

This section presents findings from the initial screening process, including how well each alterative met the evaluation criteria described in Figure M-1. Modes and street alignments were assessed separately.

Modes

The Transit Master Plan proposed that modern streetcar (with a range of transit priority improvements) be considered as the mode for the Center City Connector. Based on input received at the February 6, 2013 open house and through stakeholder interviews, Mixed-Traffic and Exclusive Streetcar[1], Enhanced Bus, Light Rail (Sound Transit Link), and Monorail modes were screened against the Project Purpose and Need. Figure M-2 provides a summary of the initial mode screening against established screening criteria.

Figure M-2 Initial Screening Mode Evaluation Results

	Mode				
Evaluation Measures	Mixed-Traffic Streetcar	Exclusive Streetcar	Enhanced Bus	Monorail	Link Light Rail
Consistent with Local/Regional Plans	Best	Good	Fair	Poor	Poor
Meets Identified Needs (Mobility/Connectivity)	Best	Good	Fair	Poor	Fair
Public/Stakeholder Support	Best	Good	Fair	Poor	Poor
Potential Right-of-Way Impacts	Best	Fair	Best	Fair	Poor
Overall	Best	Good	Fair	Poor	Poor

The following sections provide additional detail on the assessment of each mode.

Mixed-Traffic Streetcar

The Mixed-Traffic Streetcar mode was rated "best" overall based on the following evaluation. It was recommended for further study in Tier 1.

- Consistent with the TMP, Seattle Streetcar Network Plan, and others.
- Meets Project Need and could connect South Lake Union (SLU) and First Hill (FH) Streetcars.
- Strong stakeholder support.
- Minimal impacts to right-of-way.

Exclusive Streetcar

The Exclusive Streetcar mode was rated "good" overall based on the following evaluation. It was recommended for further study in Tier 1.

- Not specifically identified for the Center City Connector corridor in the TMP, but compatible with existing streetcars; a related mode (Rapid Streetcar) was identified as a potential mode option for other corridors in the TMP.

[1] The TMP distinguished between Local and Rapid Streetcar modes, with Rapid Streetcar contrasted by design features including extensive transit priority and dedicated right-of-way; higher-capacity vehicles; and a higher level of investment in station design and amenities. For the purpose of the Center City Connector alternatives evaluation, "Local Streetcar" was represented in the Mixed-Traffic Streetcar mode while "Rapid Streetcar" was represented in the Exclusive Streetcar mode. The evaluation primarily differentiated the two modes in terms of a high level of transit priority and use of dedicated right-of-way.

- Meets Project Need and could connect SLU and FH streetcars.
- Good stakeholder support; stakeholders also emphasized importance of transit priority.
- Significant impacts to right-of-way.

Enhanced Bus

Enhanced Bus was rated "fair" overall and was not recommended for further consideration. The evaluation included the following assessment:

- Not specifically identified for the Center City Connector corridor, but compatible with the corridor and identified as a potential mode option for other corridors in the TMP.
- Could meet a subset of Project needs, but is not compatible with establishing a seamless connection between the SLU and FH streetcars, which represent a substantial investment in Center City transit mobility.
- Limited stakeholder support.
- Minimal impacts to right-of-way.

Monorail

Monorail was rated "poor" overall and was not recommended for further consideration based on the following assessment:

- Not recommended for the Center City or any other corridors in current plans.
- Limited ability to meet Project needs given incompatibility with other modes.
- No recorded stakeholder support.
- Significant impacts to right-of-way.

Link Light Rail

Link Light Rail was rated "poor" overall and was not recommended for further consideration based on the following evaluation:

- Surface-running option would be unlikely to meet Sound Transit design criteria and has not been recommended in other plans.
- Limited ability to meet Project needs such as short-distance trips and not compatible with goal of creating a seamless connection between the SLU and FH streetcars.
- No recorded stakeholder support.
- Surface-running option would have significant right-of-way impacts.

Street Alignments

The TMP proposed potential Center City Connector alignments on 4th/5th Avenues (couplet) and 1st Avenue. The project team solicited public input on these and other potential alignments at the February 6, 2013 open house. Several additional alignments identified by the public were included in the range of alignments considered. A total of seven alignments were evaluated in the initial screening process, as shown in Figure M-3.

Figure M-3 Alignments Evaluated in Initial Screening

Figure M-4 shows the results of the initial screening. The 4th/5th Avenue (couplet) and 1st Avenue alignments were rated "good" and "best," respectively. These two alignments were recommended for further consideration in the Tier 1 evaluation. All other alignments received overall ratings of "fair," and were not recommended for further consideration.

Figure M-4 Initial Screening Alignment Evaluation Results

	Alignment						
Evaluation Measures	4th/5th Aves	1st Ave	1st Ave to Uptown	3rd Ave to Seattle Center	3rd Ave to Westlake	1st Ave-SODO Extension	Waterfront Streetcar
Consistent with Local/Regional Plans	Good	Best	Good	Poor	Poor	Fair	Fair
Meets Identified Needs (Mobility/Connectivity)	Good	Good	Fair	Fair	Fair	Poor	Fair
Serves Key Destinations/Attractions	Good	Best	Good	Good	Good	Fair	Fair
Public/Stakeholder Support	Fair	Best	Fair	Fair	Poor	Good	Fair
Overall	Good	Best	Fair	Fair	Fair	Fair	Fair

The following sections provide additional detail on the evaluation of each alignment.

Alignment A: 4th/5th Avenues

This alignment was rated "good" overall and was recommended for further evaluation in Tier 1. The evaluation was based on the following assessment:

- Included in TMP as Corridor CC2, not included in Seattle Streetcar Network Plan, could conflict with Seattle Bicycle Master Plan (BMP).
- Serves mobility needs and provides connections to human services and low-income workers' home and job locations in the Center City, but is more strongly oriented to downtown commuters than to tourists/visitors.
- Serves some key destinations and attractions.
- Limited stakeholder support primarily due to modal conflicts; use of couplet and land use/demand factors were also raised as concerns.

Alignment B: 1st Avenue

The 1st Avenue alignment was rated "best" overall and was recommended for further evaluation in Tier 1. The evaluation was based on the following assessment:

- Included in multiple plans including Seattle Center City Circulation Strategy Report (2004), Seattle Streetcar Network Plan (2008), and Seattle TMP (2012).
- Serves tourist/visitor mobility needs and provides connectivity to human services and home/job locations for low-income workers.
- Serves numerous key destinations and attractions.

- Strong stakeholder and public support for a 1st Avenue alignment with a connection to Westlake and the South Lake Union streetcar.

Alignment C: 1st Avenue to Uptown

The 1st Avenue to Uptown alignment (without a direct connection to Westlake) was rated "fair" overall based on the following assessment:

- Included in Seattle Streetcar Network Plan and Seattle TMP.
- Provides mobility for tourists/visitors and connectivity to human services and low-income workers, but without the Westlake connection provided by Alignment B it does not serve the Project Purpose of connecting the SLU and First Hill streetcars.
- Serves numerous key destinations and attractions.
- The connection to Uptown/Lower Queen Anne provided by this alignment received moderate stakeholder and public support but this alignment would not meet the Project Need for connecting to the South Lake Union Streetcar without a Westlake connection.

The 1st Avenue to Uptown alignment was not recommended for further consideration in Tier 1 because it did not meet the Project Purpose and Need without a connection to Westlake. However, the corridor between North Downtown and Seattle Center/Lower Queen Anne was analyzed in the Ballard-to-Downtown High Capacity Transit Study. This work will be used to determine next steps in developing a high-capacity transit connection.

Alignments D1 and D2: 3rd Avenue to Seattle Center or Westlake

The 3rd Avenue alignments were both rated "fair" based on the following assessment:

Alignment D1: 3rd Avenue to Seattle Center

The 3rd Avenue to Seattle Center alignment was rated "fair" overall based on the following assessment:

- Not consistent with current City, Sound Transit, or King County Metro plans.
- Provides good mobility for tourists/visitors and good connectivity to human services and low-income worker home locations.
- Serves some key destinations and attractions and provides connections between Intermodal Hubs but duplicates service provided by existing bus and Link light rail.
- Limited stakeholder support; significant transit conflicts.

Alignment D2: 3rd Avenue to Westlake

The 3rd Avenue to Westlake alignment received an overall evaluation of "fair" based on the following following assessment:

- Not consistent with current City, Sound Transit, or King County Metro plans.
- Provides good mobility for tourists/visitors and good connectivity to human services and low-income worker home locations.
- Serves some key destinations and attractions and provides connections between Intermodal Hubs but duplicates service provided by existing bus and Link light rail.
- Poor stakeholder support; significant transit conflicts.

Both 3rd Avenue alignments would cause significant conflicts with current transit operations unless service was operated using the Enhanced Bus mode. The initial mode screening found that Enhanced Bus did not meet the Project Purpose and Need and may duplicate some existing service on this alignment. A circulator operating on 3rd Avenue could be challenging to implement without negatively impacting important local and regional bus operations because 3rd Avenue is currently near peak period bus capacity. Neither alignment was recommended for consideration in Tier 1.

Alignment E: 1st Avenue-SODO Extension

Alignment E would extend alignment B or C to the Stadium District/South Downtown (SODO). This alignment received an overall rating of "fair" based on the following assessment:

- Has not been included in current plans, but does not conflict with local plans.
- Does not meet overall mobility needs for tourists/visitors and/or provide connectivity to social services and low-income worker home and job locations. This alignment would not meet the Project Purpose and Need in isolation.
- Serves some significant destinations and attractions, but in isolation does not connect major tourist and visitor destinations.
- Moderate stakeholder support.

A SODO alignment was not recommended for further consideration in Tier 1 but may be suitable for consideration as part of a future study.

Alignment F: Waterfront Streetcar

The Waterfront Streetcar alignment was rated "fair" overall based on the following assessment:

- Has been included in past plans (Seattle Center City Circulation Study, 2004; Seattle Center City Access Study, 2003), and was assessed for feasibility in the Seattle Waterfront Streetcar Reactivation Study (2011). This alignment is currently under consideration as part of the Central Waterfront Project.
- Provides moderate mobility for tourists/visitors and moderate-to-poor connectivity to low-income home and job locations.

- Serves few key destinations and attractions due to limited walkshed.
- Limited stakeholder support; stakeholders did not feel that this alignment would provide adequate urban circulation due to grade and walking distance from the downtown core.

This alignment was not recommended for further study in Tier 1, however the alignment was under consideration as part of the Central Waterfront Project when the initial screening was conducted and a final decision was deferred pending the outcome of the Central Waterfront process. Additionally, a limited number of stakeholders expressed interest in incorporating the historic waterfront streetcars into the Center City Connector Project.

APPENDIX N TIER 1 SCREENING REPORT

1. Introduction and Executive summary

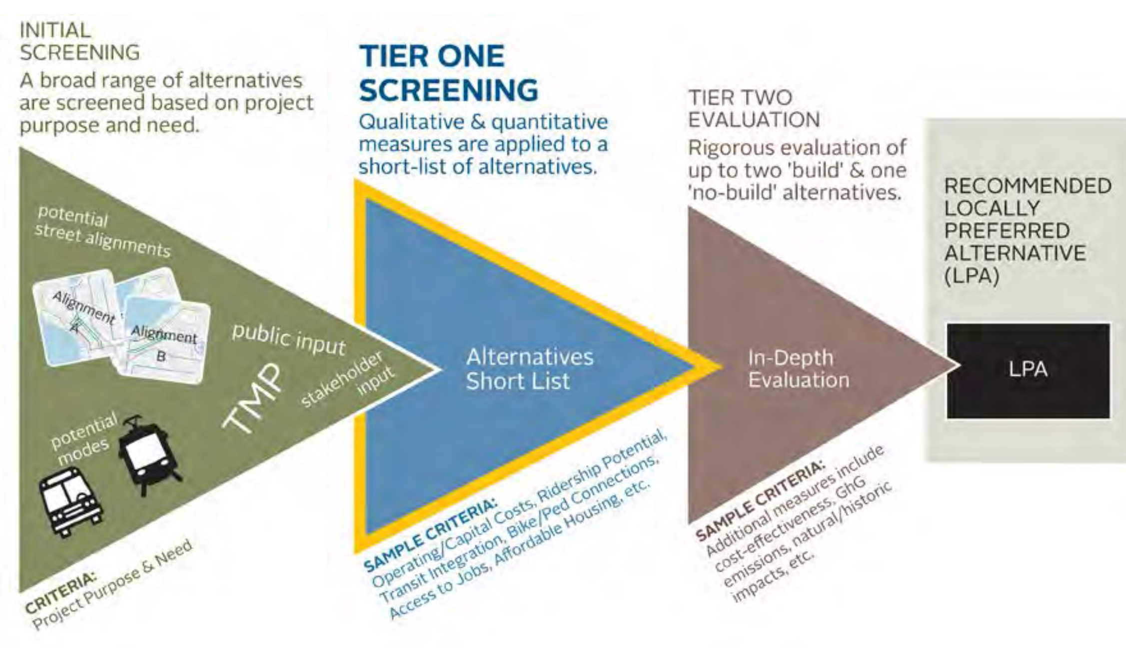
This report describes results of the Tier 1 screening of alternatives for the Seattle Center City Connector Transit Study. The purpose of the study is to evaluate a range of transit improvements in Seattle's Center City, specifically focusing on connecting north and south downtown and the existing South Lake Union Streetcar line and the planned (currently under construction) First Hill Streetcar.

Evaluation Process

Figure N-1 illustrates the evaluation process that was defined for studying and narrowing all reasonable alignment and mode options into a Locally Preferred Alternative (LPA), consistent with Federal Transit Administration (FTA) guidance.

The Initial Screening process concluded in April 2013 and resulted in the selection of mode and alignment alternatives for more detailed assessment in the Tier 1 Screening process, completed in June 2013. The Tier 1 Screening is highlighted in the graphic and is the focus of this report. An open house was held in June 2013 to present the Initial and Tier 1 Screening results and obtain public feedback.

Figure N-1 Evaluation Process Overview

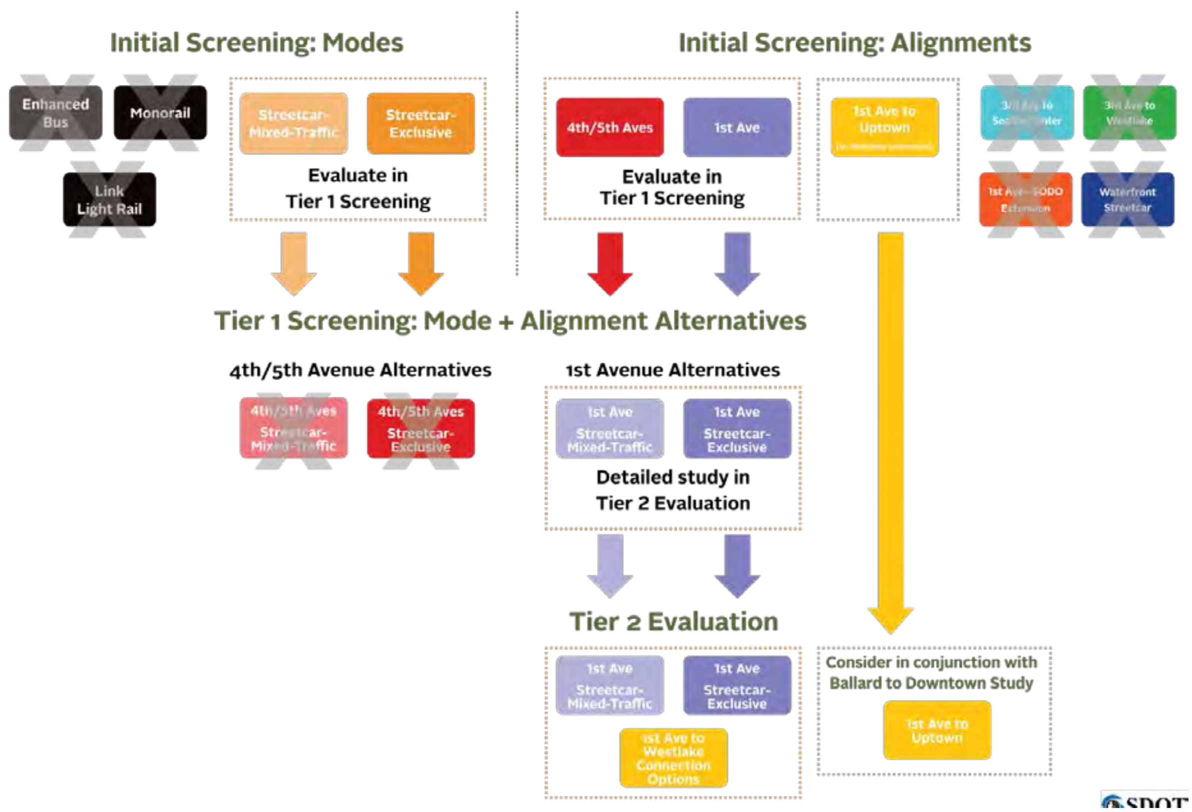


Initial and Tier 1 Screening of Alternatives

Figure N-2 shows the mode and alignment recommendations resulting from each step of the evaluation process that has been completed as part of the Center City Connector Transit Study. The outcome of the Initial Screening process was to narrow a wide range of potential mode and alignment options and to identify alternatives for further study in the Tier 1 Screening process. As shown in Figure N-2, the Tier 1 alternatives were Mixed-Traffic and Exclusive Streetcar modes and 4th/5th Avenue and 1st Avenue alignments.

The intended outcome of the Tier 1 Screening is to determine the alternative(s) that best meet the project goals and objectives and recommend alternative(s) for more detailed study in the Tier 2 Evaluation process. High-level designs were developed for each Tier 1 alternative—4th/5th Avenue Mixed-Traffic Streetcar, 4th/5th Avenue Exclusive Streetcar, 1st Avenue Mixed-Traffic Streetcar, and 1st Avenue Exclusive Streetcar. The alternatives were evaluated using a set of criteria designed to measure how well each alternative met the project need and project goals. In addition to the technical analysis, public input from the two open houses held thus far was taken into account in rating the alternatives. Ultimately, 1st Avenue Exclusive Streetcar and 1st Avenue Mixed-Traffic Streetcar were recommended for more detailed study in the Tier 2 Evaluation. In addition, it was recommended that a potential extension of the 1st Avenue alignment to Uptown be considered in conjunction with the Ballard-to-Downtown Study, which is evaluating a range of transit options north of the Westlake area.

Figure N-2 Center City Alternatives Screening Process and Outcomes



Summary of Tier 1 Screening Results

Evaluation Measures

Each Tier 1 alternative was evaluated based on a set of measures corresponding to the project goals and objectives, with each measure rated on a relative scale of Best-Good-Fair-Poor. Figure N-3 summarizes the Tier 1 Screening results.

Figure N-3 Tier 1 Screening Summary Matrix

	Evaluation Measures	4th/5th Avenues		1st Avenue	
		Mixed-Traffic	Exclusive	Mixed-Traffic	Exclusive
ENHANCE	Streetcar Travel Times	Fair	Good	Fair	Best
ENHANCE	Bus Travel Time and Reliability Impacts: Aggregate Bus Delay	Poor	Fair	Best	Best
ENHANCE	Bus Travel Time and Reliability Impacts: Aggregate Bus Passenger Delay	Poor	Fair	Best	Best
CONNECT	Connections with Existing Transit/Multi-modal Hubs	Good	Good	Best	Best
CONNECT	Future Employment within Alignment	Best	Best	Good	Good
CONNECT	Future Population within Alignment	Good	Good	Best	Best
CONNECT	Multimodal Conflicts (Bike, Pedestrian, Bus, and Freight)	Fair	Poor	Best	Best
CONNECT	Auto Travel Times / Relative Traffic Diversion Impacts	Fair	Fair	Best	Fair
CONNECT	Ridership Potential	Good	Best	Good	Best
CONNECT	Annual Operating & Maintenance Costs	Fair	Good	Fair	Best
CONNECT	Capital Costs	Best	Good	Good	Fair
DEVELOP	Economic Development Opportunities	Good	Good	Best	Best
DEVELOP	On-Street Parking Impacts	Best	Fair	Good	Fair
THRIVE	Access to Jobs	Good	Good	Good	Good
THRIVE	Access for Vulnerable Residents and to Social Services and Affordable Housing	Good	Good	Good	Good
THRIVE	Access to Tourist Destinations, Civic and Cultural Assets, and Open Spaces	Good	Good	Best	Best
THRIVE	Public Support (Open House #1 and #2) and Stakeholder Support	Fair	Fair	Best	Best
SUSTAIN	Urban Form and Placemaking Opportunities and Improvement Potential	Good	Good	Best	Best

1st Avenue offers good connections to transit hubs, has few conflicts with citywide bicycle, pedestrian, auto, and freight priorities, and serves a corridor with high population density and numerous cultural and tourist attractions.

Overall, the 1st Avenue Exclusive alternative scored "best" on 14 of the evaluation measures. 1st Avenue Exclusive had the fastest streetcar travel time as well as the lowest operating and maintenance costs.

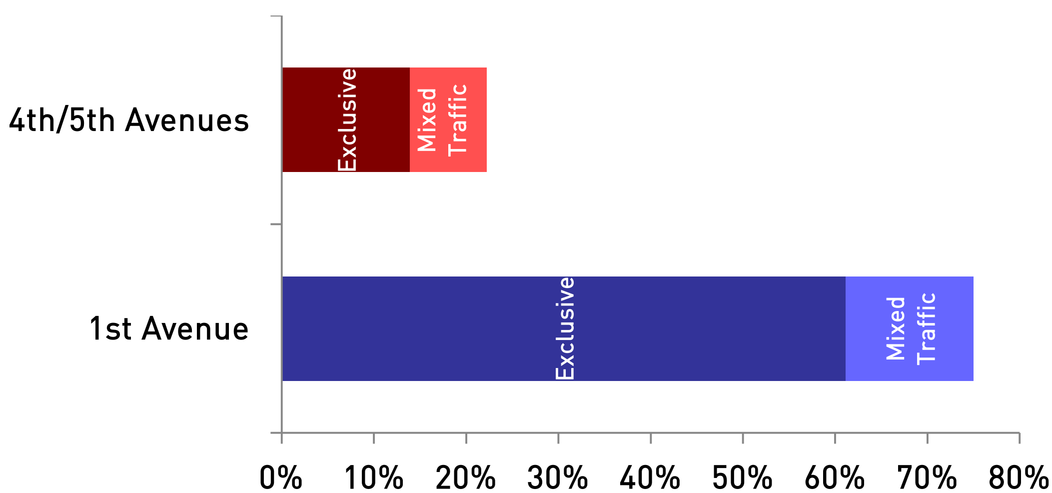
The 1st Avenue Mixed-Traffic alternative scored "best" on 12 of the evaluation measures, including the lowest impact to auto travel times.

In comparison, the 4th/5th Exclusive alternative scored "best" on only 5 measures, and 4th/5th Mixed-Traffic scored "best" on 6 measures. The 4th/5th corridor serves a greater employment and hotel density, but has a lower residential population, and a streetcar would have significant impacts on other modes including as many as 4,000 hours of additional peak-hour delay for passengers traveling on bus routes that use 4th or 5th Avenues. The high-level right-of-way design for 4th/5th Avenues included one-way cycle tracks on both streets, recognizing that cycle tracks are proposed for the corridor in the City's Bicycle Master Plan update.

Public Support

Both alignment alternatives on 1st Avenue scored well and had strong public support. Figure N-4 illustrates that 1st Avenue Exclusive had the strongest public support at the second project open house. Figure N-5 summarizes advantages and disadvantages of 4th/5th Avenue and 1st Avenue alternatives, as identified by open house participants. These findings support previous public and stakeholder preferences for a 1st Avenue alignment.

Figure N-4 Ranking of Alternatives, Open House #2: Top Choice



Over 60% of people ranked 1st Avenue Exclusive as their preferred alternative, with about 75% of completed comment cards favoring one of the First Avenue alternatives. In addition, the First Avenue alternatives received a majority of second-choice votes.

Figure N-5 Advantages and Disadvantages of 4th/5th and 1st Avenue Alternatives

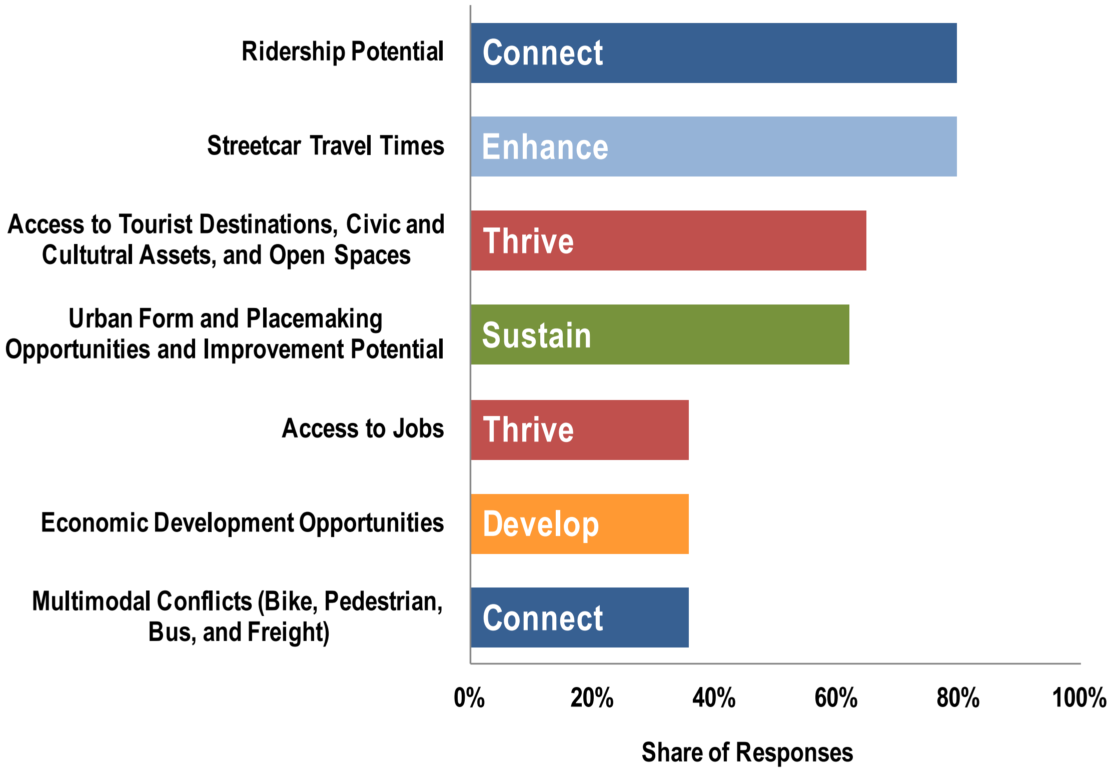
Advantages	Disadvantages
4th/5th Avenues	
▪ More direct/central to downtown retail core ▪ Large built-in ridership base ▪ Close to existing transit infrastructure ▪ Better connection to South Lake Union	▪ Serves CBD daytime ridership only ▪ Too close to I-5, too congested ▪ More redundant with existing transit infrastructure, already well-served by transit ▪ Requires couplet
1st Avenue	
▪ Connects more public/cultural amenities ▪ Serves both locals and tourists, greater off-peak demand ▪ Possibility of a future extension to Uptown and other future opportunities ▪ Currently underserved by transit ▪ Better economic development opportunities	▪ Serves primarily tourists ▪ Uphill walk to destinations ▪ Too few lanes, too congested

Source: Open House #2 Comment Cards (see Attachment N.8 for a more complete summary)

Importance of Evaluation Measures

The open house presented a summary of 14 Tier 1 evaluation measures and asked participants to select the five measures that were most important to their overall ranking of the alternatives and allowed for additional comments on each measure. The measures that received more than 10 votes are shown in Figure N-6. The top-ranked evaluation measures were Ridership Potential and Streetcar Travel Times, both of which favor an exclusive alignment. The 1st Avenue Exclusive alternative had the fastest streetcar travel times based on the Tier 1 analysis. Weighting the results by the most influential measures did not affect the overall result.

Figure N-6 Importance of Evaluation Measures based on Ranking by Open House #2 Participants



The evaluation measures identified by Open House participants as most important represent all five goal and objective themes (Enhance, Connect, Develop, Thrive, and Sustain).

Tier 1 Screening Recommendation

Based on the technical evaluation and strong stakeholder and public support in favor of 1st Avenue, the project team recommended to City Council that both the 1st Avenue Exclusive and 1st Avenue Mixed-Traffic alternatives be advanced for more detailed study in the Tier 2 evaluation. This recommendation was presented to the Seattle City Council Transportation Committee at an informational briefing on July 9, 2013. Council comments were supportive. No action was taken.

Tier 1 Report Outline

The following two chapters provide a more detailed description of the alternatives and present the evaluation results:

- Chapter 2 provides a description of the alternatives, including cross-section design and operating scenarios.
- Chapter 3 describes results from the evaluation of the Tier 1 alternatives.

A more detailed description of the evaluation methodology and/or results is provided in a set of appendices:

- Attachment N.1: Traffic Analysis
- Attachment N.2: Operating and Maintenance Cost Estimates
- Attachment N.3: Capital Cost Estimates
- Attachment N.4: Ridership Estimation
- Attachment N.5: Bus Operations Analysis
- Attachment N.6: Economic Development Analysis
- Attachment N.7: Urban Form Assessment
- Attachment N.8: Public Engagement
- Attachment N.9: Modal Conflicts

2. Description of Tier 1 Alternatives

The wide range of mode and street alignment options considered in the Initial Screening were narrowed to the following mode and street alignment options, which are the basis for the Tier 1 alternatives described in this section:

- **Modes:** Mixed-Traffic and Exclusive Streetcar.
- **Alignments:** 4th/5th Avenues (couplet) and 1st Avenue, between Jackson Street and Westlake, illustrated in Figure N-7.

Figure N-7 Street Alignments for Tier 1 Screening

Modes

The initial screening process recommended that Mixed-Traffic Streetcar and Exclusive Streetcar modes be evaluated in the Tier 1 process, based on public and stakeholder feedback about the importance of reliable and competitive transit travel times. As summarized in Figure N-8, for the purposes of comparison in the Tier 1 analysis these modes are primarily distinguished through:

- **Right-of-Way Design**. Mixed-Traffic Streetcar running primarily in lanes shared with other vehicle traffic and exclusive streetcar running primarily in exclusive transit/streetcar lanes.
- **Signal Priority**. Limited signal priority for Mixed-Traffic Streetcar and more extensive signal priority for Exclusive Streetcar.
- **Stop Spacing**. Shorter spacing between stops/stations for Mixed-Traffic Streetcar and longer stop spacing for Exclusive Streetcar (as illustrated in Figure N-10 and Figure N-21 for the 4th/5th Avenue and 1st Avenue street alignments, respectively).

Figure N-8 Typical Features of Exclusive Streetcar and Mixed-Traffic Streetcar Modes

The Tier 1 analysis of these mode alternatives primarily reflects the tradeoffs between potential travel time and capacity benefits and potentially greater impacts on other travel modes. These impacts are quantified through traffic analysis and other quantitative and qualitative analysis.

In the Tier 2 evaluation, mixed-traffic and exclusive streetcar characteristics will also be evaluated for the ability of the alignments under consideration to support longer vehicles or multiple-car trains (most often associated with the exclusive streetcar mode), compatibility of such vehicles with the existing South Lake Union (SLU) Streetcar and planned First Hill (FH) Streetcar, and potential integration with other potential exclusive streetcar implementations, such as the Downtown to Ballard Transit Study, which is also considering an exclusive streetcar mode.

Street Alignments

The Tier 1 Screening evaluated two alignments, each with mixed-traffic and exclusive design alternatives. This section defines the alternatives analyzed. **For both alignments, the Mixed-Traffic and Exclusive scenarios are intended to illustrate a range of potential benefits and impacts for the streetcar.** Tier 2 alternatives will be refined and analyzed in greater detail.

4th/5th Avenues

The 4th/5th Avenue alternatives assume:

- Streetcar runs northbound on 4th Avenue and southbound on 5th Avenue.
- Terminus on 5th between Main & Jackson, with a transfer to the First Hill streetcar at Jackson Street.
- A northbound connection from 4th to Westlake via Olive (additional options would be analyzed in the Tier 2 evaluation).
- Cycle tracks would be created on both 4th (northbound) and 5th (southbound).

Street Alignments

Figure N-10 illustrates the 4th and 5th Avenue couplet alignment and various connection options, including conceptual stop spacing for both exclusive and mixed streetcar modes. The Tier 1 Screening assumes use of Olive Way as the connection from northbound 4th Avenue to the existing SLU streetcar. Figure N-9 describes this connection and one other potential connection option that could be evaluated in additional detail as part of the Tier 2 evaluation, assuming that the 4th/5th Avenue couplet is identified as the preferred option in Tier 1.

Figure N-9 4th/5th Avenues Alignment Westlake Connection Scenarios

Option	NB (To South Lake Union)	SB (To International District)
Option Assumed for Tier 1 Evaluation		
Olive	4th – Olive – Westlake	Westlake – 5th
Additional Options for Potential Evaluation in Tier 2		
Pike	4th – Pike – 6th – Westlake	Westlake – 5th

Figure N-10 4th/5th Alignment Option for Tier 1 Screening

Cross-Sections and Right-of-Way Design

The design alternative for 4th/5th Avenues assumes a side-running streetcar.[1] Figure N-11 describes the cross-sections for both existing conditions and the two proposed alternatives.

Figure N-11 Existing and Proposed Cross-Section Alternatives (Typical)

Scenario	Bike Facility	On-Street Parking	General Public (GP) Lanes	Exclusive Transit/Streetcar
4th Avenue				
Existing	5-foot bike lane (or sharrows during peak)	Peak-restricted in bike lane	3 GP (varies)	Bus-only lane
Mixed Traffic	8-foot cycle track (passing cycle track in some blocks)	Parking on west side of some blocks (between cycle track and Streetcar/GP lanes)	11 foot GP 11 foot GP/Streetcar	12-foot transit
Exclusive Lane	7-foot cycle track (e.g., 5-foot with 2-foot buffer)	Generally not present	10-foot GP 10-foot GP lane	11-foot GP/Streetcar 12-foot transit

[1] An internal SDOT cross-section workshop was conducted in March 2013 to obtain feedback on the viability of various design options.

Scenario	Bike Facility	On-Street Parking	General Public (GP) Lanes	Exclusive Transit/Streetcar
5th Avenue				
Existing	Shared with GP	On-street parking in some blocks N. of Marion	3 GP (varies)	Shared with GP Contra-flow bus south of Cherry
Mixed Traffic	6 to 8-foot cycle track (passing cycle track in some blocks)	Eliminate on-street parking on some blocks N. of Marion	3 GP	Shared with GP Maintain contra-flow bus south of Cherry
Exclusive Lane	6 to 8-foot cycle track (passing cycle track in some blocks)	Eliminate on-street parking on some blocks N. of Marion	2 GP	1 transit lane (likely Spring-Cherry) Maintain contra-flow bus south of Cherry

Existing and Planned Facilities

Figure N-12 and Figure N-13 illustrate the existing cross-sections for 4th and 5th Avenues. The bullets below describe how the existing 4th and 5th Avenue cross-sections support transit, bicycle, and general-purpose (GP) vehicle traffic.

- **Transit**: Current mixed-traffic and regional buses use a transit lane on 4th Avenue for northbound travel; GP vehicles are allowed to use the lane for right-turns. On 5th Avenue, bus volumes are lower than on 4th Avenue and buses share the western curb lane with GP vehicle travel.
- **Bicycle**: Currently cyclists use a 5-foot bicycle lane on 4th Avenue for northbound travel in the corridor, or shared lanes when peak-hour parking restrictions are lifted. There is no designated facility on 5th Avenue but all lanes may be used for southbound travel, especially outside lanes. A separated bicycle facility, e.g., buffered bike lanes or cycle track, along this corridor has been envisioned as part of the City's Bicycle Master Plan update.
- **General Purpose**: Three GP lanes are available on 4th Avenue. Three GP lanes are available on 5th Avenue. The outside lanes on 5th Avenue are wide and are used for

on-street parking or for a contra-flow bus lane (south of Cherry) in portions of the alignment.

Figure N-12 Existing 4th Avenue, Marion Looking North

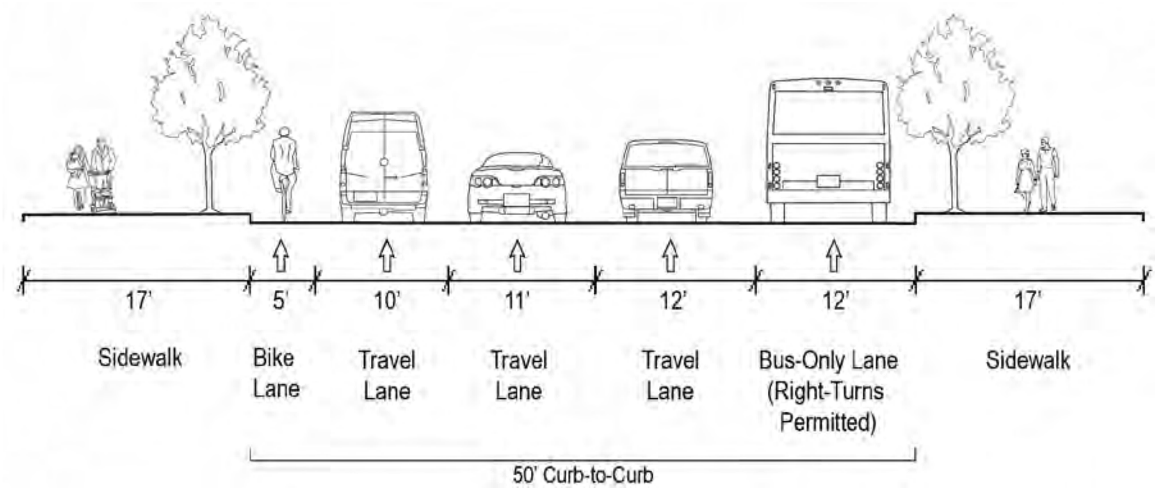
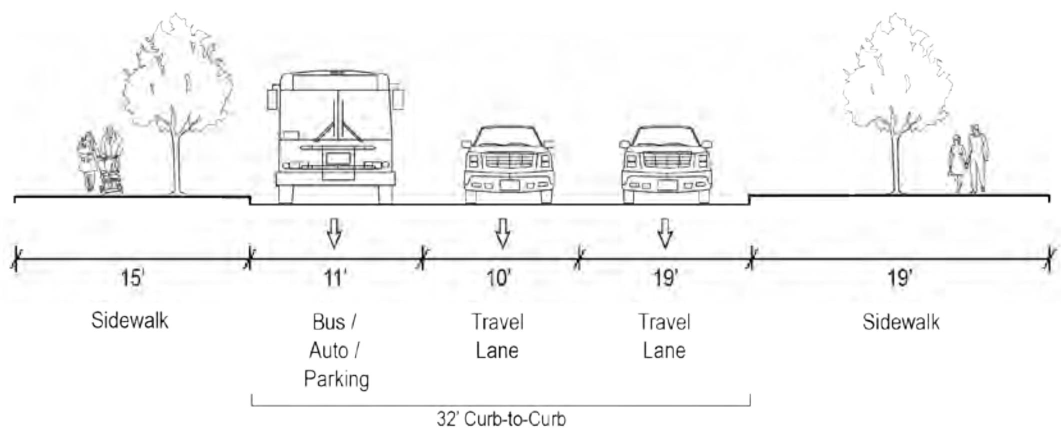


Figure N-13 Existing 5th Avenue, Union Looking North



Note: Other parts of 5th Avenue have different cross-sections, e.g. approximately 46' curb-to-curb in the central and southern portions of 5th Avenue.

4th Avenue Mixed-Traffic Streetcar

Between Stations

The bullets below and graphics in Figure N-14 and Figure N-15 describe how the Mixed-Traffic alternative on 4th Avenue would support transit, bicycle, and general-purpose (GP) vehicle traffic.

- **Streetcar.** The streetcar would share a general purpose lane on the west side of 4th, adjacent to a cycle track.
- **Transit.** Bus-only eastern curb lane would be maintained similar to existing conditions, with right-turns permitted for general purpose traffic.
- **Bicycle Treatment.** An 8-foot one-way raised cycle track would be located along the west side of 4th; this requires eliminating one existing general purpose travel lane. The cycle track could include passing lane segments.
- **General Purpose Vehicles.** Two general purpose lanes available including the shared streetcar lane. On-street parking or left-turn pockets could be located on the west side of 4th in some blocks, between the cycle track and general purpose lanes. A sidebar below (see the 5th Avenue section) provides an example of design treatments for left-turn movements across the cycle track.

Figure N-14 4th Avenue Mixed-Traffic Cross-Section between Stations (Marion looking North)

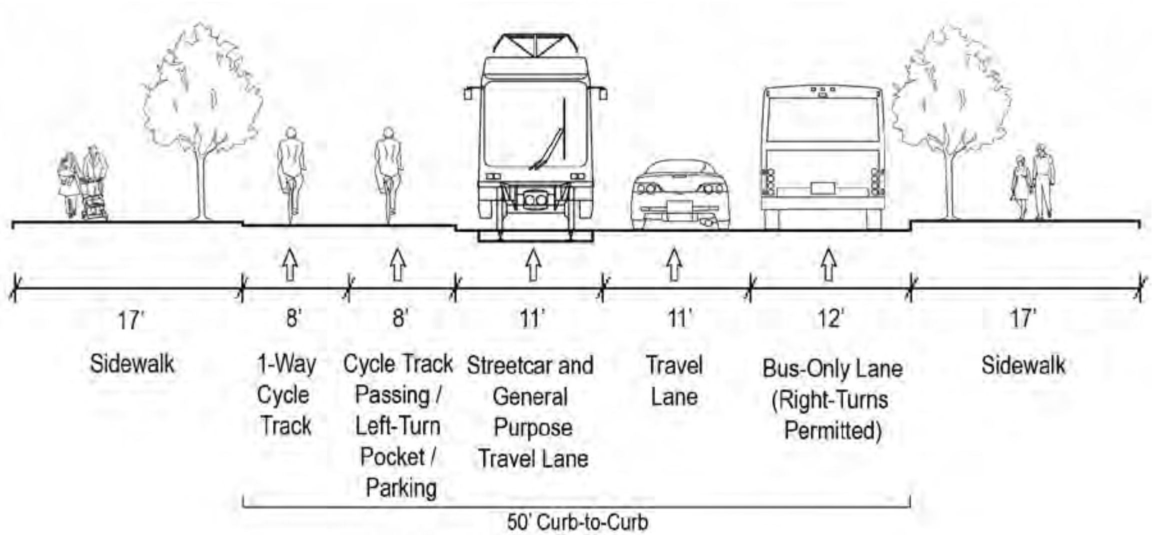
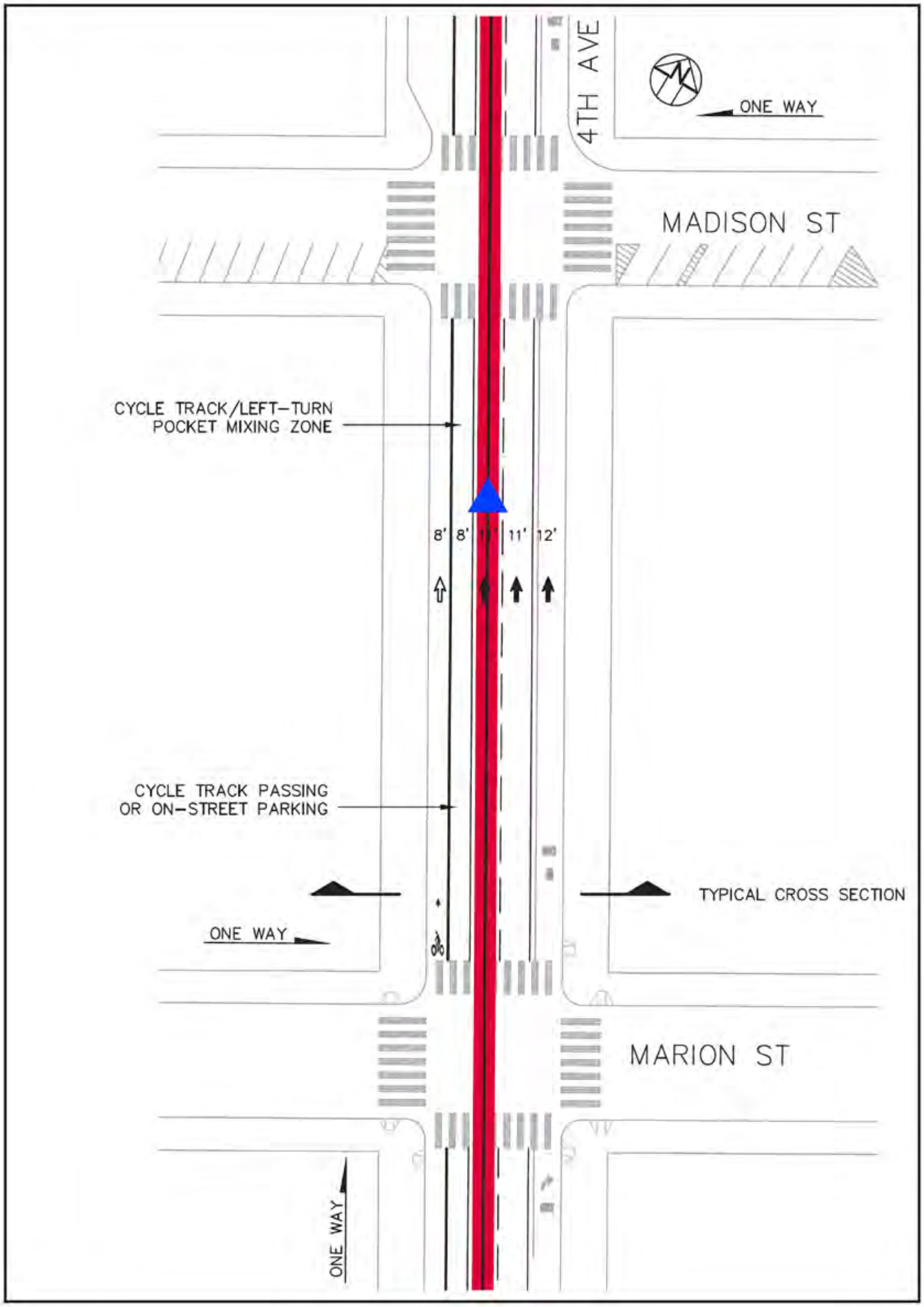


Figure N-15 4th Avenue Mixed-Traffic Plan Diagram between Stations (Marion-Madison)

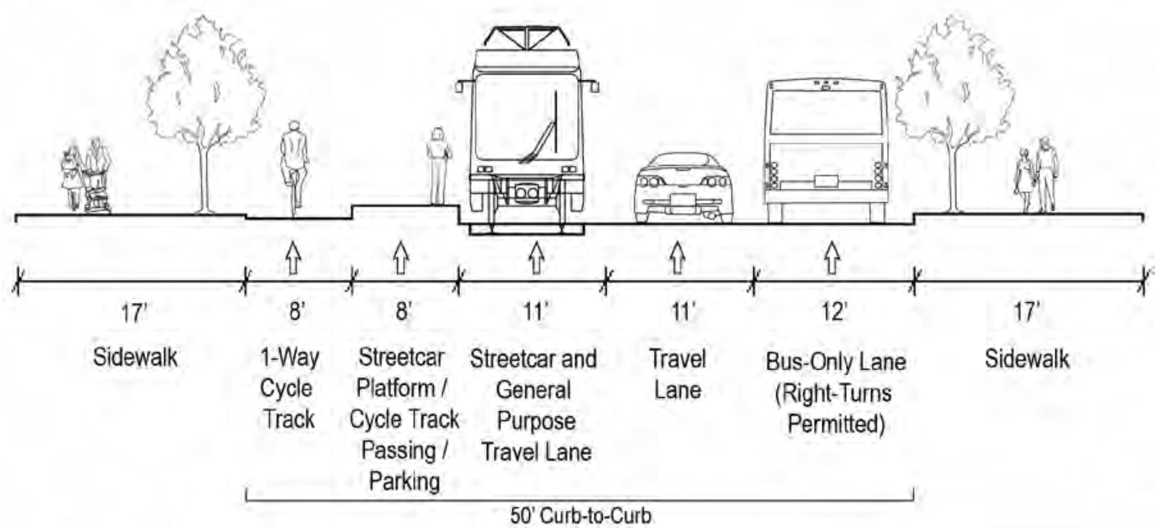


Source: URS

At Stations

As illustrated in Figure N-16 and Figure N-17, station platforms would be located on the west side of 4th, between the streetcar lane and the cycle track. The sidebar below provides examples of transit platforms integrated with a cycle track.

Figure N-16 4th Avenue Mixed-Traffic Cross-Section at Stations (Cherry looking North)



Integrating Streetcar Platforms and Cycle Tracks

When cycle tracks are routed on the curb side of streetcar station platforms, best practices include providing clearly defined transitions between the sidewalk and the platform, with "ladder" or raised crosswalks and signage. Formalizing the pedestrian crossing zone raises the visibility of pedestrians to bicyclists and ensures that pedestrians understand that they are about to cross a bicycle throughway.

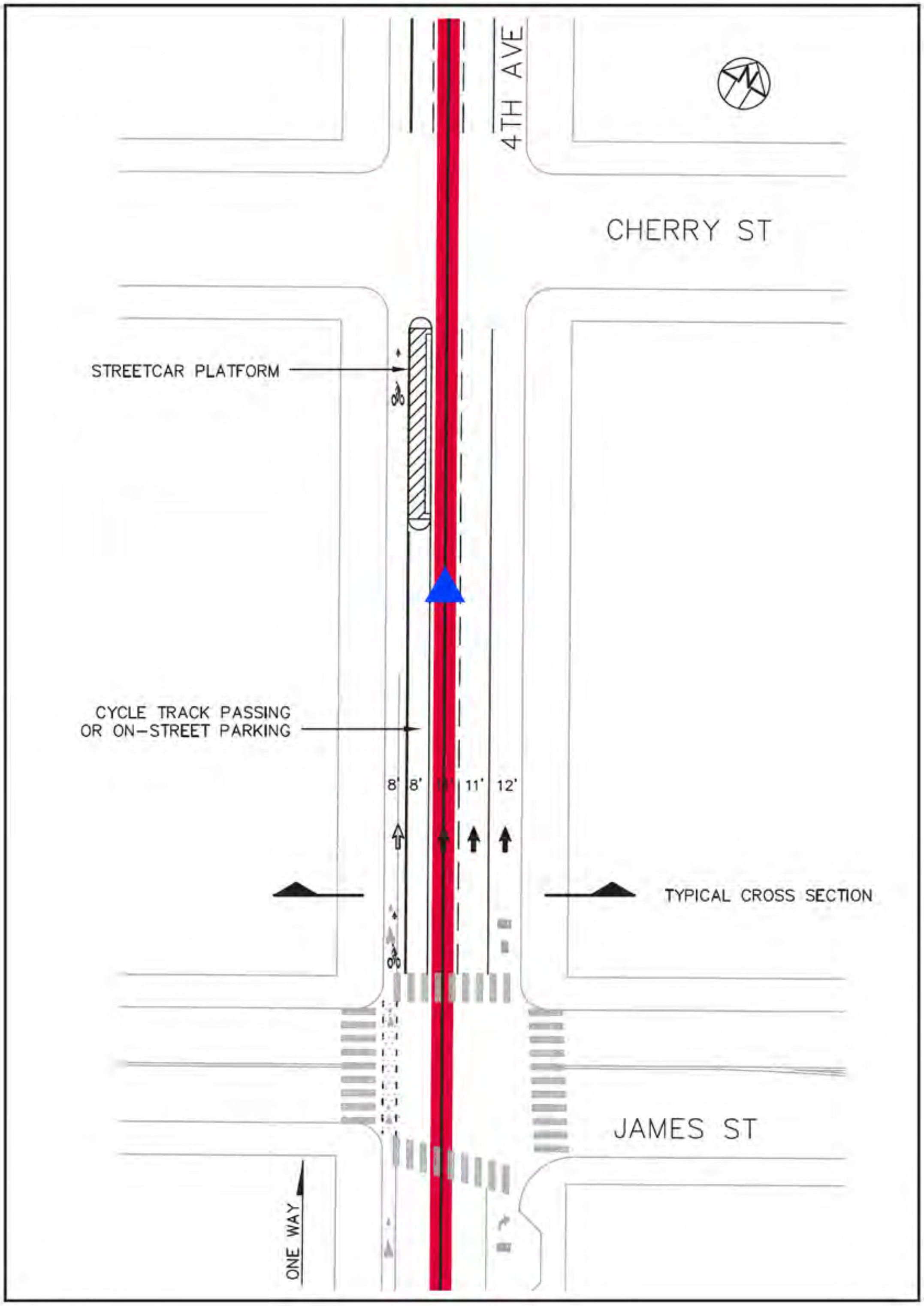
Buffered bike lanes run on the curb side of bus islands on Dexter Ave.

Image from Flickr user rese.arch

The Dunsmuir Bikeway in Vancouver BC has marked crossings between the transit boarding islands and the sidewalk.

Image from Flickr user Paul Krueger

Figure N-17 4th Avenue Mixed-Traffic Plan Diagram at Stations (James-Cherry)



Source: URS

4th Avenue Exclusive Streetcar

Between Stations

The bullets and diagrams below describe how streetcar would operate in the Exclusive scenario on 4th Avenue:

- The streetcar would run in the 2nd eastern lane, which would be transit-only. General purpose right-turns would typically still be permitted in the eastern lane.
- A raised cycle track (typically 7-foot including a 2-foot buffer) would be located on the west side of 4th.

Figure N-18 and Figure N-19 illustrate a typical 4th Avenue cross-section and streetcar operations between stations.

Figure N-18 4th Avenue Exclusive Cross-Section between Stations (Marion looking North)

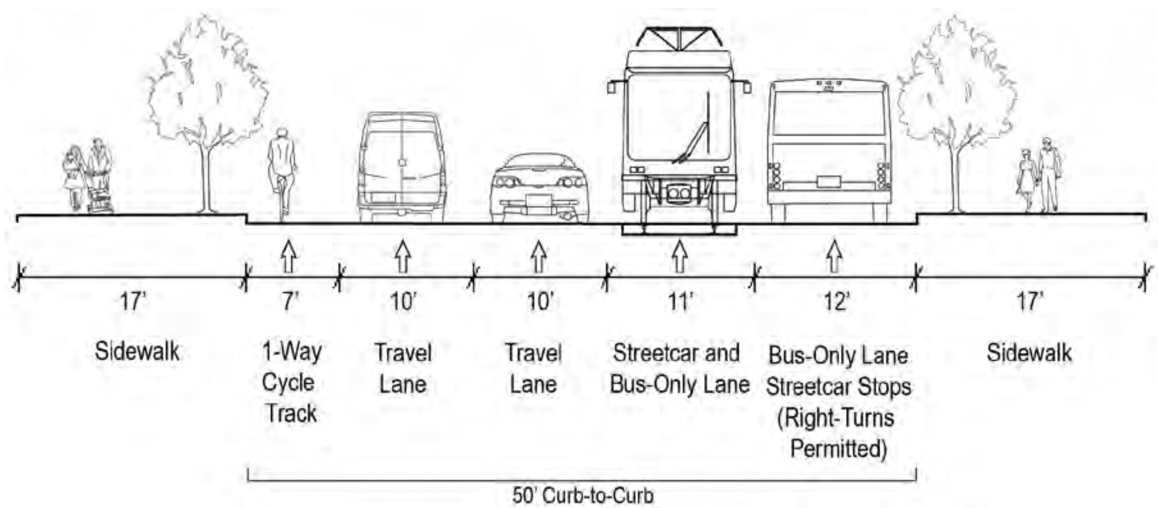
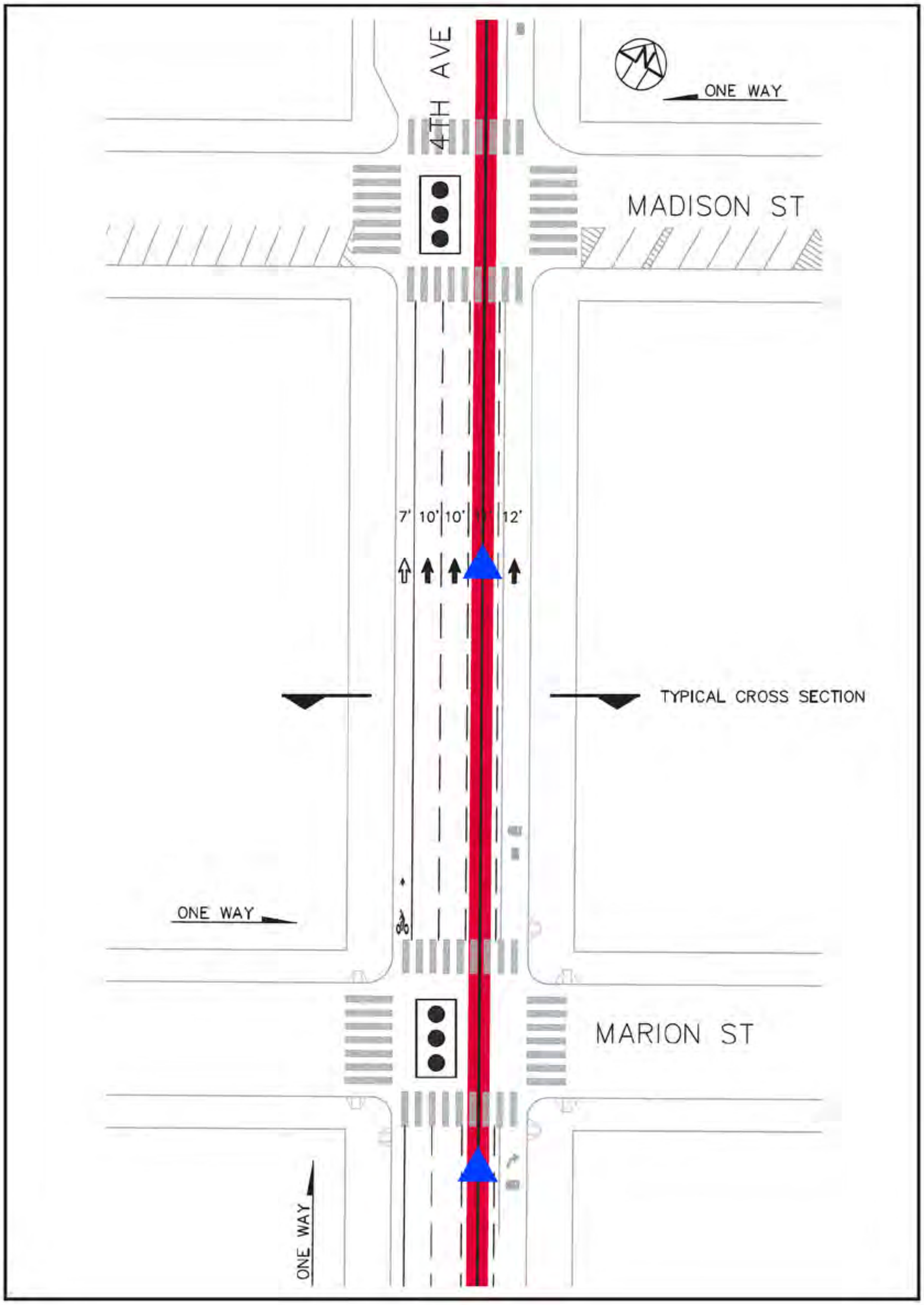


Figure N-19 4th Avenue Exclusive Plan Diagram between Stations (Marion-Madison)

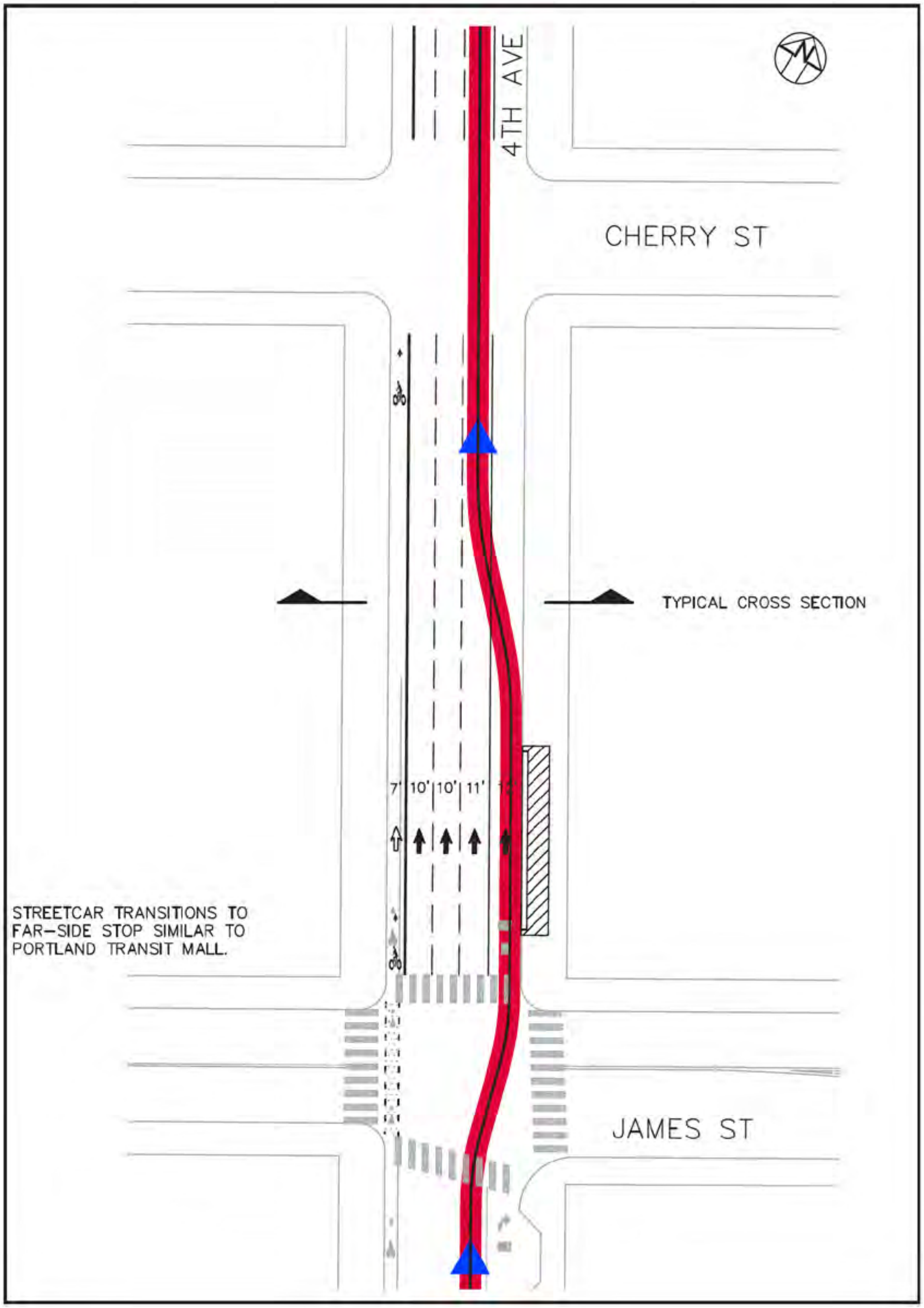


Source: URS

At Stations

The streetcar would weave to the eastern curb (right) lane and typically have stops on the far-side of intersections. The streetcar would weave back to the 2nd eastern lane as it leaves the platform to reduce conflicts with stopping buses. Figure N-20 provides a plan diagram of streetcar weaving operations at stops. Attachment N.5 includes an analysis of the distance required for this weaving to occur, estimated at approximately 170 feet from the upstream intersection.

Figure N-20 4th Avenue Exclusive Plan Diagram at Stations (James-Cherry)



Source: URS

5th Avenue Mixed-Traffic and Exclusive Streetcar

The bullets below describe how the Mixed-Traffic and Exclusive alternatives on 5th Avenue would support transit, bicycle, and general-purpose (GP) vehicle traffic. Figure N-21 and Figure N-22 provide cross-section diagrams for the central and northern portions of 5th Avenue, respectively.

- **Streetcar/Transit**. Streetcar would share the western travel lane with general purpose traffic and buses as follows:
  - Mixed-Traffic: lane is shared with buses and general purpose travel, similar to current conditions.
  - Exclusive: same as mixed, with a streetcar/transit-only lane from approximately Spring to Cherry.
- **Bicycle/Pedestrian Treatment.** A 6- to 8-foot one-way raised cycle track could be located on the western side of 5th in both the Mixed-Traffic and Exclusive alternatives. The cycle track could include passing lane segments. Currently cyclists use all lanes on 5th Avenue for southbound travel, especially outside lanes.
- **General Purpose Vehicles.** Two general purpose lanes would be available north of Spring and south of Cherry, including the streetcar lane. Three lanes would be available for general purpose travel between Spring and Cherry; one would be transit-only in the Exclusive alternative. Right-turns for general purpose travel would typically be permitted, with turn pockets at key intersections, e.g., Madison and Columbia. The sidebar below provides an example of design treatments for turn movements across the cycle track. On-street parking could be provided between the streetcar lane and cycle track in some blocks.

Cycle Tracks and Turning Vehicles: Managing Conflicts

Careful facility design is required to manage conflicts between cycle tracks and vehicles making turns across the cycle track. This example illustrates a mixing/yield zone with a left-turn pocket.

Image from New York City DOT

Figure N-21 Central Portion of 5th with Right-Turn Pocket (Columbia looking North) – Mixed-Traffic or Exclusive Streetcar

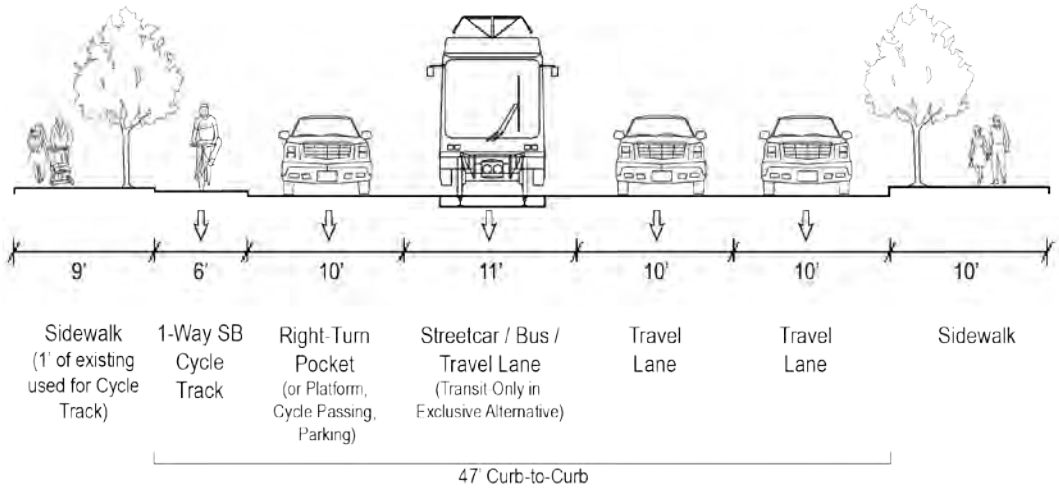


Figure N-22 Northern Portion of 5th with Narrow Right-of-Way (Union Looking North) – Mixed-Traffic or Exclusive Streetcar

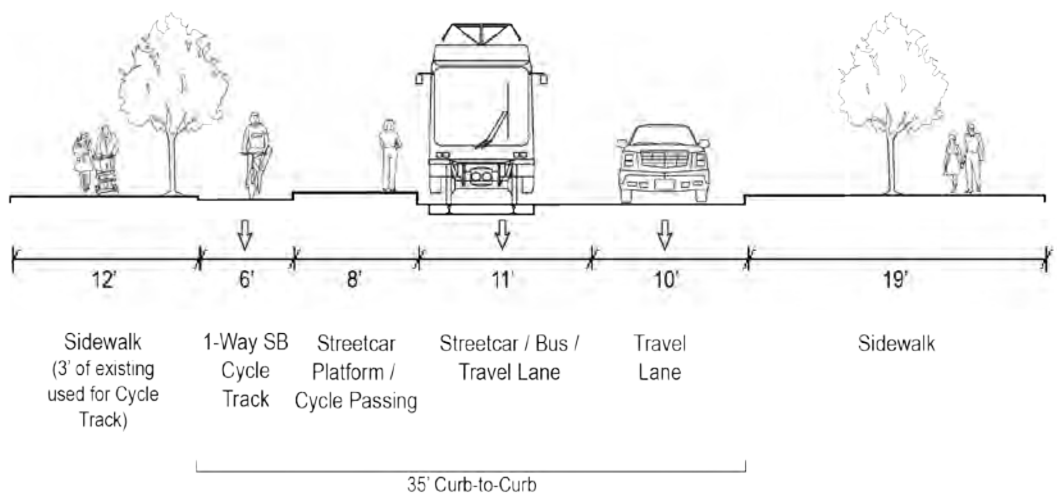
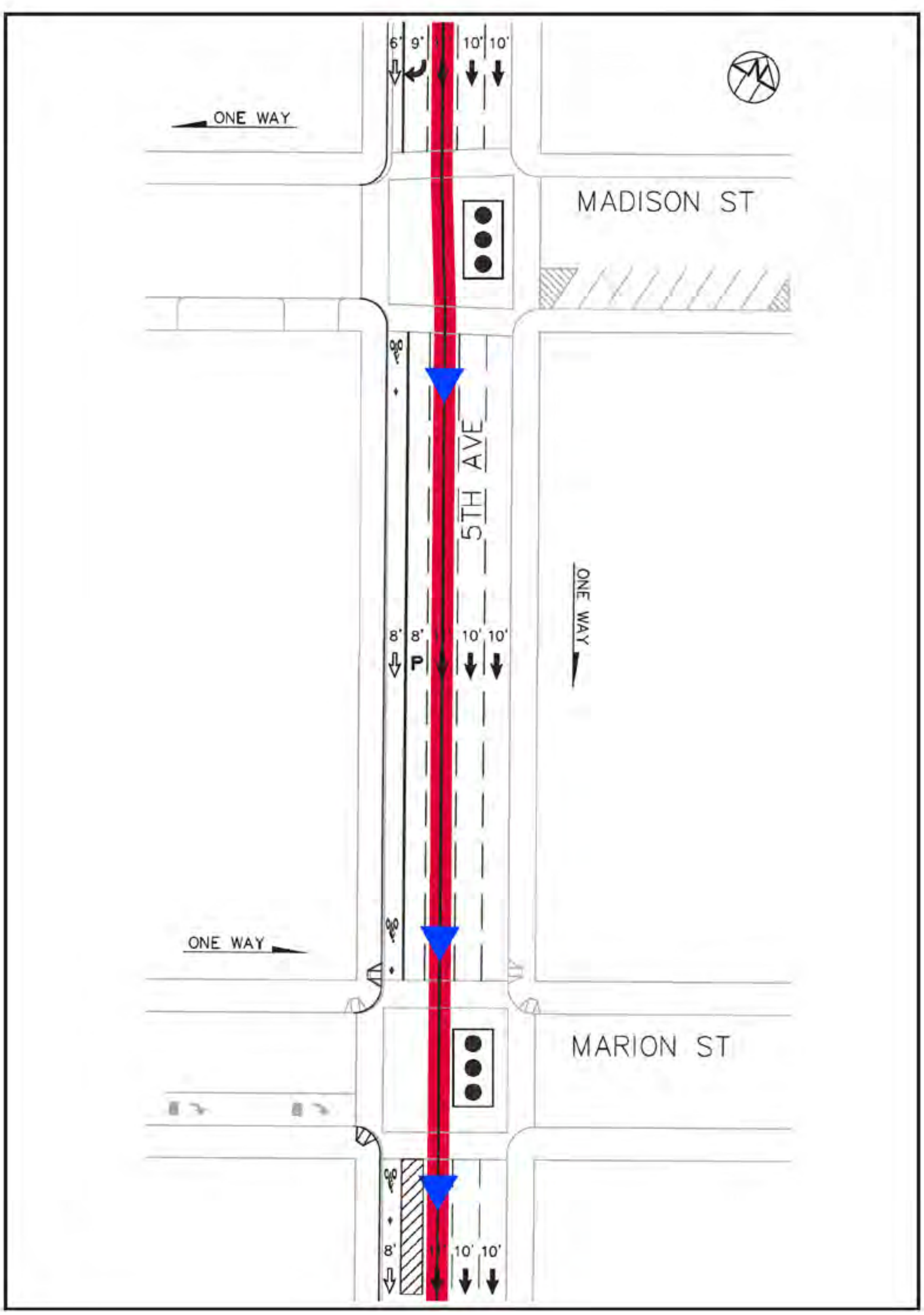


Figure N-23 5th Avenue Mixed-Traffic or Exclusive Plan Diagram (Marion-Madison)



Note: Other parts of 5th Avenue have different cross-sections, e.g. approximately 32'to 35' curb-to-curb in the northern portion of 5th Avenue.

Source: URS

1st Avenue

The design alternatives for 1st Avenue Avenues assume:

- Streetcar runs in the center lanes on 1st Avenue between Jackson Street and the Pike Place Market area.
- In the Exclusive scenario, the center-running lanes would be streetcar-only with extensive signal priority and fewer stations than the Mixed-Traffic scenario.
- Stewart Street and Olive Way are used between 1st Avenue and the existing SLU streetcar at Westlake. Additional 1st Avenue to Westlake connection options would be analyzed in the Tier 2 evaluation.
- A connection to Uptown could be considered in conjunction with the Ballard-to-Downtown project.

Street Alignments

Figure N-25 illustrates the 1st Avenue alignment and various connection options, including conceptual stop spacing for both Mixed-Traffic and Exclusive Streetcar alternatives. The Tier 1 screening assumes use of Stewart Street and Olive Way to connect between 1st Avenue and the existing SLU streetcar. Figure N-24 describes this connection and several other potential connections that could be evaluated in greater detail as part of the Tier 2 evaluation. In addition, as shown on the map (Figure N-25), the Uptown – Pike Place segment of 1st Avenue could be considered as a potential future phase of the Center City Connector, assuming that 1st Avenue is identified as the preferred option in Tier 1.

Figure N-24 1st Avenue Alignment Westlake Connection Scenarios

	EB/NB (To South Lake Union)	SB/WB (To 1st Avenue)
Option Assumed for Tier 1 Evaluation		
Stewart/Olive	Stewart[1] – Olive – Westlake	Westlake – Stewart[1]
Additional Options for Potential Evaluation in Tier 2		
Virginia/Stewart	Virginia – Westlake	Stewart - Westlake
Pike/Pine (via 4th/Olive)	Pike – 4th – Olive - Westlake	Westlake – 5th - Pine
Pike/Pine (via 6th)	Pike – 6th – Westlake	Westlake – 5th - Pine

Notes: (1) Bidirectional streetcar operations on Stewart between 1st and 3rd Avenue

Figure N-25 1st Avenue Alignment Options for Tier 1 Screening

Cross-Sections and Right-of-Way Design

The design alternative for 1st Avenue assumes a center-running streetcar.[2]

Figure N-26 describes the cross-sections for existing conditions and the proposed alternatives.

Figure N-26 Existing and Proposed Cross-Section Alternatives (Typical)

Scenario	Bike Facility	On-Street Parking	General Public (GP) (per direction except as noted)	Exclusive Transit/ Streetcar (per direction except as noted)
Existing	None	Present in one direction in some blocks (typically peak-restricted)	2-3 lanes: ▪ 2 GP ▪ 1 GP/peak-restricted parking (in only one direction)	None
Mixed Traffic	None	Parking (likely peak-restricted) in some blocks between stations and/or where not required for bus stops	2-3 lanes: ▪ 11 foot GP/streetcar ▪ 10 foot GP ▪ 10 foot GP/ peak-restricted parking (in only one direction)	None
Exclusive Lane	None	Parking (likely peak-restricted) in some blocks between stations and/or where not required for bus stops	1-2 lanes: ▪ 10-foot GP ▪ 10-foot GP/peak-restricted parking (in only one direction)	11-foot streetcar

[2] An internal SDOT cross-section workshop was conducted in March 2013 to obtain feedback on the viability of various design options.

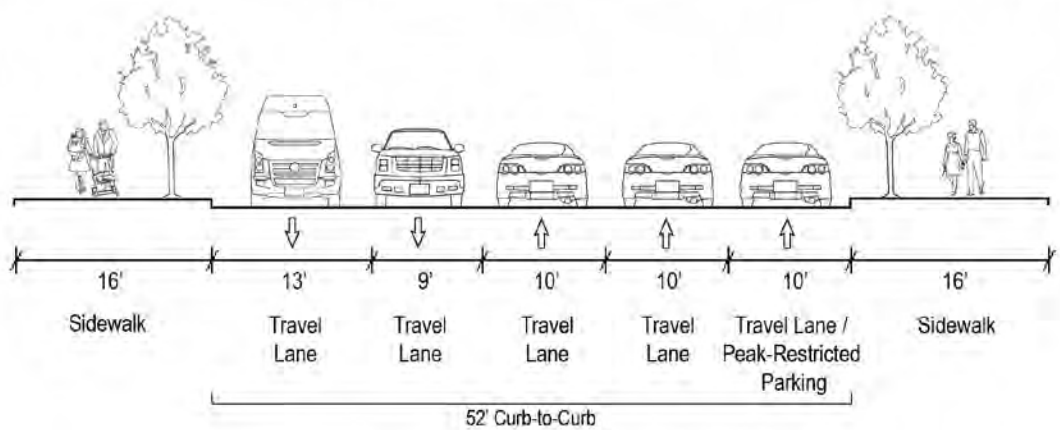
Existing and Planned Facilities

The bullets below describe how the existing 1st Avenue cross-section supports transit, bicycle, and general purpose (GP) vehicle traffic.

- **Transit**: There is limited local bus service on 1st Avenue.
- **Bicycle**: There are no existing or planned bike facilities on 1st Avenue.
- **General Purpose**: Between Virginia and Spring, three general purpose northbound travel lanes and two general purpose southbound travel lanes are available on 1st Avenue. On-street parking is present in some blocks, e.g., between University and Spring.

Figure N-27 illustrates a typical existing cross-section for 1st Avenue.

Figure N-27 Existing 1th Avenue, Madison Looking North



1st Avenue Mixed-Traffic Streetcar

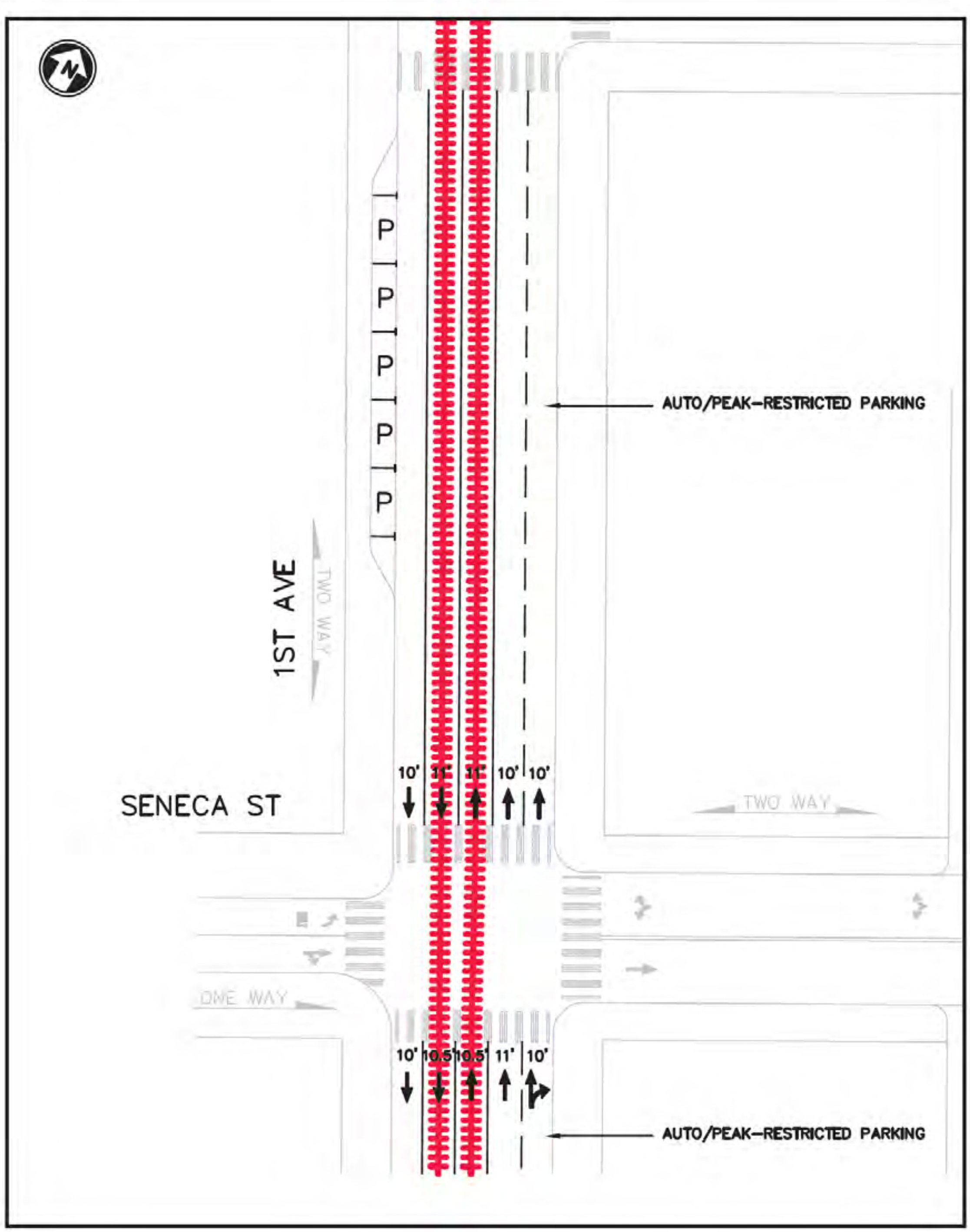
Between Stations

The bullets below describe how the Mixed-Traffic alternative on 1th Avenue would support streetcar and general-purpose (GP) vehicle traffic.

- Streetcar would run in center lanes shared with general purpose travel. The streetcar lanes would diverge to make room for station platforms. Stations could be staggered across intersections to allow more room for passengers.
- Southbound left-turns would typically be permitted.
- One curbside lane in each block could allow parking between stations.

Figure N-28 illustrates mixed-traffic streetcar operations between stations.

Figure N-28 1st Avenue Mixed-Traffic Plan Diagram between Stations (Seneca)

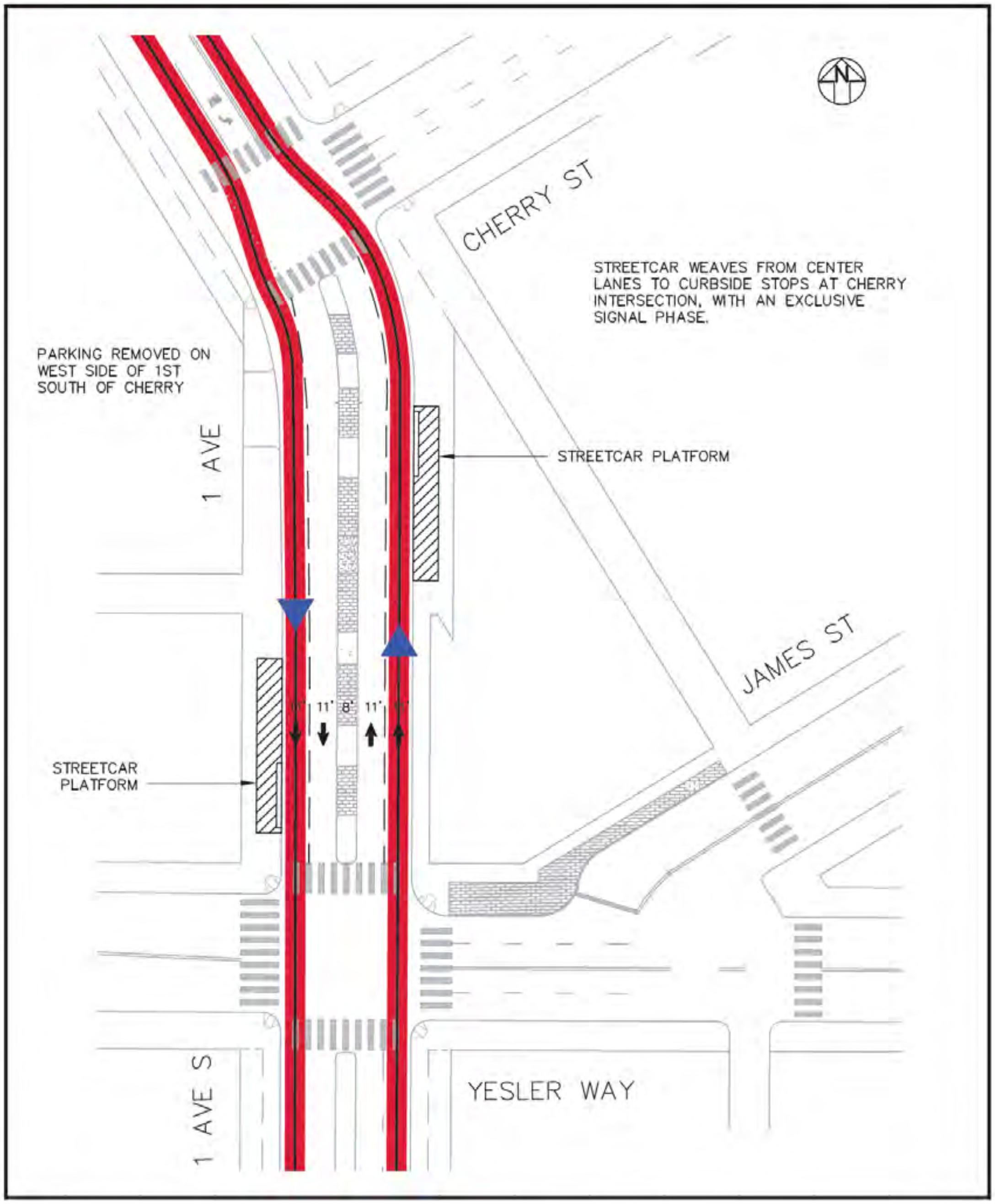


Source: URS

Cherry-Yesler

As illustrated in Figure N-29, due to median street trees this alternative assumes the streetcar would weave to curbside stops in this block. The streetcar would run curbside between Cherry and Jackson, requiring removal of on-street parking.

Figure N-29 1st Avenue Mixed-Traffic Plan Diagram (Cherry - Yesler)



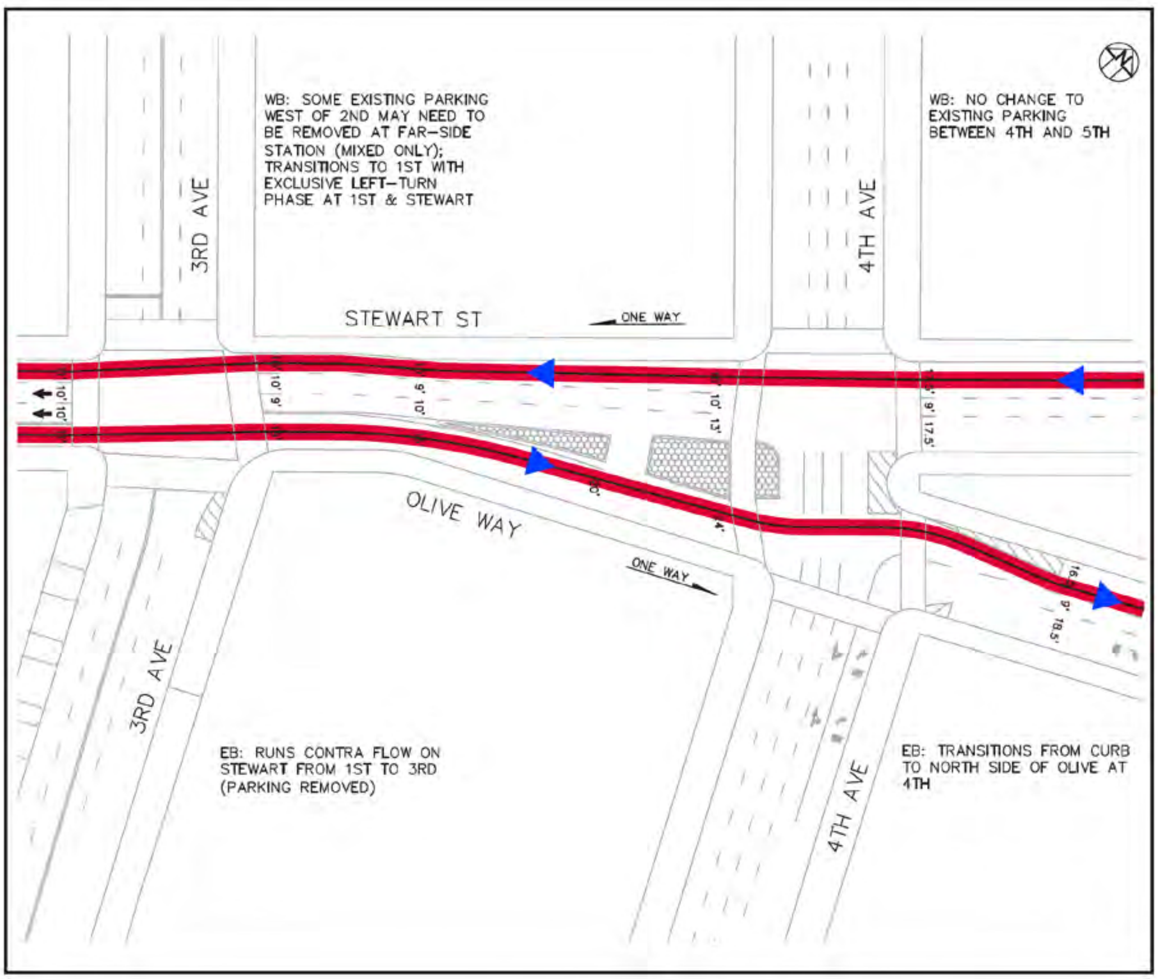
Stewart-Olive

As illustrated in Figure N-30, the streetcar would operate in the curbside lane in both directions on Stewart Street and Olive Way:

- Stewart/Olive (NB/EB direction to Westlake): Streetcar would run contra-flow, switching to north-side along Olive Way at the 4th Ave intersection.
- Stewart (SB/WB direction to 1st Avenue): Streetcar would run along the curb with a curbside platform next to the Westin Hotel.

Additional 1st Avenue to Westlake connection options would be analyzed in the Tier 2 evaluation.

Figure N-30 1st Avenue Mixed-Traffic and Exclusive Plan Diagram (Stewart-Olive)



Source: URS

1st Avenue Exclusive Streetcar

Between Stations

In this scenario, one general purpose travel lane would be maintained in each direction between stations. One additional lane, shown in the northbound direction, could be used for on-street parking (may be peak-restricted) or right-turns. Figure N-31 and Figure N-32 illustrate the cross-section and streetcar operations between stations in the Exclusive alternative.

Figure N-31 1st Avenue Exclusive Cross-Section between Stations (Seneca looking North)

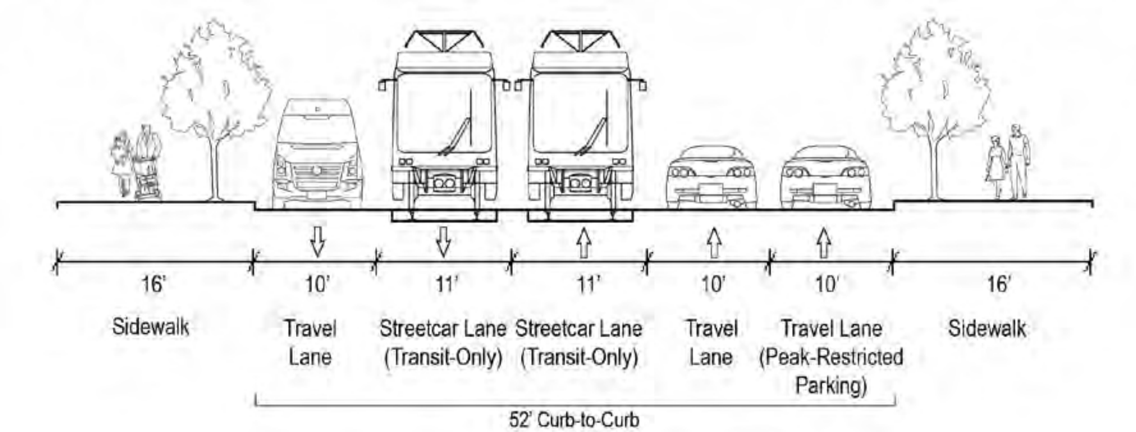
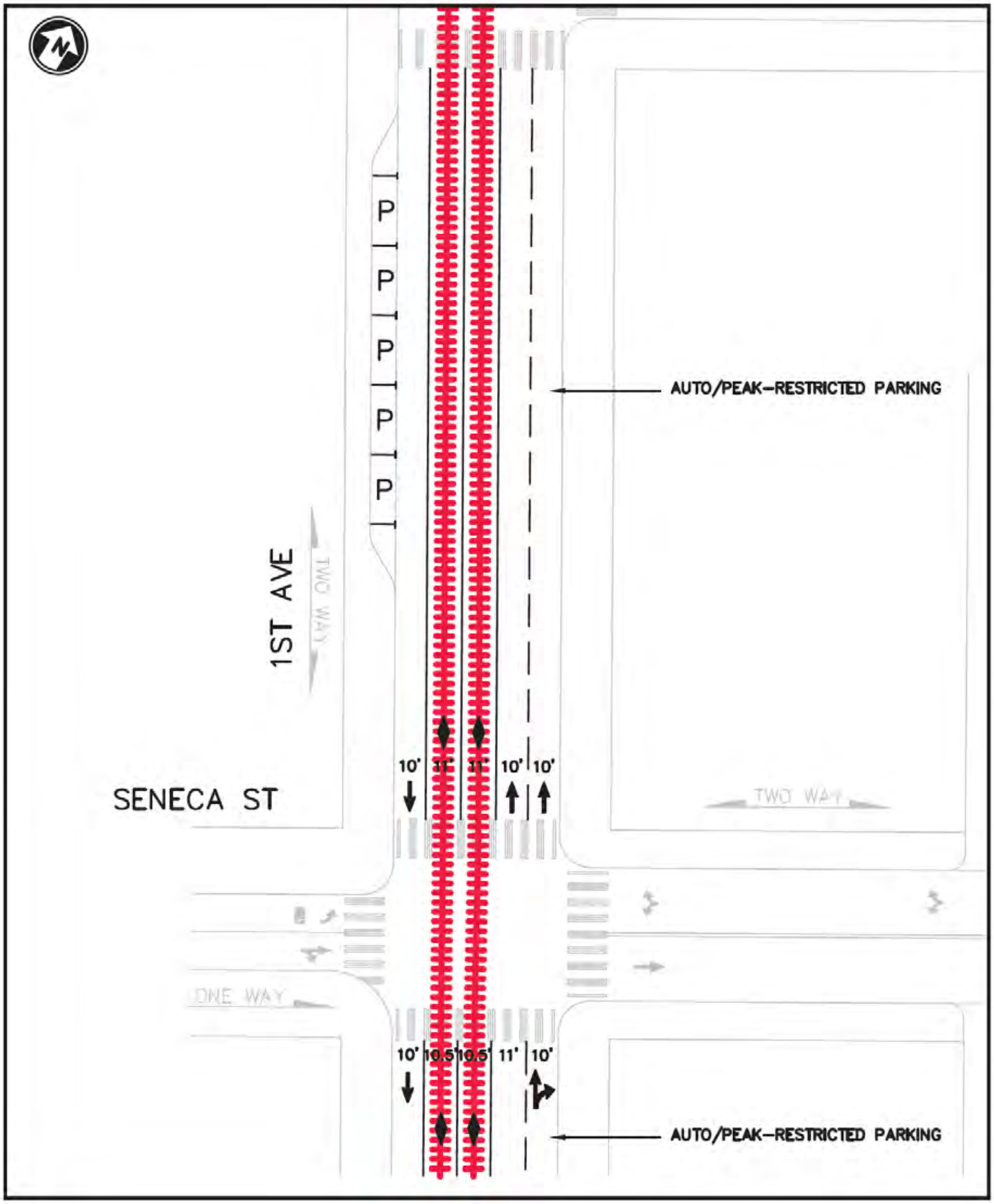


Figure N-32 1st Avenue Exclusive Plan Diagram between Stations (Seneca)

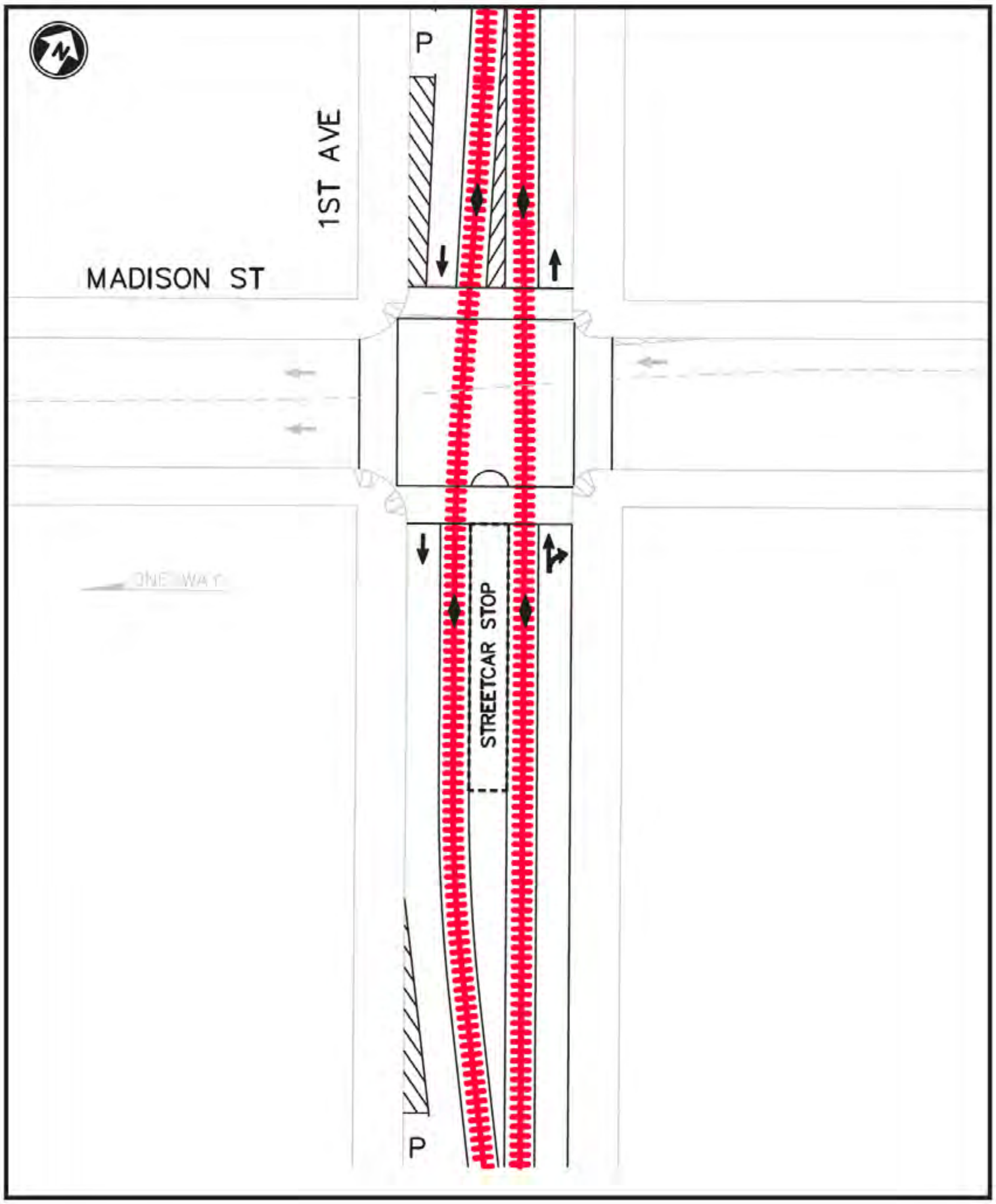


Source: URS

At Stations

Figure N-33 illustrates that on-street parking would terminate to accommodate station locations, which would be located in the street median.

Figure N-33 1st Avenue Exclusive Plan Diagram (Madison)



Source: URS

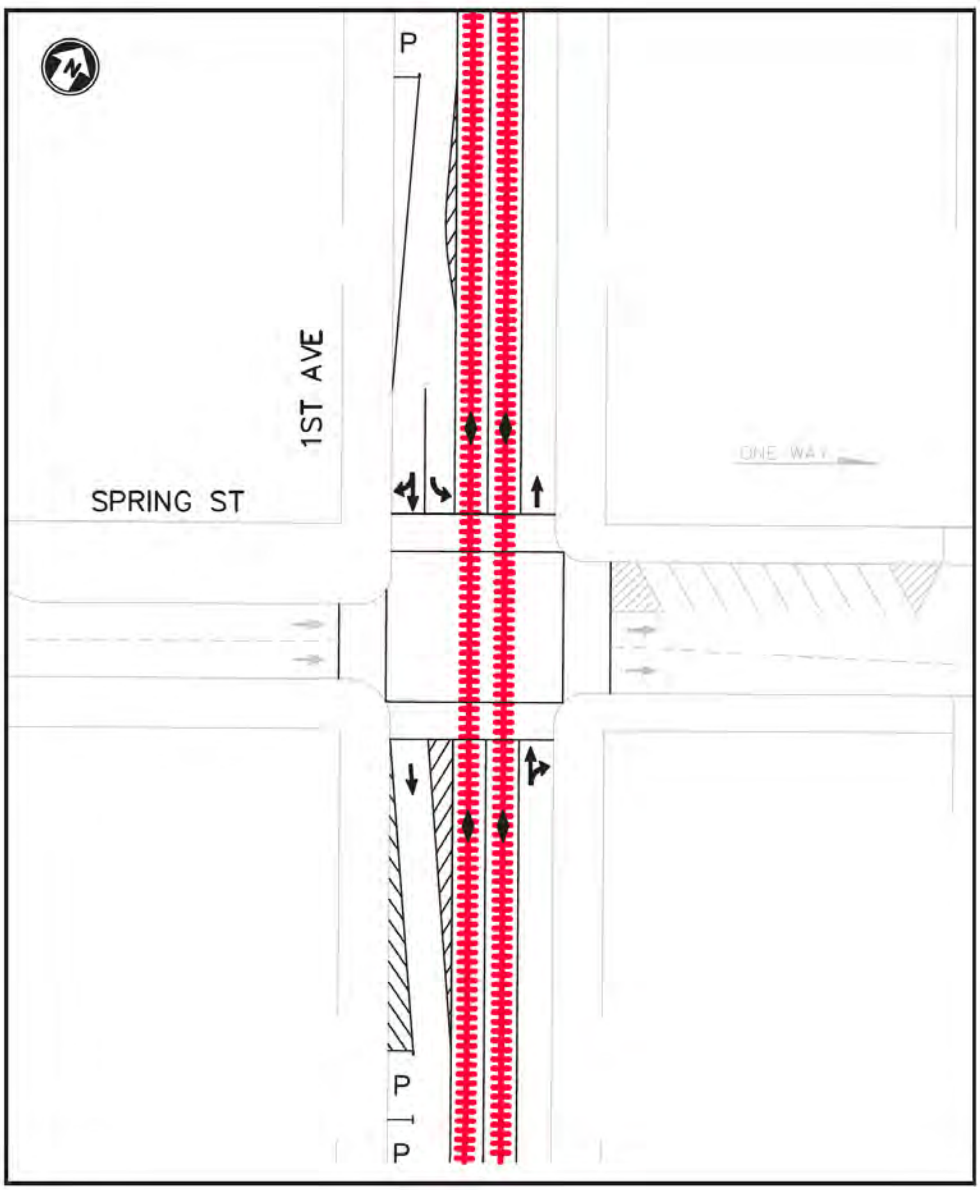
Critical Intersections

Turn pockets would enable left-turns at critical intersections connecting to the freeway or waterfront, as shown in Figure N-34:

- Northbound: Madison and Pike
- Southbound: University, Spring, Cherry, and Jackson

Left-turns would not be permitted at other locations.

Figure N-34 1st Avenue Exclusive Plan Diagram (Spring)



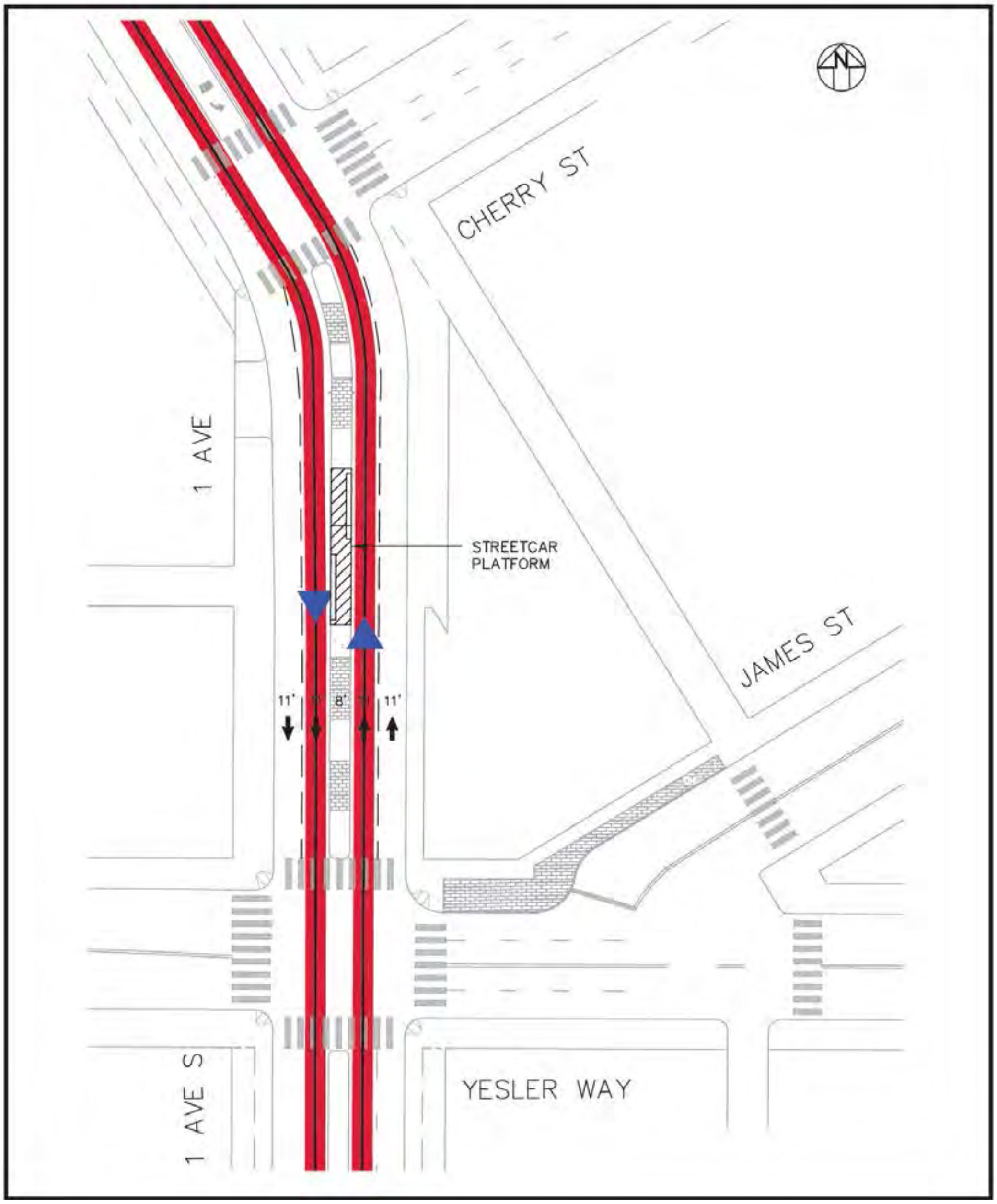
Source: URS

Cherry-Yesler

As illustrated in Figure N-35, in this alternative it is assumed that the streetcar would have median stops between Cherry and Yesler, which would require removal of median street trees.

The Mixed-Traffic alternative includes an option for curb stops that would not impact the median street trees.

Figure N-35 1st Avenue Mixed-Traffic Plan Diagram (Cherry - Yesler)



Source: URS

Operating Scenarios

Figure N-36 (table) and Figure N-37 (map) identify the primary operating scenarios that were evaluated as part of the Tier 1 screening process for a complete streetcar network that includes the South Lake Union line, Center City Connector line, and First Hill Streetcar line. Some scenarios analyze continuous, through-routed operation while others assume a transfer between the Center City Connector line and First Hill line.

Figure N-36 Operating Scenarios for Tier 1 Screening (Table)

Map Color	Center City Connector Primary Street Alignment	Scenario Description
Operating Scenarios for Tier 1 Evaluation		
Red + Gold	4th/5th Avenues	South Lake Union line to Center City Connector line (via 4th/5th) to First Hill line (Transfer between First Hill and Center City Connector lines in International District)
Green	1st Avenue	Continuous routing of South Lake Union line to Center City Connector line to First Hill line (No transfer required)
Blue + Gold	1st Avenue	South Lake Union line to Center City Connector line to First Hill line (Transfer to between First Hill and Center City Connector lines in Pioneer Square)

Note: Additional scenarios could be evaluated as part of the Tier 2 evaluation.

For purposes of the Tier 1 analysis, operating scenarios for the complete streetcar network are assumed to be consistent with the First Hill Streetcar operations plan as of February 2012. That plan assumes a service span of 20 hours per day Monday through Saturday and 12.0 hours on Sunday for a total of 132.0 hours per week.[3] Three service span categories were assumed—Peak, Off-Peak, and Sundays/Holidays—with the total number of annual revenue hours determined based on the following assumptions:

[3] Service characteristics to be refined in the Tier 2 evaluation. Current plans for the First Hill Streetcar are for a 20-hour service span Monday-Saturday (5 AM – 1 AM) and 12 hour service span on Sundays and Holidays (7 AM – 7 PM); this is a total of 132 hours per week.

- **Peak**. Consists of 78 hours per week of operation (Monday–Saturday 6 a.m.–7 p.m.), 10-minute headways.
- **Off-Peak**. Early mornings (before 6 a.m.) and evenings (after 7 p.m.) Monday–Saturday, 15-minute headways.
    - **Sundays/Holidays**. All hours (7 a.m.–7 p.m.), 15-minute headways.

These assumptions are similar to those from the First Hill Streetcar 2012 operations plan, however the Tier 2 evaluation will use longer service span assumptions (see Attachment N.2 for an example).

Figure N-38 provides estimated operating and maintenance costs for each scenario and estimates the total number of vehicles required and the number of additional vehicles that would be required to operate the complete network, i.e., in addition to existing South Lake Union Streetcar and planned First Hill Streetcar vehicles.

Figure N-37 Operating Scenarios for Tier 1 Screening (Map)

Figure N-38 Tier 1 Estimated Operating and Maintenance Costs and Vehicle Requirements (Full Network)

Tier 1 Alternative	Map Colors	Tier 1 Operating Scenario Description	Annual Operating Cost Estimate[2]	Total Number of Vehicles [3]	Vehicles in Addition to South Lake Union and First Hill Lines [4]	Vehicle Capital Costs [4]
4th/5th Avenue Alternatives						
A1: Mixed-Traffic	Red Gold	SLU Line + CCC Line via 4th/5th Aves Transfer to First Hill Line at International District Station	$12.3 M	13	3	$13.5 M
A2: Exclusive (CCC Only)[1]	Red Gold	SLU Line + CCC Line via 4th/5th Aves Transfer to First Hill Line at International District Station	$12.0 M	12	2	$9.0 M
1st Avenue Alternatives						
B1: Mixed-Traffic	Blue Gold	SLU Line + CCC Line via 1st Ave Transfer to First Hill Line at Pioneer Square	$12.3 M	13	3	$13.5 M

Tier 1 Alternative	Map Colors	Tier 1 Operating Scenario Description	Annual Operating Cost Estimate[2]	Total Number of Vehicles [3]	Vehicles in Addition to South Lake Union and First Hill Lines [4]	Vehicle Capital Costs [4]
B1: Mixed-Traffic	Red Gold	SLU Line + CCC Line via 1st Ave + First Hill Line (through-routed with no transfers)	$12.3 M	13	7	$23.5 M
B2: Exclusive (CCC Only)[1]	Green	SLU Line + CCC Line via 1st Ave + First Hill Line (through-routed with no transfers)	$11.2 M	11	5	$14.5 M

Notes: (1) Exclusive operating scenarios assume exclusive characteristics (e.g., exclusive lanes, fewer stops, more extensive signal priority) on Center City Connector (CCC) segment only. (2) Based on existing South Lake Union (SLU) and planned First Hill streetcar operating costs. (3) Total number of vehicles required to operate streetcar on the SLU, CCC, and First Hill lines, including spares. (4) Based on the ability to utilize the existing (SLU) and planned (First Hill) streetcar fleets and an assumed cost of $4.5 million per vehicle. The vehicle capital cost reflects only the added cost to supply the additional vehicles required for the CCC line. If all three streetcar lines were operated as completely through-routed, it would require replacing existing SLU vehicles, which cannot operate off-wire. It is assumed that these vehicles could be sold (a resale value of $2.0 million is assumed). (5) Additional dwell or layover time may be needed for transfer scenarios.

Key Analysis Assumptions

The technical analysis conducted for the Tier 1 Screening and planned for the Tier 2 Evaluation relies on a set of assumptions regarding service characteristics such as frequency and span, potential operating scenarios, right-of-way design, and other factors. These assumptions were initially described as part of the Seattle Center City Connector Methods Report; updated methodology is provided in the appendices to this report.

Figure N-39 summarizes key assumptions and identifies where each assumption is described in additional detail (if applicable).

Figure N-39 Summary of Key Methodology Assumptions

	Tier 1	Tier 2	Supporting Tables/Graphics
Modes	▪ Mixed-traffic and exclusive streetcar, differentiated based on cross-section design (mixed-traffic vs. exclusive lanes), stop spacing, level of priority	▪ To be determined based on Tier 1	▪ N/A2
Vehicles	▪ Quantity based on headway goals (see below) and Tier 1 traffic model results	▪ More detailed analysis of vehicle needs based on ridership estimates	▪ N/A
Alignments and Right-of-Way Design	▪ 4th/5th Ave with 4th/Pine connection to Westlake ▪ 1st Ave with Stewart/Olive connection to Westlake	▪ To be determined based on Tier 1	▪ N/A
Operating Scenarios	▪ 4th/5th Ave: South Lake Union to Jackson St (transfer to First Hill Streetcar) ▪ 1st Ave ▪ South Lake Union to First Hill (no transfer required) ▪ South Lake Union to Jackson Street (Transfer to First Hill Streetcar)	▪ To be determined based on Tier 1	▪ N/A

	Tier 1	Tier 2	Supporting Tables/Graphics
Stops	▪ Closer stop spacing for mixed-traffic streetcar and longer stop spacing for exclusive streetcar ▪ Assume 20 second dwell time at stops	▪ To be determined	▪ N/A
Transit Signal Priority (TSP)	▪ No signal priority and full signal priority (range of impacts)	▪ Likely hybrid level of priority	▪ Attachment N.1
Traffic Analysis	▪ High level analysis, focused on differentiating primary alignments ▪ 2030 traffic forecasts ▪ Synchro analysis ▪ Very high-level analysis of traffic diversion ▪ Track parking loss for each scenario evaluated	▪ More detailed analysis including sub-options ▪ Likely 2020 as proxy for opening year ▪ Synchro and vissim analysis (micro-simulation) ▪ More detailed analysis of traffic diversion	▪ Attachment N.1
Operating Plan / Headway Goals)	▪ 10-minute weekday peak headways; 15-minute off-peak.	▪ To be determined	▪ Attachment N.2
Operating Cost Estimates	▪ At this level of analysis, cost per revenue hour of about $200, based on 2012 SLU Streetcar actual costs	▪ No change	▪ Attachment N.2

	Tier 1	Tier 2	Supporting Tables/Graphics
Capital Cost Estimates	▪ Capital cost per mile plus special considerations (based on First Hill cost data)	▪ Standard Cost Category approach	▪ Attachment N.3
Ridership Estimation	▪ Sketch-level model based on peer data (similar to Seattle TMP approach)	▪ STOPS ridership model under development	▪ Attachment N.4 ▪ Methods Report, Attachment N.3: Ridership Estimation

3. Evaluation of Tier 1 Alternatives

Goals and Objectives

The goals for the Center City Connector project are captured in the following five themes: Enhance, Connect, Develop, Thrive, and Sustain, illustrated in Figure N-40. Figure N-41 identifies objectives that were developed to help evaluate how well each alternative supports the goals.

Figure N-40 Project Goals

Figure N-41 Project Goals and Objectives

ENHANCE *Enhance the customer experience on transit*

Objectives:

- Provide comfortable, visible, and easy to use transit services and facilities for all riders
- Ensure reliable, frequent transit service

CONNECT *Connect neighborhoods and improve local circulation*

Objectives:

- Improve connections between Center City neighborhoods, the regional transit system, and major attractions and destinations
- Support walkable neighborhoods and multimodal transportation choices
- Maximize transit ridership
- Enhance the value of existing transit investments

DEVELOP *Support local and regional economic development goals*

Objectives:

- Provide transit capacity to support and attract residential and commercial growth
- Support small and local businesses in Center City business and retail districts
- Support local and regional goals to foster compact, mixed-used development

THRIVE *Strengthen downtown and Center City neighborhoods*

Objectives:

- Enhance access to jobs
- Increase access to affordable housing and social services
- Enhance access and mobility to tourist destinations, civic and cultural assets, and open spaces
- Improve transportation options for Seattle's most vulnerable residents
- Incorporate public and stakeholder input

SUSTAIN *Improve and sustain human and ecological health*

Objectives:

- Reduce greenhouse gas emissions
- Minimize impacts to natural, historical, and cultural resources
- Maximize placemaking opportunities
- Provide people with healthy travel options
- Enhance the safety of all roadway users

Screening Criteria

Figure N-42 provides the evaluation criteria used in the Tier 1 evaluation. Where applicable, quantitative measures were normalized using 1/8-mile (approximately 2 block) buffers around the primary Tier 1 alignments. In some cases, the buffer was adjusted to capture major attractors that were slightly beyond an 1/8-mile distance but are within an 1/8 mile of alignment sub-options (which would be evaluated in Tier 2), e.g., the Aquarium and Convention Center. Where possible, quantitative data was analyzed using a natural breaks (4 category) method. Each objective was evaluated qualitatively using a Best-Good-Fair-Poor scale. The ratings for all objectives are summarized in single scorecard-style matrix (Figure N-43).

Figure N-42 Tier 1 and 2 Evaluation Criteria

Objective	ID	Screening Criteria	Presentation	Analysis
ENHANCE: Enhance the customer experience on transit				
▪ Provide reliable, frequent transit service	E1a	▪ Streetcar travel times	▪ End-to-end travel times for each alternative based on lane configuration and level of transit priority	Quantitative
	E1b	▪ Existing transit system impacts (reduction in corridor bus capacity and increased transit and bus passenger delay)	▪ Tables/map identifying key impacts, opportunities, and challenges ▪ Bus and Bus Passenger Delay	Quantitative
	TIER 2	▪ Capacity/potential for transit priority features	▪ None; used for Tier 2 evaluation	
▪ Provide comfortable, visible, and easy to use transit services and facilities for all riders	TIER 2	▪ Quality, comfort, ease-of-access, legibility of facilities ▪ Quality, comfort of vehicle technologies ▪ Quality of passenger amenities/infrastructure	▪ None; used for Tier 2 evaluation	

Objective	ID	Screening Criteria	Presentation	Analysis
CONNECT: Enhance connections between and access to Center City neighborhoods				
▪ Enhance the value of existing transit investments and transit service for Center City trips	C1a	▪ Connections with existing transit/multimodal hubs	▪ Number of hubs served; discussion of connections/integration	Qualitative
	C1b	▪ Future employment within alignment Future population within alignment	▪ Number and density of employment and population	Quantitative
	TIER 2	▪ Potential connections to future high-capacity transit services (e.g., Link, Ballard, Eastlake)	▪ None; used for Tier 2 evaluation	
▪ Support walkable neighborhoods and multimodal transportation choices	C2a	▪ Conflicts with bicycle, freight, and transit priorities	▪ Evaluation of bicycle, pedestrian, transit, and freight impacts	Qualitative
	C2b	▪ Auto travel times	▪ End-to-end auto travel times for each alternative, based on lane configuration changes	Quantitative
▪ Maximize transit ridership	C3a	▪ Ridership potential	▪ Center City Connector Projected Ridership, based on peer cities and expected service characteristics	Quantitative
	C3b	▪ Operating and maintenance costs	▪ Operating costs of Center City Connector alternatives (for identified operating scenarios)	Quantitative
	C3c	▪ Capital costs	▪ Capital costs of Center City Connector alternatives	Quantitative

Objective	ID	Screening Criteria	Presentation	Analysis
DEVELOP: Support local and regional economic development goals				
▪ Promote new development where residents and workers have transportation options ▪ Support local and regional goals to foster compact and mixed-use development ▪ Provide transit capacity to support and attract residential and commercial growth	D1a	▪ Capacity for new investment	▪ Map showing vacant and redevelopable land and pipeline projects within 1/8 mile (2 blocks) of alignment	Quantitative/ Qualitative
	D1b	▪ Potential transit impact		Qualitative
	D1c	▪ Connection to jobs and housing		Qualitative
	TIER 2	▪ Housing Opportunity (total and affordable)		
▪ Support small and local businesses in Center City business and retail districts	D2	▪ Parking removal	▪ Percent of block faces that retain on-street parking in each alternative relative to existing conditions	Quantitative

Objective	ID	Screening Criteria	Presentation	Analysis
THRIVE: Strengthen downtown and Center City neighborhoods				
▪ Enhance access to jobs	T1	Number of Center City residents with access to Center City Connector alignments (live or work), including connections to other lines	Map(s) showing home and work locations of Center City residents who live or work within 1/8 mile of proposed alignment (by block)	Quantitative
▪ Improve transportation options for Seattle's most vulnerable residents ▪ Increase access to affordable housing and social services	T2a	Number of low-income, minority, elderly, and persons with disabilities with access to Center City Connector	Map of relative transit propensity, a measure that considers transit-related characteristics of key transit dependent populations	Quantitative
	T2b	Number of social service sites with access to Center City Connector	Map showing social service sites within 1/8 mile of proposed alignment	Quantitative
▪ Enhance access and mobility to tourist destinations, civic and cultural assets, and open spaces	T3a	Visitor attractions served and number of annual visitors	Map/chart showing number of annual visitors to attractions within 1/8 mile of each proposed alignment	Quantitative
	T3b	Number of hotel rooms	Map/chart showing number of hotel rooms within 1/8 mile of each proposed alignment	Quantitative
▪ Incorporate public/stakeholder comments into decision-making	T4	Comments from Open House 1 and 2 and stakeholder input	Summary memo	Quantitative/ Qualitative

Objective	ID	Screening Criteria	Presentation	Analysis
SUSTAIN: Improve and sustain human and ecological health				
▪ Maximize placemaking opportunities ▪ Enhance the safety of all roadway users ▪ Provide people with healthy travel options	S1	▪ Urban form assessment	▪ Assessment of corridor development form and character to support walking and transit travel: ○ Sidewalk paving ○ Pedestrian crossings ○ Transit facilities (bus stops with associated use patterns) ○ Adjacent uses (e.g. active storefront retail, blank walls, parking, etc) ○ Pedestrian lighting ○ Pedestrian amenities (benches, way-finding signs, trash receptacles, adjacent bldg. edge weather canopies, etc) ○ Unique and/or public places and/or civic buildings	Qualitative
▪ Reduce greenhouse gas emissions	TIER 2	▪ Reduction in GhG emissions	▪ None; used for Tier 2 evaluation	Quantitative
▪ Minimize impacts to natural, historical, and cultural resources	TIER 2	▪ Impacts to natural, historical, and cultural resources	▪ None; used for Tier 2 evaluation	Qualitative

Key Findings

The following section provides an overview of the findings for each of the evaluation measures used to compare alternatives. A summary of the findings is shown below in Figure N-43. Further detail on many of the evaluation measures and the methodology used to develop ratings can be found in the appendices of this report.

Figure N-43 Tier 1 Screening Summary Matrix

	Evaluation Measures	4th/5th Avenues		1st Avenue	
		Mixed-Traffic	Exclusive	Mixed-Traffic	Exclusive
ENHANCE	Streetcar Travel Times	Fair	Good	Fair	Best
ENHANCE	Bus Travel Time and Reliability Impacts: Aggregate Bus Delay	Poor	Fair	Best	Best
ENHANCE	Bus Travel Time and Reliability Impacts: Aggregate Bus Passenger Delay	Poor	Fair	Best	Best
CONNECT	Connections with Existing Transit/Multi-modal Hubs	Good	Good	Best	Best
CONNECT	Future Employment within Alignment	Best	Best	Good	Good
CONNECT	Future Population within Alignment	Good	Good	Best	Best
CONNECT	Multimodal Conflicts (Bike, Pedestrian, Bus, and Freight)	Fair	Poor	Best	Best
CONNECT	Auto Travel Times / Relative Traffic Diversion Impacts	Fair	Fair	Best	Fair
CONNECT	Ridership Potential	Good	Best	Good	Best
CONNECT	Annual Operating & Maintenance Costs	Fair	Good	Fair	Best
CONNECT	Capital Costs	Best	Good	Good	Fair
DEVELOP	Economic Development Opportunities	Good	Good	Best	Best
DEVELOP	On-Street Parking Impacts	Best	Fair	Good	Fair
THRIVE	Access to Jobs	Good	Good	Good	Good
THRIVE	Access for Vulnerable Residents and to Social Services and Affordable Housing	Good	Good	Good	Good
THRIVE	Access to Tourist Destinations, Civic and Cultural Assets, and Open Spaces	Good	Good	Best	Best
THRIVE	Public Support (Open House #1 and #2) and Stakeholder Support	Fair	Fair	Good	Best
SUSTAIN	Urban Form and Placemaking Opportunities and Improvement Potential	Good	Good	Best	Best

Enhance

Objective E1: Provide reliable, frequent transit service

Screening Criteria	Evaluation Summary	4th/5th		1st Ave	
		Mixed-Traffic	Exclusive	Mixed-Traffic	Exclusive
Streetcar travel times (min)					
The data at right is for one-way streetcar travel times between Jackson Street and Westlake. Figure N-44 (4th/5th Avenues) and Figure N-45 (1st Avenue) illustrate streetcar travel times relative to auto travel time (No-Build).	▪ Both Exclusive alternatives provide a faster streetcar travel time than driving. ▪ 1st Avenue Exclusive alternative provides the shortest streetcar travel time. ▪ Both Mixed-Traffic alternatives provide slower streetcar travel times (including stops) than driving. ▪ Transit receives the least benefit in the Exclusive alternatives on: 4th Avenue (Pike to Westlake), All of 5th Avenue, Stewart Street (westbound direction). ▪ Streetcar operates primarily in mixed-traffic in the above segments.	12.8 min Fair	8.9 min Good	11.6 min Fair	6.1 min Best
Aggregate bus vehicle delay (min)					
The data at right is for change in aggregate bus delay during the 5-6 p.m. period in 2030 relative to No-Build.	▪ Mixed-Traffic: Aggregate bus delay increases by about 60% on 4th Avenue and by about 25% on 5th Avenue. ▪ Exclusive: Aggregate bus delay decreases by 25% on 4th Avenue, due to a second transit-only lane.	181 min Poor	-62 min Fair	N/A Best	N/A Best

Screening Criteria	Evaluation Summary	4th/5th		1st Ave	
		Mixed-Traffic	Exclusive	Mixed-Traffic	Exclusive
Figure N-46 illustrates the change in delay.	On 5th Avenue the increase in aggregate bus delay is mitigated with a transit-only lane over part of the alignment.				
Aggregate passenger delay (hours)					
The data at right is for change in aggregate bus passenger delay during the 5-6 p.m. period in 2030 relative to No-Build. Figure N-47 illustrates the change in delay.	▪ Mixed-Traffic: Aggregate bus passenger delay increases by about 60% on 4th Avenue and by over 40% on 5th Avenue. ▪ Exclusive: Aggregate bus passenger delay decreases by 25% on 4th Avenue due to a second transit-only lane. On 5th Avenue, delay increases by 5% with a transit-only lane over part of the alignment.	4,005 hours Poor	297 hours Fair	N/A Best	N/A Best

Overall Summary: Both 4th/5th Avenue Exclusive and 1st Avenue Exclusive offer faster travel times due to the use of exclusive right-of-way. With projected 2030 peak hour bus volumes on portions of 4th and 5th Avenue, both 4th/5th Avenue alternatives incur significant delay to buses and passengers due to impacts on bus operations. 1st Avenue Exclusive best meets this objective due to lower delay to buses and passengers and the fastest end-to-end travel time. 4th/5th Avenue Mixed-Traffic least meets this objective, as it would cause significant delay to buses and passengers and has the slowest end-to-end travel time. The Tier 2 evaluation will consider the potential for transit priority features in more detail, and the resulting impact on travel times.

Figure N-44 Average One-Way Travel Time, 4th/5th Aves

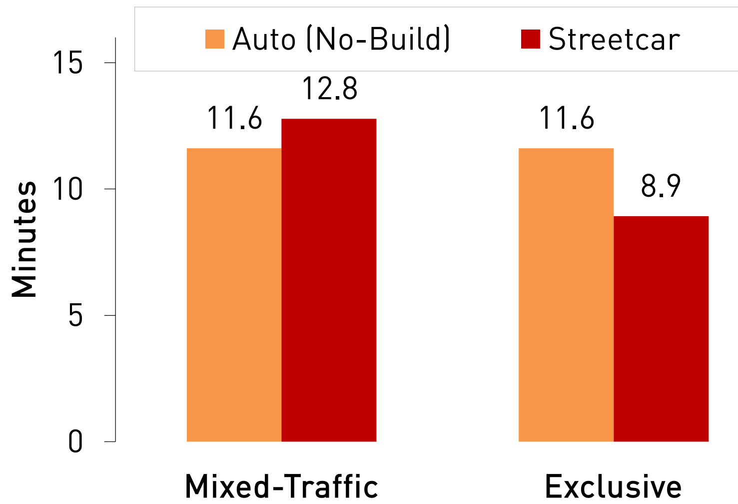


Figure N-45 Average One-Way Travel Time, 1st Ave

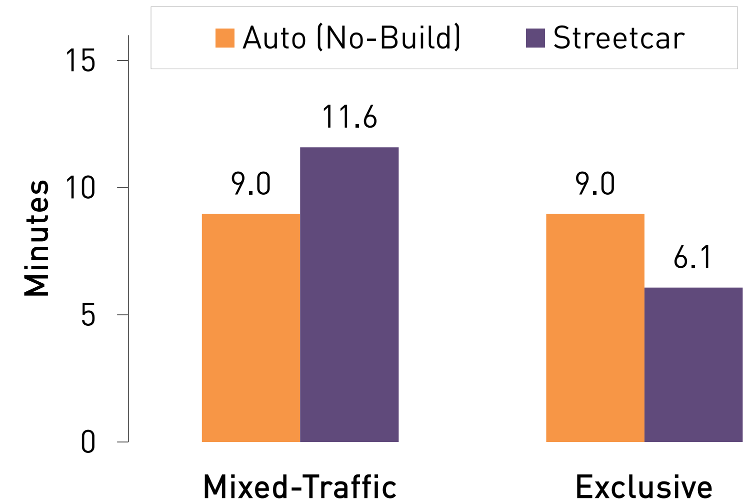


Figure N-46 Change in Aggregate Bus Delay Compared to No-Build, 5-6 PM, Minutes

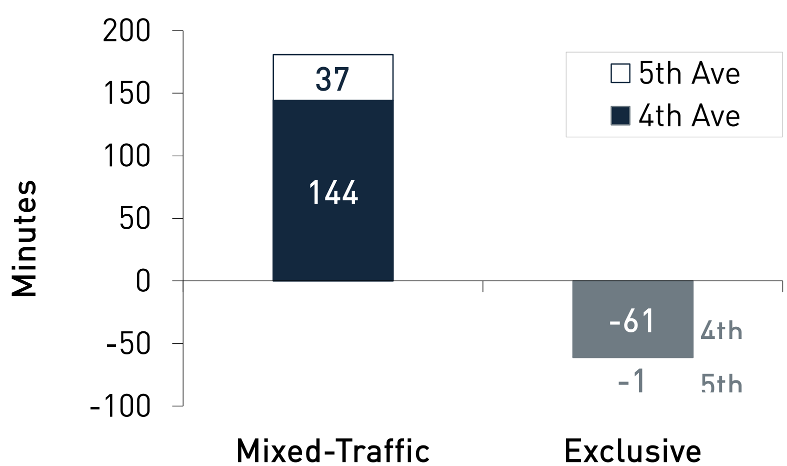
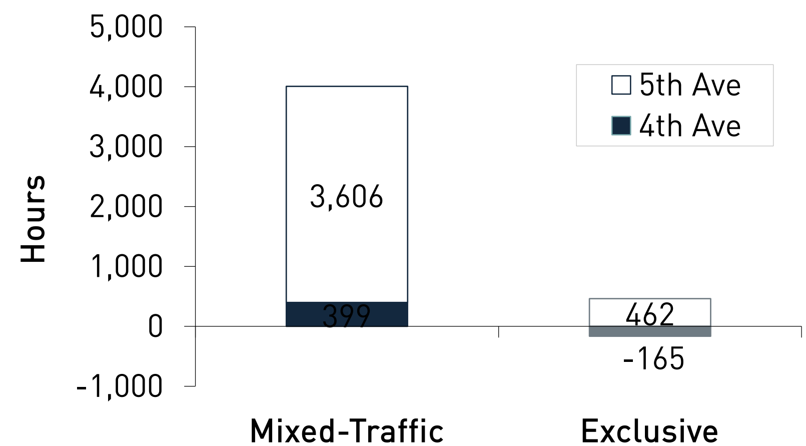


Figure N-47 Aggregate Passenger Delay (based on average load), 5-6 PM, Hours



Connect

Objective C1: Enhance the value of existing transit investments and transit service for Center City trips

Screening Criteria	Evaluation Summary	4th/5th		1st Ave	
		Mixed-Traffic	Exclusive	Mixed-Traffic	Exclusive
Connections with existing transit/multimodal hubs					
Qualitative assessment of connections with multimodal hubs, connections to local bus service, and connections to regional bus service.	▪ 1st Avenue alternatives provide potential connections between all three multimodal hubs while 4th/5th alternatives connect to the King Street and Westlake Hubs, but not to Colman Dock. ▪ 1st Avenue alternatives serve a corridor that is not served by regional transit, while 4th/5th Avenue alternatives serve a corridor with regional bus service. ▪ All alternatives increase connectivity to the 3rd Avenue transit spine and the Downtown Transit Tunnel, which runs underneath 3rd Avenue.	Good	Good	Best	Best

Screening Criteria	Evaluation Summary	4th/5th		1st Ave	
		Mixed-Traffic	Exclusive	Mixed-Traffic	Exclusive
Future employment within alignment					
The data at right shows the expected total 2030 employment and employment density per acre within 1/8 mile of each alignment. Figure N-48 illustrates the number of employees projected in 2030.	▪ Both corridors enhance access to employment, but the 4th/5th Avenue corridor is expected to serve a larger number and concentration of employees.	132,000 employees 580.6 employees/acre		93,090 employees 433.0 employees/acre	
		Best	Best	Good	Good
Future population within alignment					
The data at right shows the expected total 2030 population and population density per acre within 1/8 mile of each alignment. Figure N-49 illustrates the projected 2030 population.	▪ The 1st Avenue corridor is expected to serve a larger population and higher residential density.	7,540 persons 33.1 persons /acre		10,709 persons 49.8 persons/acre	
		Good	Good	Best	Best
Overall Summary for C1: The 1st Avenue alternatives expand transit service to a corridor that is currently served by only one bus route and serve all three multimodal hubs, and are also expected to serve a greater population. The 4th/5th Avenue alternatives are expected to serve more employees.					

Figure N-48 2030 Employees

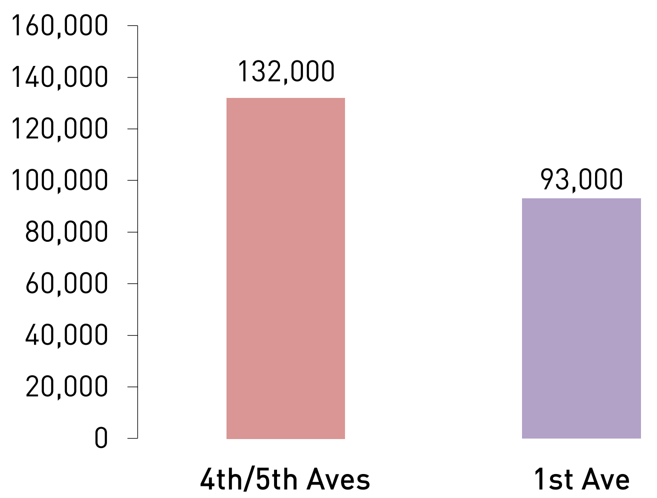
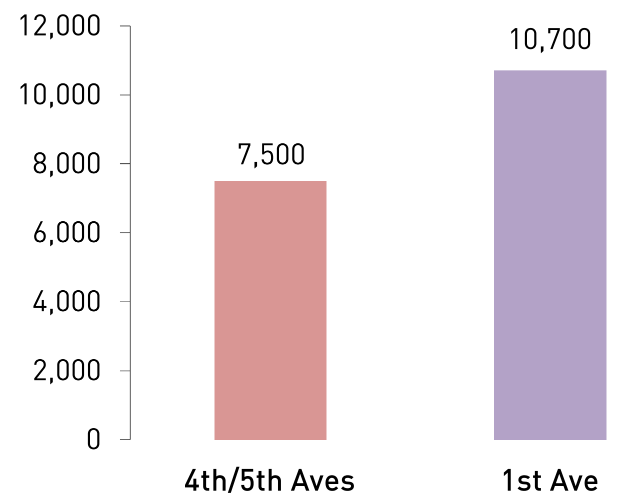


Figure N-49 2030 Population



Objective C2: Support walkable neighborhoods and multimodal transportation choices

Screening Criteria	Evaluation Summary	4th/5th		1st Ave	
		Mixed-Traffic	Exclusive	Mixed-Traffic	Exclusive
Conflicts with pedestrian, bicycle, freight, and transit priorities					
Qualitative evaluation of impacts to each mode.	▪ Bicycles: Assuming a streetcar and planned cycle tracks on 4th/5th Avenues, there are constraints given limited right-of-way. There are no planned bicycle facilities for 1st Avenue. ▪ Pedestrians: Potential conflict between cycle tracks and streetcar platforms and sidewalk use on 4th/5th Avenues. On 1st Avenue streetcar development has the potential to improve pedestrian conditions, e.g., sidewalks, street crossings, etc. ▪ Bus: A second transit lane with a 4th Avenue Exclusive alternative would reduce bus delay overall, though it would negate this potential benefit by reducing bus stop capacity at key shared bus stop zones in the north part of the corridor. Curbside stops and operations on 5th Ave could increase bus delay. There are limited opportunities to provide exclusive transit lanes on 5th Avenue given a cycle track. No bus routes operate on the full extent of the 1st Avenue alignment. ▪ Freight: Minimal impacts on 4th/5th Avenues. Potential for local delivery conflicts on 1st Avenue. None of the potential streets are designated freight routes.	Fair	Poor	Best	Best

Screening Criteria	Evaluation Summary	4th/5th		1st Ave	
		Mixed-Traffic	Exclusive	Mixed-Traffic	Exclusive
Auto travel times (min)					
The data at right shows the change in end-to-end auto travel times relative to a 2030 No-Build condition. Figure N-50 and Figure N-51 illustrate the average one-way travel time for each alternative.	▪ 1st Avenue Exclusive increases auto travel time the most and may cause up to 50% of traffic to divert to other streets. ▪ The 4th/5th Avenue alternatives have comparatively lower impacts to auto travel times yet still are estimated to cause up to 25% and 30% of traffic to divert, respectively. ▪ 1st Avenue Mixed-Traffic fares the best on this measure; it slightly decreases auto travel times and would cause only minimal diversion to other streets.	+1.6 min Fair	+1.3 min Fair	-0.2 min Best	+2.8 min Fair
Overall Summary for C2: The 4th/5th Avenue alternatives have greater conflicts with pedestrian, bicycle, and transit modes, but lower impacts on auto travel. 1st Avenue Mixed-Traffic has the lowest impact on all modes due to the mixed-traffic design and low impact to auto travel. 4th/5th Avenue Exclusive does not have significant conflicts with pedestrian, bicycle, or freight modes but has the greatest impact to auto travel times and traffic diversion.					

Figure N-50 Average One-Way Auto Travel Time, 2030, 4th/5th Avenues, Minutes

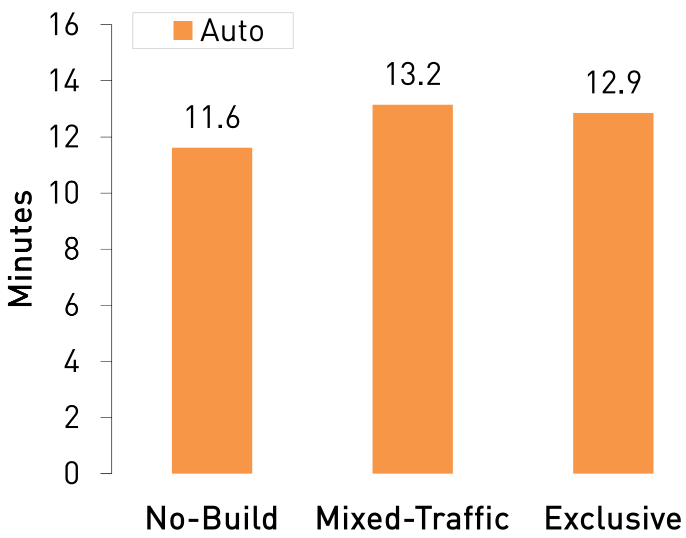
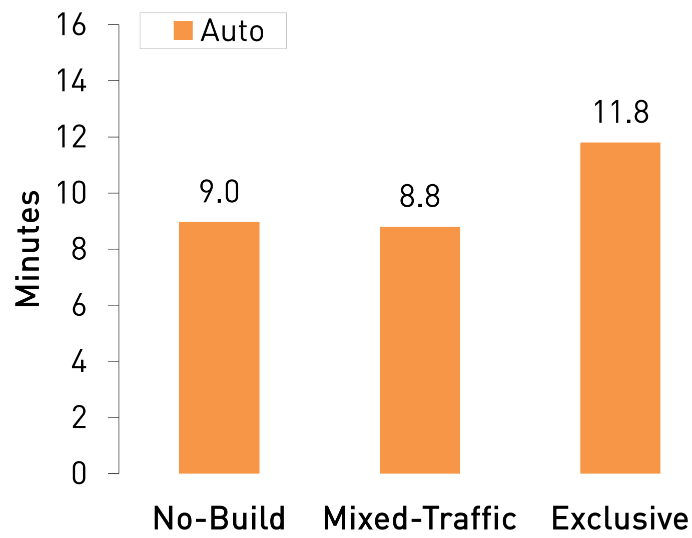


Figure N-51 Average One-Way Auto Travel Time, 2030, 1st Avenue, Minutes



Objective C3: Maximize transit ridership

Screening Criteria	Evaluation Summary	4th/5th		1st Ave	
		Mixed-Traffic	Exclusive	Mixed-Traffic	Exclusive
Ridership potential					
The data at right shows estimated average weekday riders for the streetcar system including SLU, Center City Connector, and First Hill. Figure N-52 illustrates high, low, and average estimates.	▪ Ridership estimates for 4th/5th Avenue and 1st Avenue alternatives are comparable at this level of evaluation. ▪ An Exclusive alternative would be expected to attract higher ridership than a Mixed-Traffic alternative. ▪ A significantly more detailed ridership forecast will be developed in the Tier 2 evaluation, based on the FTA STOPS ridership model.	7,500 riders Good	8,500 riders Best	7,500 riders Good	8,500 riders Best
Operating and maintenance costs (millions of dollars)					
The data at right is for combined operating and maintenance costs for the SLU, Center City, and First Hill streetcar lines (in 2012 dollars). Figure N-53 illustrates the costs for each alignment.	▪ Exclusive streetcar alternatives achieve the highest speeds on each alignment, e.g., via longer stop spacing. This reduces operating costs and vehicle requirements compared to the Mixed-Traffic alternatives. ▪ 1st Avenue Exclusive alternative has the lowest annual operating costs.	$12.3 M Fair	$12.0 M Good	$12.3 M Fair	$11.2 M Best

Screening Criteria	Evaluation Summary	4th/5th		1st Ave	
		Mixed-Traffic	Exclusive	Mixed-Traffic	Exclusive
Capital costs					
Capital costs per mile are shown at right (in 2013 dollars). The total costs for 4th/5th Avenue alternatives include a 16" water line on 4th and cycle tracks on both streets. The route distances are 1.13 miles for the 4th/5th couplet and 1.21 miles for 1st Avenue. Figure N-54 shows capital costs per mile. Figure N-55 shows high and low estimates of the total capital costs for each alignment.	▪ It is generally less expensive to construct a streetcar on two one-way streets due to increased flexibility in accommodating existing utilities, potential to modify rather than replace traffic signals, and reduced construction footprint. ▪ Higher cost of exclusive alternatives accounts for extra traffic signal treatments, reconfiguring parking, and channelization. ▪ Bicycle facility costs represent about \$3.0 million (about 5%) of overall 4th/5th Avenue capital costs. ▪ More detailed estimates will be produced as part of the Tier 2 evaluation.	\$50.7 M Best	\$56.8 M Good	\$54.7 M Good	\$58.1 M Fair

Overall Summary for C3: Exclusive alternatives attract more riders to the system and have lower operating costs due to gains in travel time. The Exclusive alternatives have the highest ridership potential. 1st Avenue Exclusive also has the lowest operating costs. However, exclusive alternatives also have higher capital costs due to more extensive traffic signal treatments and other right-of-way reconfiguration. 4th/5th Avenues Mixed-Traffic has the lowest capital cost, while 1st Avenue Exclusive has the highest capital cost.

Figure N-52 Estimated Average Daily Riders (SLU, Center City Connector, and First Hill)

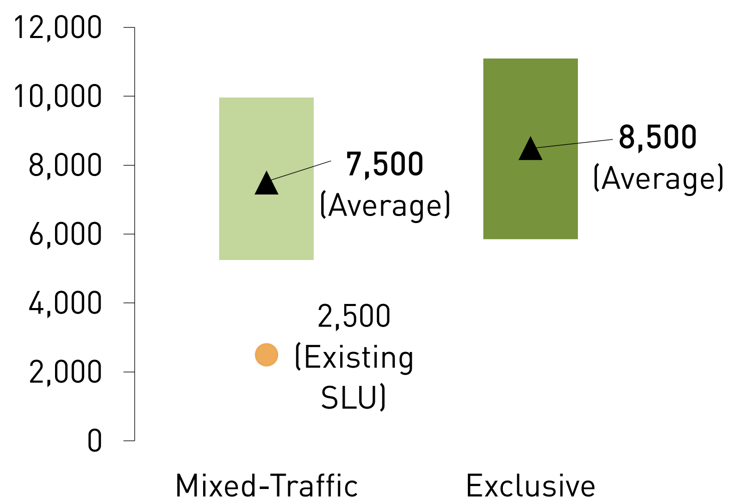


Figure N-53 Operating and Maintenance Costs

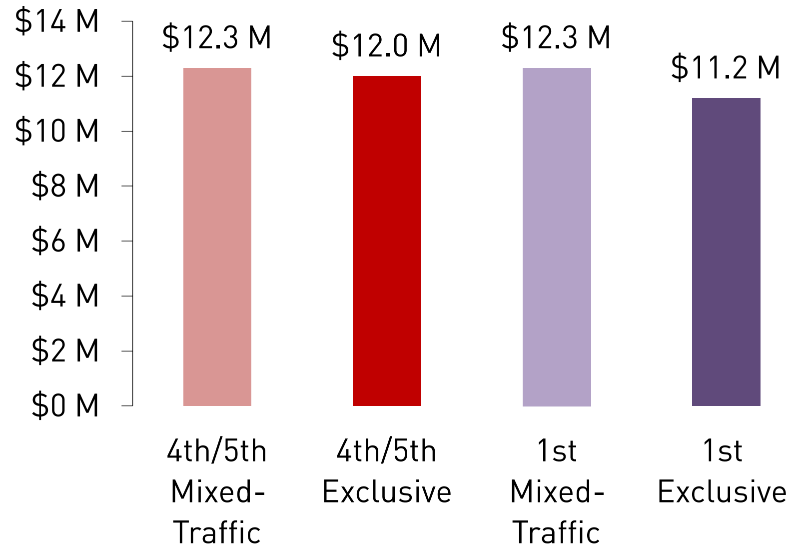


Figure N-54 Capital Costs per Mile

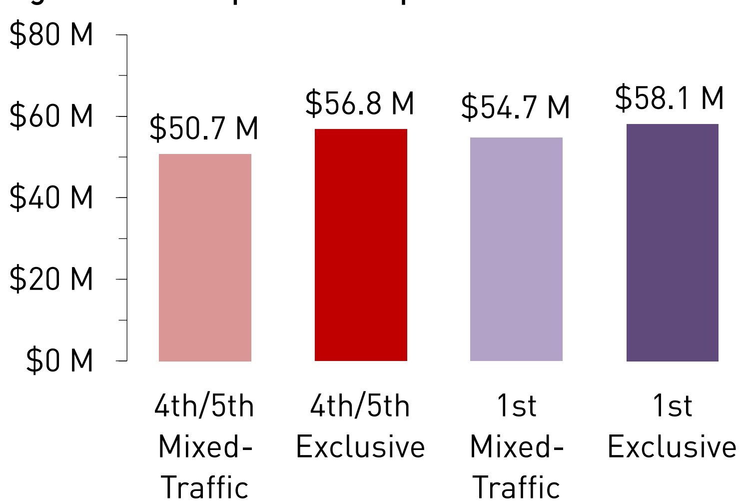
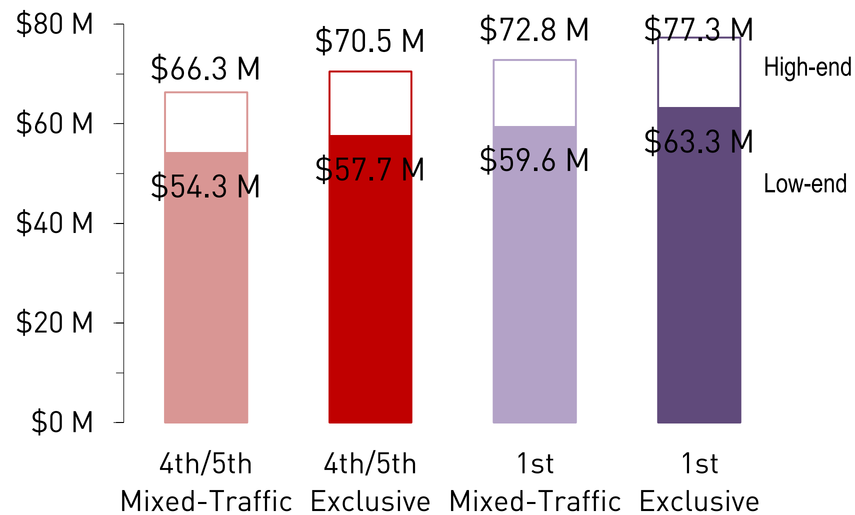


Figure N-55Total Capital Costs



Develop

Objective D1: Promote new development where residents and workers have transportation options; Support local and regional goals to foster compact and mixed-use development

Screening Criteria	Evaluation Summary	4th/5th		1st Ave	
		Mixed-Traffic	Exclusive	Mixed-Traffic	Exclusive
Capacity for new investment					
Qualitative assessment of economic and property characteristics, including average building and parcel size, building age and quality, and percent of space built or renovated since 1990. Figure N-56 and Figure N-57 show locations of recent investment and development opportunities.	▪ The First Avenue corridor is generally characterized by older, smaller, and somewhat lower value and quality buildings as compared to the 4th/5th Avenue corridor. ▪ The 4th/5th Avenue corridor has experienced substantially greater development than the First Avenue corridor over the past 60 years, with more than three times more space added since 1950. This investment pattern is partly a function of zoning where height limits are greater in the 4th/5th corridor.	Good	Good	Good	Good

Screening Criteria	Evaluation Summary	4th/5th		1st Ave	
		Mixed-Traffic	Exclusive	Mixed-Traffic	Exclusive
Potential transit impact					
The ratings at right are based on a qualitative evaluation of the potential of transit investment to influence future development within each corridor.	▪ The potential for transit investment to influence future development is rated only fair for $4^{th}/5^{th}$, due to the already strong market preference and the relative proximity of the transit tunnel stations. ▪ 1^{st} offers greater potential for transit investment to influence development, given existing development capacity and distance from other transit service.	Fair	Fair	Best	Best
Connections to Jobs and Housing					
The ratings shown at right reflect quantitative data (current population, housing units, employees) and qualitative evaluation of potential for new mixed use development to serve residents and employees.	▪ 4th and 5th Aves present a number of significant development opportunities and provides the best connection to existing jobs, however there are fewer housing units in the corridor. ▪ This corridor offer good connections to existing jobs and housing.	Housing Fair Employees Best	Housing Fair Employees Best	Housing Good Employees Good	Housing Good Employees Good

Screening Criteria	Evaluation Summary	4th/5th		1st Ave	
		Mixed-Traffic	Exclusive	Mixed-Traffic	Exclusive
Overall Summary for D1: ▪ 4th and 5th Avenues present significant development opportunities and provide the best connection to existing jobs. The potential for transit investment to influence future development is rated only fair due to the already strong market preference and the relative proximity of the transit tunnel stations. ▪ 1st Avenue has a somewhat greater number of reinvestment and redevelopment opportunities, however due to lower height limits total development capacity is less than the 4th/5th corridor. 1st offers good connections to existing jobs and housing and much better opportunity for transit investments to have a material impact on future development decisions.		Good	Good	Best	Best

Figure N-56 Recent Investment/Reinvestment

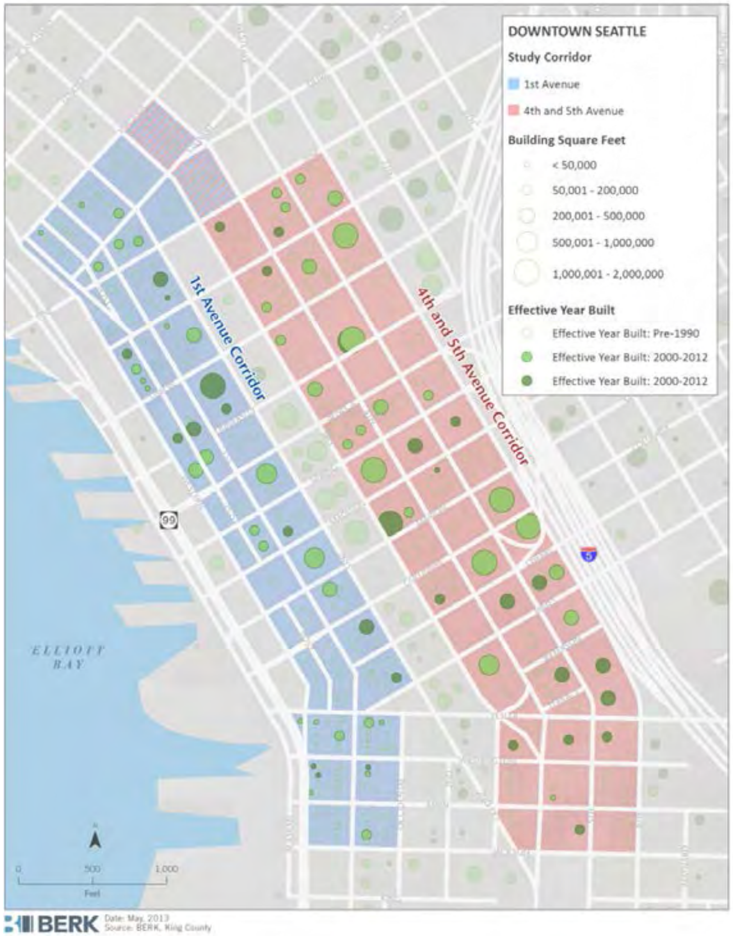
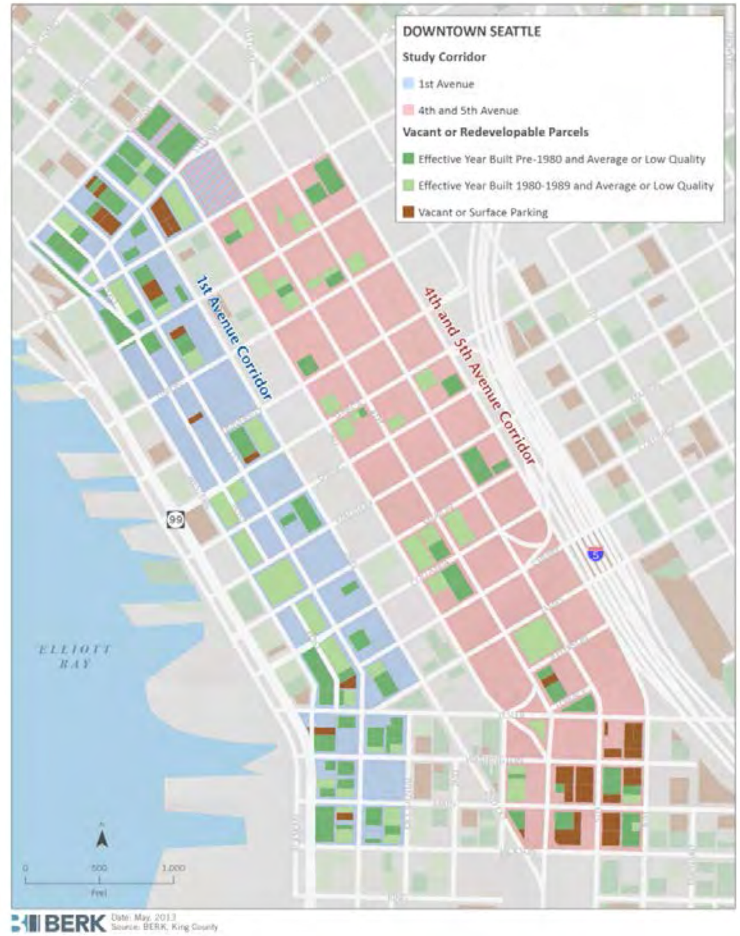


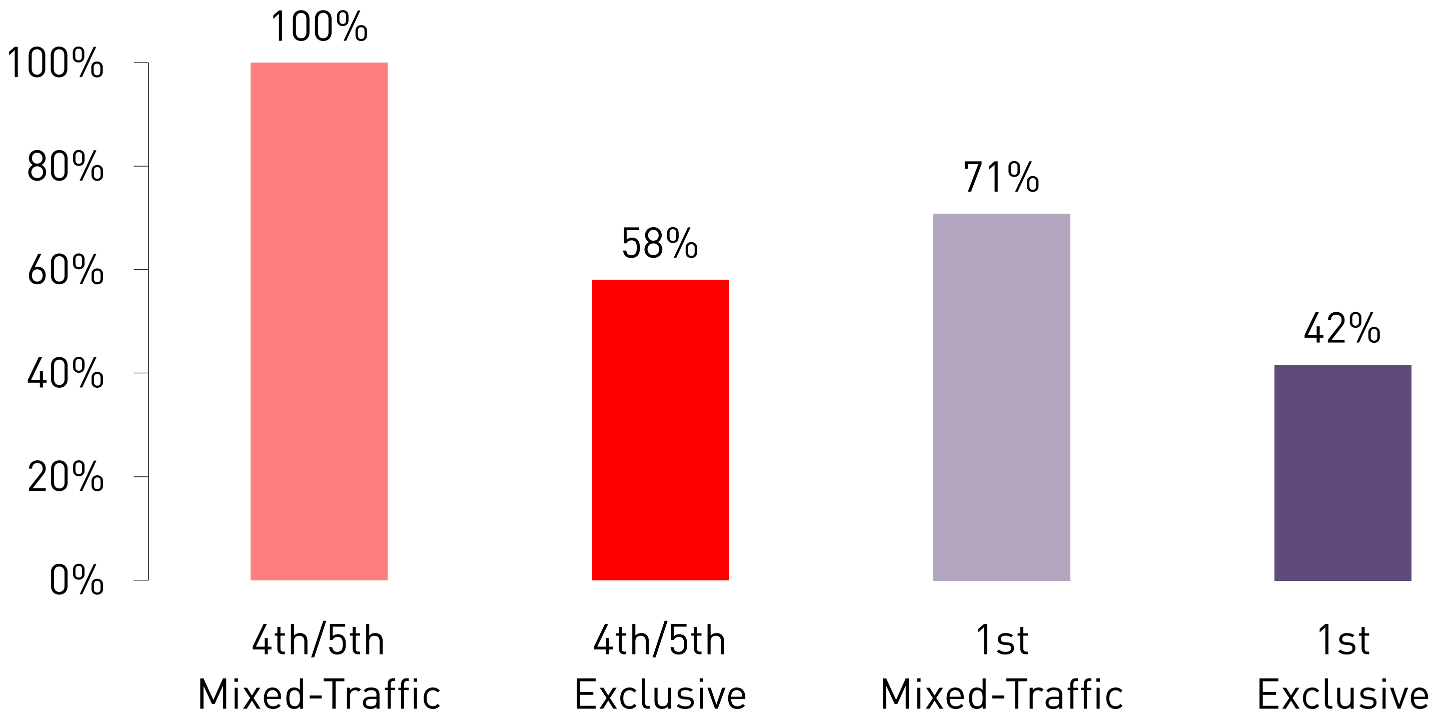
Figure N-57 Vacant and Redevelopable Parcels



Objective D2: Support small and local businesses in Center City business and retail districts

Screening Criteria	Evaluation Summary	4th/5th		1st Ave	
		Mixed-Traffic	Exclusive	Mixed-Traffic	Exclusive
Parking removal					
The data at right shows the percent of block faces that would retain on-street parking in each design alternative. Net impacts are based on the number of block faces with existing parking (including peak-restricted parking) minus the number of block faces where parking is assumed in each alternative. Figure N-58 shows the comparison for each alignment.	▪ On-street parking supports small and local businesses in Center City business and retail districts. ▪ There are 24 existing block faces with on-street parking along the 4th/5th Avenue alignment and 31 existing block faces with on-street parking along the 1st Avenue alignment. ▪ High-level assumptions were developed in the traffic analysis for net parking impacts in each alternative. ▪ On-street parking and access to off-street parking will be assessed in greater detail in the Tier 2 evaluation.	100% Best	58% Fair	71% Good	42% Fair

Figure N-58 Percent of block faces that retain on-street parking



Thrive

Objective T1: Enhance access to jobs

Screening Criteria	Evaluation Summary	4th/5th		1st Ave	
		Mixed-Traffic	Exclusive	Mixed-Traffic	Exclusive
Access to Jobs					
The data at right shows the number of low- to moderate income workers who live within 1/8 mile of each corridor. Figure N-59 shows home locations for low and moderate income workers by Census block.	▪ Residential locations of low-to-moderate income workers in the study area are concentrated in the southern portion of the 4th/5th Avenue corridor and the northern portion of the 1st Avenue corridor, including Belltown.	2,666		2,931	
		Good	Good	Good	Good

Figure N-59 Home Locations of Low-to Moderate-Income Workers, 2010

Objective T2: Improve transportation options for Seattle's most vulnerable residents; Increase access to affordable housing and social services

Screening Criteria	Evaluation Summary	4th/5th		1st Ave	
		Mixed-Traffic	Exclusive	Mixed-Traffic	Exclusive
Number of low-income, minority, elderly, and persons with disabilities with access to Center City Connector					
The relative distribution of transit-reliant populations, including low-income, minority, elderly, and persons with disabilities, is shown in Figure N-60.	▪ Both corridors serve populations who rely on public transportation (including low-income households, persons with disabilities, seniors, and youth).	Good	Good	Good	Good
Number of social service sites with access to Center City Connector					
The location of social service sites is also shown in Figure N-60.	▪ Transit-reliant populations, social service sites, and affordable housing locations are concentrated in the southern portion of 4th/5th Avenues and the northern portion of 1st Avenue, including Belltown. Both corridors serve different populations and housing sites, with some overlap. Similarly, some social service sites are served uniquely by each alignment while some sites are served by either alignment.	Good	Good	Good	Good

Screening Criteria	Evaluation Summary	4th/5th		1st Ave	
		Mixed-Traffic	Exclusive	Mixed-Traffic	Exclusive
Overall Summary: Both corridors serve transit-reliant populations, social service sites, and affordable housing locations. Alternatives B1 and B2, which offer the possibility of a future extension through Belltown, would have the potential to serve additional transit-reliant populations and social service locations. An extension through Belltown to Lower Queen Anne will be considered in conjunction with the Ballard to Downtown study.		Overall Good	Overall Good	Overall Good	Overall Good

Figure N-60 Transit-Reliant Populations, Social Service Sites and Affordable Housing

Objective T3: Enhance access and mobility to tourist destinations including civic and cultural assets and open spaces

Screening Criteria	Evaluation Summary	4th/5th		1st Ave	
		Mixed-Traffic	Exclusive	Mixed-Traffic	Exclusive
Activity centers and number of annual visitors served					
Figure N-61 shows the volume of annual visitors for each corridor, in millions. Figure N-63 shows the location of landmarks and attractions relative to each alignment.	▪ 4th/5th Avenues serve primarily governmental/institutional locations including Seattle/King County/Sound Transit offices, Seattle City Hall, and Seattle/King County/US District courthouses. Visitor attractions include Seattle Central Library and the Convention Center. ▪ The 1st Avenue corridor serves more special event sites and a larger number of attractions that draw more annual visitors. Primarily cultural/tourist attractions served by the 1st Avenue corridor, include the Seattle Art Museum, the Seattle Aquarium, Central Waterfront attractions, and Pike Place Market. Via an east/west connection to Westlake, the alignment also serves the US District Court and the Convention Center.	1.3 M visitors Fair	Fair	12.6 M visitors Best	Best
Number of hotel rooms					
Figure N-62 shows the number of hotel rooms for each corridor. Figure N-63 shows the location	▪ The 4th/5th Avenue alignment has somewhat more hotel rooms and is in closer proximity to the primary hotel area in Seattle's Center City area.	6,595 rooms Best	Best	4,260 rooms Good	Good

Screening Criteria	Evaluation Summary	4th/5th		1st Ave	
		Mixed-Traffic	Exclusive	Mixed-Traffic	Exclusive
of hotels relative to each alignment.					
Overall Summary for T3: 4th/5th Avenues serve a greater number of institutional attractions and have more hotel rooms. However, 1st Avenue has a greater concentration of tourist-oriented and cultural attractions, and a much higher volume of annual visitors.		Overall Good	Overall Good	Overall Best	Overall Best

Figure N-61 Number of Annual Visitors (Millions)

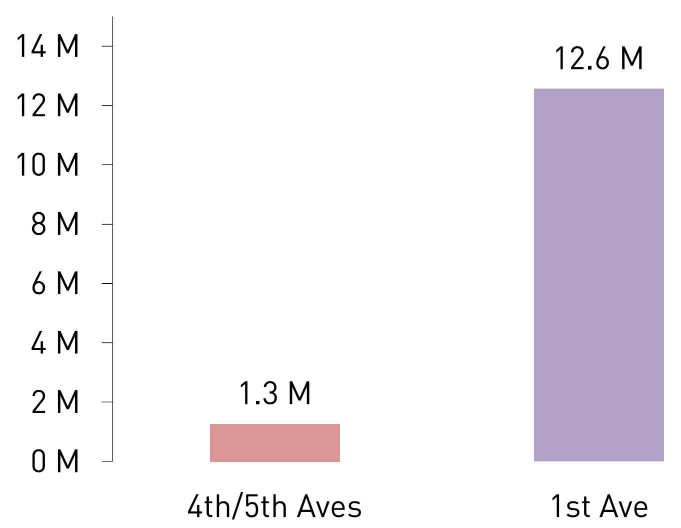


Figure N-62 Number of Hotel Rooms

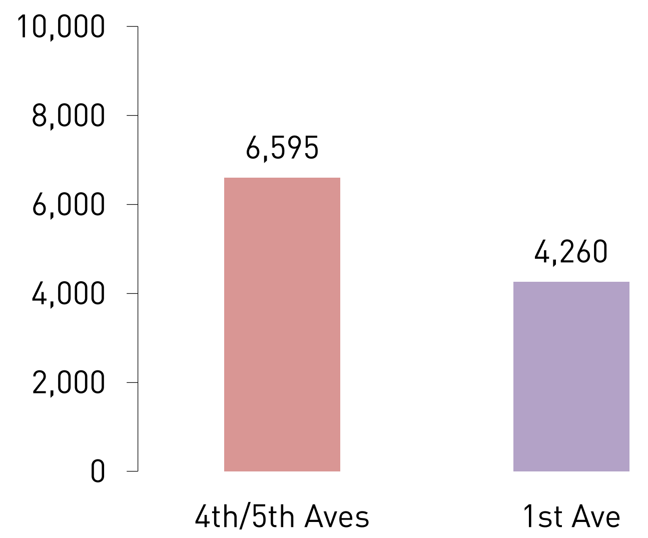
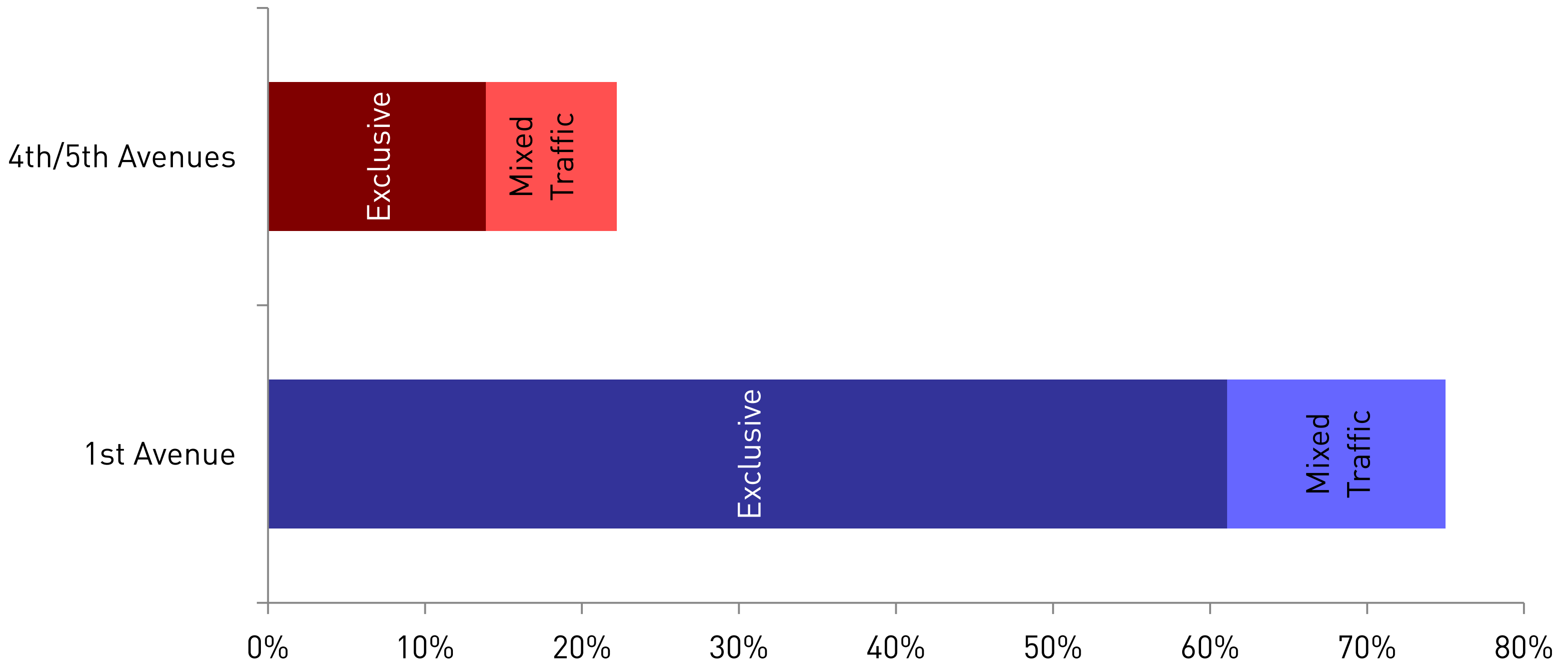


Figure N-63 Landmarks and Attractions

Objective T4: Incorporate public/stakeholder comments into decision-making

Screening Criteria	Evaluation Summary	4th/5th		1st Ave	
		Mixed-Traffic	Exclusive	Mixed-Traffic	Exclusive
Stakeholder support					
Qualitative evaluation based on stakeholder interviews conducted in November-December 2012, the February 2013 open house, and the June 2013 open house.	▪ The vast majority of stakeholders interviewed and participants at the February open house preferred a streetcar mode. Reasons included a desire for a seamless connection between the two streetcars. A number of comments at the February open house emphasized the importance of fast and reliable service. In a prioritization exercise, participants placed nearly three times as many dots in support of 1st Avenue street alignments (about 60) as did for 4th and 5th Avenue alignments (about 20). ▪ Figure N-64 illustrates preferences for the 1st Avenue Exclusive Tier 1 alternative based on feedback provided at the June open house. ▪ Many of the stakeholders interviewed identified specific benefits from a 1st Avenue alignment, including potential for future extensions to the north and south. They also expressed concerns about conflicts between streetcar and other modes on 4th and 5th Avenues.	Fair	Fair	Good	Best

Figure N-64 Ranking of Alternatives, Open House #2



Sustain

Objective S1: Maximize placemaking opportunities; Enhance the safety of all roadway users; Provide people with healthy travel options

Screening Criteria	Evaluation Summary	4th/5th		1st Ave	
		Mixed-Traffic	Exclusive	Mixed-Traffic	Exclusive
Sidewalks and pedestrian amenities					
	▪ 1st Avenue has wide sidewalks with many covered sections, street-front retail, and numerous outdoor restaurants and bar patios. ▪ The 4th/5th Avenue corridor has wide sidewalks through most of the alignment.	Good	Good	Best	Best
Pedestrian crossings					
	▪ 5th Avenue has several mid-block pedestrian crossings ▪ Most crossings on 1st Avenue are at block ends.	Fair	Fair	Good	Good
Transit facilities					
	▪ 1st Avenue provides connections to Seattle's three multimodal hubs and to destinations that currently are not well-served by transit. ▪ 4th/5th Avenues offer direct access to a variety of transit facilities.	Fair	Fair	Good	Good

Screening Criteria	Evaluation Summary	4th/5th		1st Ave	
		Mixed-Traffic	Exclusive	Mixed-Traffic	Exclusive
Placemaking					
	▪ 1st Avenue is a two-way street with a partial boulevard and medians, lowering travel speeds and improving placemaking opportunities. ▪ 4th/5th is a one-way couplet with three travel lanes in each direction for much of the corridor.	Good	Good	Best	Best
Small business opportunities					
	▪ More retail frontages on 1st Avenue than on 4th/5th ▪ Two-way traffic on 1st increases storefront visibility	Good	Good	Best	Best
Overall Summary for S1: Both corridors offer opportunities for a good pedestrian experience and could be further developed to provide the amenities needed by transit users and other pedestrians. 4th and 5th Avenues have pedestrian and transit facilities that are currently more developed and in better condition. 1st Avenue offers more existing and potential placemaking opportunities and has greater potential for improvement.		Overall Good	Overall Good	Overall Best	Overall Best

APPENDIX N

Attachments

ATTACHMENT N.1 TRAFFIC ANALYSIS

This Attachment[1] describes the traffic analysis for the Tier 1 screening and Tier 2 evaluation of alternatives for the Seattle Center City Connector (CCC) Project. It focuses on the traffic analysis completed for the Tier 1 Screening and also addresses the analysis planned as part of the Tier 2 Evaluation (subject to change as the Tier 2 Evaluation is defined in more detail). The intent of the attachment is to provide documentation of the key assumptions and methodologies used in the traffic analysis, including analysis years, study area limits, travel demand forecasting and modeling methodologies, and operational parameters.

Tier 1 and Planned Tier 2 Methodology

Analysis Year and Time Period

The traffic analysis conducted for the Tier 1 Screening was only for the horizon year. This horizon year is considered to be year 2030 based on relevant available data. The Tier 2 analysis may include a year of opening (e.g., 2020) and/or other horizon year analysis.

The traffic analysis was conducted for the PM peak hour as this is considered to be the highest congestion time period in downtown Seattle. Future Project stages, such as environmental documentation, may include additional time periods, i.e., AM peak hour.

Alternatives Analyzed

In Tier 1, a No-Build alternative and two Build alternatives (1st Avenue and 4th/5th Avenues) were analyzed using a combination of Synchro and Excel. Design and operational variations were tested for the two Build alternatives, including mixed-traffic and exclusive-lane configurations along each corridor.

In Tier 2, a No-Build alternative and one Project alternative will be analyzed using a combination of Synchro (for signal timing inputs) and VISSIM (for multi-modal traffic simulation and operational results). This analysis in Tier 2 would support selecting a Locally Preferred Alternative to advance into the next Project phase.

Traffic Measures of Effectiveness

Two Build alternatives were evaluated in the Tier 1 analysis and compared against a No-Build condition. The traffic analysis for Tier 1 incorporated roadway, alignment, traffic signal/operations and stop location options. In Tier 1, a Synchro model was constructed to

[1] Prepared by CH2MHill

analyze and screen alternatives to assist in identifying the preferred corridor. Traffic Measures of Effectiveness (MOE's) produced for the Tier 1 screening include intersection LOS and delay, auto vehicle travel times, and estimated streetcar travel times.

The traffic analysis for Tier 2 screening will compare one build alternative to a no-build condition using both Synchro and VISSIM models. The build alternative in VISSIM will incorporate pedestrian, bicycle, bus and parking movements. Intersection refinements can be evaluated with VISSIM, including separate streetcar signal phases and transit signal priority (TSP) treatments. These design options and treatments will be screened in Tier 2 with the goal of recommending a Locally Preferred Alternative (LPA).

In Tier 2, Synchro will continue to be used but as a basis to establish signal timing parameters and provide intersection LOS and delay while VISSIM will directly simulate the interaction of auto, truck, bus, streetcar, and pedestrian modes of travel along the corridor. MOE's from VISSIM will include travel time for autos, streetcars and buses, as well as vehicle and person throughput. Person throughput will be created by incorporating ridership estimates with vehicle data. Figure N.1-1 identifies the models used in the Tier 1 and Tier 2 analysis.

Figure N.1-1 Screening Levels of Analysis

Screening Levels	Tier 1	Tier 2
Type of Analysis	Screen two Build alignment alternatives against a No Build condition.	Compare No Build and one Build alternative and provide impacts of Project
Tools	Synchro and Emme/2	Synchro (for signal timing inputs) & VISSIM (multi-modal simulation)
Measures of Effectiveness	▪ Traffic demand diversion caused by lane reductions ▪ Intersection LOS & delay (from Synchro) ▪ Auto travel time (from Synchro) ▪ Streetcar travel time (estimated from Synchro & Excel)	▪ Intersection LOS & delay (from Synchro) ▪ Auto travel time (from VISSIM) ▪ Bus travel time (from VISSIM) ▪ Streetcar travel time (from VISSIM) ▪ Vehicle & person throughput (from VISSIM) ▪ Level of traffic diversion expected with any lane reductions

Traffic Study Area Limits

The traffic analysis study area for the Project includes roadways that are under the jurisdiction of the City of Seattle. Chapter 2 of the main Tier 1 report provides maps of the 1st Avenue and 4th/5th Avenue alternatives for the Tier 1 screening of the Project.

The study area includes up to 68 intersections, with up to 15 along the 1st Avenue alternative, up to 36 along the 4th/5th Avenue Couplet alternative, and an additional 17 intersections for the potential connection options to the Westlake Streetcar Station as seen in Figure N.1-2. The potential connection options are the options for connecting the 1st Ave and 4th/5th Avenue alternatives with the existing South Lake Union Streetcar at McGraw Square. Intersections along parallel corridors were not included in the Tier 1 traffic analysis, but additional connecting corridors may be considered in Tier 2. Figure N.1-3 shows the location of each study intersection.

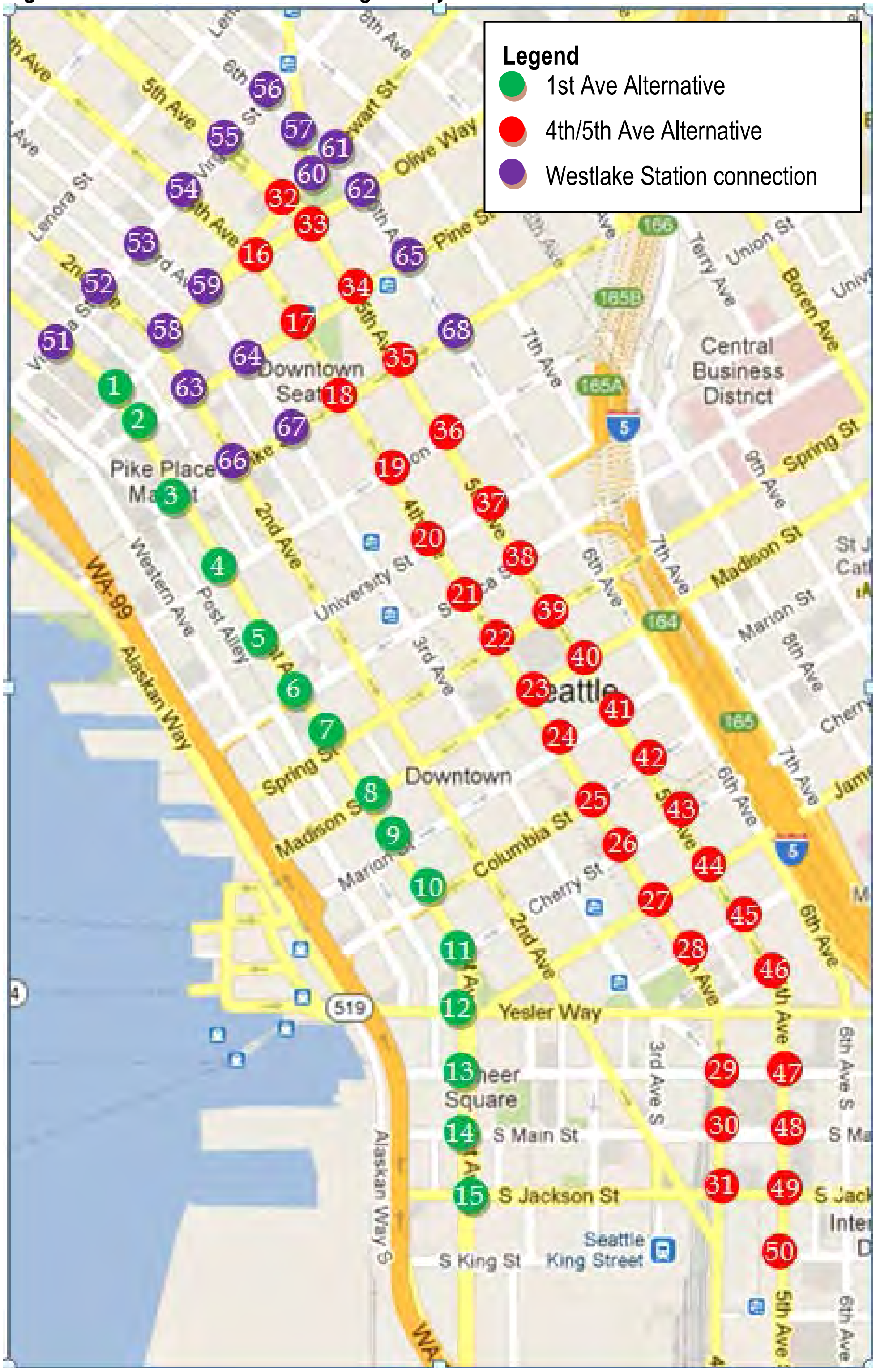
Figure N.1-2 Traffic Study Intersections – 1st Avenue and 4th/5th Ave

ID#	Intersection	Data Source	ID#	Intersection	Data Source
1	1st Ave & Stewart St	AWV FEIS	36	5th Ave & Union St	SDOT
2	1st Ave & Pine St	AWV FEIS	37	5th Ave & University St	SDOT
3	1st Ave & Pike St	SDOT	38	5th Ave & Seneca St	SDOT
4	1st Ave & Union St	SDOT	39	5th Ave & Spring St	SDOT
5	1st Ave & University St	AWV FEIS	40	5th Ave & Madison St	SDOT
6	1st Ave & Seneca St	AWV FEIS	41	5th Ave & Marion St	SDOT
7	1st Ave & Spring St	AWV FEIS	42	5th Ave & Columbia St	SDOT
8	1st Ave & Madison St	AWV FEIS	43	5th Ave & Cherry St	SDOT
9	1st Ave & Marion St	AWV FEIS	44	5th Ave & James St	SDOT
10	1st Ave & Columbia St	AWV FEIS	45	5th Ave & Jefferson St	SDOT
11	1st Ave & Cherry St	AWV	46	5th Ave & Terrace St	SDOT

ID#	Intersection	Data Source	ID#	Intersection	Data Source
		FEIS			
12	1st Ave & Yesler Way	AWV FEIS	47	5th Ave & S Washington St	SDOT
13	1st Ave & S Washington St	AWV FEIS	48	5th Ave & S Main St	SDOT
14	1st Ave & S Main St	AWV FEIS	49	5th Ave & S Jackson St	SDOT
15	1st Ave & Jackson St	AWV FEIS	50	5th Ave & S King St	SDOT
16	4th Ave & Stewart St	AWV FEIS	51	1st Ave & Virginia St	AWV FEIS
17	4th Ave & Pine St	AWV FEIS	52	2nd Ave & Virginia St	AWV FEIS
18	4th Ave & Pike St	AWV FEIS	53	3rd Ave & Virginia St	SDOT
19	4th Ave & Union St	AWV FEIS	54	4th Ave & Virginia St	AWV FEIS
20	4th Ave & University St	AWV FEIS	55	5th Ave & Virginia St	SDOT
21	4th Ave & Seneca St	AWV FEIS	56	6th Ave & Virginia St	SDOT
22	4th Ave & Spring St	AWV FEIS	57	6th Ave & Westlake Ave	SDOT
23	4th Ave & Madison St	AWV FEIS	58	2nd Ave & Stewart St	AWV FEIS
24	4th Ave & Marion St	AWV FEIS	59	3rd Ave & Stewart St	SDOT
25	4th Ave & Columbia St	AWV FEIS	60	Westlake Ave & Stewart St	SDOT
26	4th Ave & Cherry St	AWV FEIS	61	6th Ave & Stewart St	SDOT

ID#	Intersection	Data Source	ID#	Intersection	Data Source
27	4th Ave & James St	AWV FEIS	62	6th Ave & Olive Way	SDOT
28	4th Ave & Jefferson St	AWV FEIS	63	2nd Ave & Pine St	AWV FEIS
29	4th Ave & S Washington St	AWV FEIS	64	3rd Ave & Pine St	SDOT
30	4th Ave & S Main St	AWV FEIS	65	6th Ave & Pine St	SDOT
31	4th Ave & S Jackson St	AWV FEIS	66	2nd Ave & Pike St	AWV FEIS
32	5th & Stewart St	SDOT	67	3rd Ave & Pike St	SDOT
33	5th Ave & Olive Way	SDOT	68	6th Ave & Pike St	SDOT
34	5th Ave & Pine St	SDOT			
35	5th Ave & Pike St	SDOT			

Figure N.1-3 Tier 1 Screening Study Intersections



Data Collection

Traffic data from other relevant projects, such as Alaskan Way Viaduct (AWV) FEIS, Central Waterfront Project (CWP), and First Hill Streetcar was used to develop the traffic analysis for Tier 1. The data from these files, such as traffic volumes, signal timing and roadway channelization was used to establish project models for the alternatives.

Year 2030 traffic volumes and signal timing data was mainly based on the AWV FEIS Synchro model as it has the greatest coverage of the Project's study area. Data gaps were filled in through data obtained from SDOT or other projects (SDOT CWP and SDOT First Hill Streetcar project). Existing traffic signal timing and phasing was gathered from SDOT (refer to Figure N.1-3 for the data source by intersection).

Traffic Volume Forecasting

Future auto demand volumes were based on the 2030 non-tolled scenario forecast developed for the AWV FEIS. The non-tolled scenario forecasts were utilized since WSDOT is currently in the process of updating the tolling forecasts and these have yet to be finalized or agreed to by stakeholders. In Tier 1, a high-level travel demand forecast was conducted to determine the amount of diversion that is likely to occur from a Streetcar operating scenario that requires the reduction of general-purpose travel lanes on either 1st Avenue or 4th/5th Avenues.

At intersections where future forecasts are not readily available, the future intersection volumes were estimated using a combination of existing traffic counts, post-processing adjustments, and volume-balancing from nearby intersections where future forecasts are published.

Operational Analysis Tools and Inputs

Synchro software, version 8, was used for the intersection analysis in Tier 1. Synchro utilizes methods from the Highway Capacity Manual (HCM) 2000. The reported results include the overall intersection LOS from the HCM report for signalized locations. Level of Service (LOS) is a qualitative measurement of intersection operation based on control delay. LOS is reported as letter grades A (low delay per vehicle, favorable traffic progression) through F (extremely high delay per vehicle, could involve long queues). Critical approaches, as defined by LOS F, will also be reported.

For the Tier 1 screening, transit signal priority (TSP) will be integrated with the streetcar operations, through a combination of Synchro and Excel (using a methodology developed and applied through previous studies for SDOT). The TSP levels analyzed for Tier 1 provided a bookend (limited vs. more extensive) of potential TSP levels. The limited TSP signal adjustments were applied to the mixed-traffic streetcar operating scenario while the more extensive TSP adjustments were applied to the exclusive-lane streetcar operations scenario. In either of these two TSP scenarios, the side-street green times were not reduced below minimum thresholds to allow pedestrians the required street crossing time and did not skip pedestrian phases.

In the Tier 2 evaluation, VISSIM software will be utilized to reflect a more detailed modeling of signal operating conditions. VISSIM has the ability to simulate multi-modal traffic flows, such as cars, trucks, buses, streetcar/LRT, bicyclists, and pedestrians, and signal strategies compared to Synchro. The assumptions and parameters used in the Synchro model are shown in Figure N.1-4. Values in Figure N.1-4 were developed based on a combination of discussions with City staff, previous City project experience and default values recommended from the HCM 2010. Figure N.1-5 shows the parameters that will be used in the VISSIM model in the Tier 2 Evaluation.

Figure N.1-4 Synchro Parameters/Assumptions (for Tier 1 screening)

Parameter	Future Year Assumption
Peak Hour Factor	From 2030 AWV Synchro or count, otherwise 0.92 for intersection
Conflicting Pedestrians per Hour	From 2030 AWV Synchro or count, otherwise use 200 peds/hr per crosswalk
Conflicting Bicycles per Hour	From 2030 AWV Synchro or count, otherwise use 20 bicycles/hr
Area Type	CBD
Ideal Saturation Flow Rate (for all movements)	1900
Lane Width	From 2030 AWV Synchro or SDOT paint line sketches, otherwise assume 11'.
Percent Heavy Vehicles	From 2030 AWV Synchro or count/current transit service, otherwise use 3% per approach (including trucks and buses)
Percent Grade	From 2030 AWV Synchro, otherwise calculated from field data

Parameter	Future Year Assumption
Parking Maneuvers per Hour	From 2030 AWV Synchro, otherwise assume 8 maneuvers/hr for two-way streets; assume 16 maneuvers/hr for one-way streets
Bus Blockages	From 2030 AWV Synchro, otherwise from existing transit routes and headways.
Intersection signal phasing and coordination	From 2030 AWV Synchro or existing data from SDOT
Intersection signal timing optimization limits	From 2030 AWV Synchro or existing data from SDOT (80 sec cycle length)
Minimum Green time	From 2030 AWV Synchro or existing data from SDOT,
Yellow and all-red time	From 2030 AWV Synchro or existing data from SDOT, otherwise use: (Y) = 3.5 seconds and (R) = 1 second
Right Turn on Red	Allow where currently permitted.
Speed Limit	30 mph

Figure N.1-5 VISSIM Parameters/Assumptions (for Tier 2 Evaluation)

VISSIM Parameters	Future Year Assumption
VISSIM Version	▪ 5.40-03
Simulation Resolution	▪ 10 time steps/sec
Seeding Time	▪ TBD – Minimum of 15 minutes
Recording Time	▪ 1 hr
# of Random Seeds	▪ Starting seed of 100, increment of 10. 10 seeds.
Driver Behavior, Car Following	▪ Wiedemann 74 ▪ Add. Part of safety distance = 2.40 (default= 2.00) ▪ Mult. Part of safety distance = 3.30 (default = 3.00) ▪ Note: parameters changed to make sat. flow rate = 1900 vphg
Traffic Composition	▪ SDOT Data and 2030 AWV Synchro
Vehicle Types	▪ GP Car (vehicle model = Car, Occupancy = TBD) ▪ HGV (vehicle model = HGV, occupancy = 1.0, length ~ 20-70') ▪ Bus (vehicle model = Bus, occupancy = TBD based on ST forecast model, length ~ 40') ▪ Streetcar (vehicle model = Tram, occupancy = TBD based on Ridership model, length ~65')
Conflicting Pedestrians Per Hour	▪ SDOT Data and 2030 AWV Synchro, otherwise assume 200 peds/hr per crosswalk
Parking Maneuvers/Hour	▪ SDOT Data and 2030 AWV Synchro, otherwise 8 maneuvers/hr for two-way streets; assume 16 maneuvers/hr for one-way streets
Grade	▪ From 2030 AWV Synchro, otherwise calculated from field data
Intersection Turning Speed	▪ Right = 11-13 mph; Left = 13-17 mph
Transit Assumptions	▪ Existing Bus Routes (from KC Metro, Sound Transit, and other transit agencies) and stops along Preferred Alignment route will be modeled. Data

VISSIM Parameters	Future Year Assumption
	from KC Metro will be utilized for boarding/alighting and dwell time at stop locations, otherwise assume 20 second dwell time and 10 second standard deviation. ▪ No changes will be made to existing bus service for future No Build alternative. ▪ No changes will be made to existing bus service for future Preferred Build alternative unless alignment calls for modifications to existing bus stop locations, and will be confirmed by SDOT.
Signal Controller Type	▪ No Build = Pre-timed ▪ Build = Actuated-Coordinated with TSP where warranted
Streetcar Headway	▪ Assume 10 minute headways
Streetcar Signal Operations	▪ TSP to be applied where warranted; TSP parameters to be coordinated with SDOT; Exclusive streetcar phases required at intersections where route turns across traffic
Signal Phasing, Timing, and Coordination	▪ No Build based on 2030 AWV FEIS Synchro; ▪ Build to be modified where exclusive streetcar phases are required or where geometric modifications warrant changes in phasing.

ATTACHMENT N.2 OPERATING AND MAINTENANCE COST ESTIMATES

Note: This attachment supplements the description of scenarios and the evaluation results for Objective C3 that are provided in the Tier 1 Report.

This document[2] describes the methodology for developing an operations plan for use in the Tier 1 Screening and Tier 2 Evaluation for the Center City Connector. The analysis will include estimates of the total operating and maintenance costs for a streetcar network comprised of three segments—South Lake Union (SLU), Center City Connector (CCC), and First Hill (FH)—based on considerations such as frequency, travel speed, operating period, etc.

Tier 1 Operating Options

The Center City Connector will connect the SLU Streetcar line with the FH Streetcar line. Several operating scenarios were modeled and evaluated in the Tier 1 Screening, including single operation for the connected system and split operations. The Tier 1 Report (see Chapter 2) provides additional detail on the operating scenarios that were assumed for the Tier 1 analysis.

Although a combined single line of operations scenario that includes the SLU, CCC, and FH Streetcars is one logical option, there are three vehicles owned by Seattle that cannot be used for such an operation. The current SLU vehicles in operation do not have off-wire capability to travel the Capitol Hill to downtown segment; options to overcome this such as splitting operations or converting the vehicles will be evaluated and discussed. This would impact the Project cost and design.

The operations plan estimated the number of streetcar vehicles required to support proposed service levels, including the total number of hours of revenue service.

In some operating scenarios, flexibility can be considered to address predictive priority and/or potential exclusive right-of-way and longer stop spacing for higher travel speed if desired.

[2] Prepared by Shiels Obletz Johnsen (SOJ)

Approach and Detailed Methodology

Approach

An operating cost model for the Center City Connector was developed for the Tier 1 Screening based on the following high-level approach:

- Estimate annual operating cost of SLU, FH and CCC lines (individually)
- Estimate annual operating cost and characteristics for combined, single-line Streetcar Network comprised of SLU, FH and CCC segments.
- Estimate annual operating cost and characteristics for other operating scenarios defined for Tier 1 analysis.

This model will be refined further in the Tier 2 Evaluation.

Data Inputs and Sources

The following data sources were utilized to develop and refine the operating cost model for the Center City Connector.

- **South Lake Union Streetcar Line**–operating data
- **South Lake Union Streetcar Line**–historic, current, and projected operating costs
- **First Hill Streetcar Line**–projected operating data.[3] Once operating plans for the FH streetcar line are established, they can be used to refine the Operating Hours and Cost Estimate model.
- Operating Hours and Cost Estimate Model (SOJ)

Detailed Methodology

The operations plan was based upon the distance the streetcar must travel and assumptions with regard to speed of operation. The following are key parameters:

- **Operating Speed**. The Tier 1 Screening included planning-level analysis of mixed-traffic and exclusive right-of-way scenarios for each alignment. The Tier 2 Evaluation will include more detailed analysis of priority scenarios. Operating speed assumptions from the traffic analysis were incorporated into the operations methodology.

  Vehicles are assumed to operate in mixed-traffic with similar operating speeds as buses, except where the design alternatives indicate otherwise. Operating speed includes stopping to pick up passengers. Average speeds for streetcar in mixed-traffic range from 6 mph to 9 mph depending upon the number of stops and volume of passenger load. Peak periods with high traffic and loads can average as low as 6 mph.

[3] Initially, this is based on preliminary operating plans for the FH streetcar line (February 2012). Once finalized, the revised/final FH Streetcar operating plan can be used to refine the operating hours and cost estimate.

The Tier 1 and Tier 2 analysis will include consideration of the benefits from priority and "rapid streetcar" type features in achieving desired average speeds. The average operating speed will be determined by dividing the distance by the travel time estimated. This is varied depending upon verification of estimated travel times from simulations.

- **Distance**. The distance of the line is used as a base to estimate round trip time. The distance is assumed as one-way distance with the return trip included at the same travel speed. The estimates are for round trip times.
- **Travel Time.** The actual travel time for the streetcar for the route. This is estimated based upon anticipated operating speeds, and may vary for different priority scenarios.
- **Travel Time + Recovery.** A minimum of 5 minutes is added to the travel time as "recovery" time which allows for the streetcar to make up its schedule. Additional time may be required to assure proper breaks and layover for the operation. Up to an additional 5 minutes or more is included for such layover. The travel time plus recovery is divided by the number of vehicles to determine frequency.
- **Headway**. The number of minutes between vehicles traveling in the same direction, calculated as travel time and recovery divided by number of vehicles operating.
- **Vehicles.** Service headway goals and the end-to-end travel time including recovery determine the required number of vehicles on a line. The existing fleet of vehicles includes three vehicles in operation and one spare (this does not include one additional vehicle that will be funded by Amazon and used to increase peak frequency).
- **Service Span.** For purposes of the Tier 1 analysis, operation is assumed to be consistent with the FH Streetcar operations plan as of February 2012. That plan assumes 20 hours per day Monday through Saturday and 12.0 hours on Sunday for a total of 132.0 hours per week.[4] Three service span categories operation are assumed—Weekends, Off-Peak and Peak—and this allocation of service is used to determine the total number of annual revenue hours operated:
    - **Peak**. Consists of 78 hours per week of operation (Monday–Saturday 6 a.m. –7 p.m.), 10-minute headways.
    - **Off-Peak**. Early mornings (before 6 a.m.) and evenings (after 7 p.m.) Monday–Saturday, 15-minute headways.
    - **Sundays/Holidays**. All hours (7 a.m. – 7 p.m.), 15-minute headways.
- **Cost per Hour.** The annual cost per revenue hour is used to estimate the total cost of operations.

[4] Service characteristics to be refined in the Tier 2 Evaluation. Current plans for the First Hill Streetcar are for a 20-hour service span Monday-Saturday (5 AM – 1 AM) and 12 hour service span on Sundays and Holidays (7 AM – 7 PM); this is a total of 132 hours per week.

Tier 2 Evaluation

Note that different operating assumptions including a longer service span and shorter headways are likely to be used for Tier 2. Figure N.2-1 provides an example. Based on detailed ridership modeling, Tier 2 would also analyze requirements for higher capacity vehicles.

Figure N.2-1 Potential Tier 2 Service Hours and Headway Assumptions

	Start Time	End Time	Headway (MIN)	Span
Weekday	**5 a.m.**	**1 a.m.**	**Varies**	**20**
Weekday Early Morning	5 a.m.	6 a.m.	15	1
Weekday Day/Early Eve	6 a.m.	8 p.m.	10	14
Weekday Later Eve	8 p.m.	1 a.m.	15*	5
Saturday	**5 a.m.**	**1 a.m.**	**Varies**	**20**
Saturday Early Morning	5 a.m.	8 a.m.	15	3
Saturday Day/Early Eve	8 a.m.	11 p.m.	10	15
Saturday Later Eve	11 p.m.	1 a.m.	15	2
Sunday/Holiday	**7 a.m.**	**10 p.m.**	**15**	**17**
Sunday Early Morning	6 a.m.	8 a.m.	15	2
Sunday Day/Early Eve	8 a.m.	11 p.m.	10	15
Sunday Later Eve	--	--	--	--
Total hours/Week				**137**

Sample Operating Cost Model

Figure N.2-2 provides a sample operating plan for the three lines individually and with combined operations as a network. It includes assumptions for transit service levels and travel times in mixed-traffic. The Tier 1 Report provides results for additional scenarios that demonstrate the effects of priority and fewer stop spacing options.

Figure N.2-2 Seattle Local Streetcar – Operation Hours and Cost (Example)*

South Lake Union									
	Vehicles	Distance	Travel Time	Time +Recovery	Headway	Hours/ week	Annual Hours	Annual Cost	MPH
Sun/Hol	2	1.30	20	30	15	12	1,248		7.80
Mon–Sat Off-Peak	2	1.30	20	30	15	42	4,368		7.80
Mon–Sat Peak	3	1.30	22	30	10	78	12,168		7.09
TOTAL						**132**	**17,784**	**$3,556,800**	
First Hill									
	Vehicles	Distance	Travel Time	Time +Recovery	Headway	Hours/ week	Annual Hours	Annual Cost	MPH
Sun/Hol	3	2.50	40	45	15	12	1,872		7.80
Mon–Sat Off-Peak	3	2.50	40	45	15	42	6,552		7.80
Mon–Sat Peak	5	2.50	45	50	10	78	20,280		7.09
TOTAL						**132**	**28,704**	**$5,740,800**	

Center City Connector									
	Vehicles	Distance	Travel Time	Time +Recovery	Headway	Hours/ week	Annual Hours	Annual Cost	MPH
Sun/Hol	2	1.20	20	30	15	12	1,248		7.50
Mon–Sat Off-Peak	2	1.20	20	30	15	42	4,368		7.50
Mon–Sat Peak	3	1.20	22	30	10	78	12,168		6.67
TOTAL						**132**	**17,784**	**$3,556,800**	

Combined Seattle Streetcar									
	Vehicles	Distance	Travel Time	Time +Recovery	Headway	Hours/ week	Annual Hours	Annual Cost	MPH
Sun/Hol	6	5.00	80	90	15	12	3,774		7.50
Mon–Sat Off-Peak	6	5.00	80	90	15	42	13,104		7.50
Mon–Sat Peak	10	5.00	88	98	10	78	40,560		6.82
TOTAL						**132**	**57,408**	**$11,481,600**	

Assumptions:

1. Mixed-traffic operation
2. Cost per revenue hour approx. $200 (based on 2012 actual costs for South Lake Union streetcar, to be confirmed)

ATTACHMENT N.3 CAPITAL COST ESTIMATES

Note: This attachment supplements the evaluation results for Objective C3 that are provided in the Tier 1 Report.[5]

Tier 1 Order-of-Magnitude Capital Cost Estimates

This section describes the methodology used to prepare capital cost estimates for the Tier 1 Screening of alternatives. The purpose of Tier 1 is to compare among a range of alternatives. The Tier 1 capital cost estimates have been prepared using data on cost-per-mile for similar projects.

Cost estimates prepared at this very early planning stage are based on the best available information. However, the streetcar concepts developed to date include only a limited amount of design with many of the details to be determined later. **It is important to understand the limitations with these early estimates and recognize that the next study phase (Tier 2) will include further design refinement and a cost estimating methodology that includes the development of more precise unit costs.** The Tier 1 cost estimates should only be used to compare among the alternative alignments and operating environments and to provide a very general sense of the order-of-magnitude cost for a streetcar project connecting Westlake with S. Jackson Street.

Tier 1 cost estimates have been prepared for each alignment under two conditions; mixed-traffic operation and exclusive transit operation, resulting in cost estimates for four alternatives:

- 4th/5th Couplet – Mixed-Traffic
- 4th/5th Couplet – Exclusive
- 1st Avenue – Mixed-Traffic
- 1st Avenue – Exclusive

Because of the many unknowns associated with each alternative, the Tier 1 capital cost estimates are presented as ranges. These cost ranges are intended to account for a variety of factors that could influence the Project cost such as the extent of utility conflicts and sidewalk/streetscape improvements.

Assumptions

The First Hill (FH) Streetcar project provides a current local project to use as the basis for estimating the cost-per-mile. Because each project has unique conditions, adjustments were

5 Prepared by URS

made to adapt the cost-per-mile to fit the City Center alternatives. The cost-per-mile for the First Hill Streetcar project includes the following conditions:

- Median, double track alignment
- Two-way cycle track
- Significant sidewalk/streetscape improvements
- Traffic signal priority at some signalized intersections
- Available costs in 2012 dollars

With an understanding of the conditions that contributed to the average cost-per-mile for the First Hill Streetcar project, URS used that average cost to develop an average cost-per-mile applicable to each of the four alternatives. The most recent cost-per-mile data for First Hill is a cost of $53 million per mile (2012$). This includes all project costs including design, construction management, utilities, vehicles, maintenance facility, cycle track, traffic signals and streetscape improvements in addition to the rail, pavement, overhead contact system, communications and stations.

In order to estimate a per mile cost for each City Center alternative URS adjusted the First Hill costs by:

- Reducing the maintenance facility costs by 70% to account for the currently available maintenance capacity at the First Hill and South Lake Union facilities.
- Increasing the systems and OCS costs by 20% assuming a 2-way OCS configuration (FHS uses OCS for outbound operations only).
- Maintaining the cycle track cost only for the 4th/5th Couplet alternative and removing the cycle track cost from the other alternatives.
- Escalating the costs from 2012 to 2013 by 9% per year – based on recent estimating data in the Seattle area.

A premium for constructing an exclusive transit option was added to the two exclusive alternatives. The cost-per-mile used to estimate the Tier 1 capital cost for the four alternatives is as follows:

- 4th/5th Couplet – Mixed-Traffic $50.7 million
- 4th/5th Couplet – Exclusive $56.8 million
- 1st Avenue – Mixed-Traffic $54.7 million
- 1st Avenue – Exclusive $58.1 million

These costs are presented per route mile, meaning that they account for both directions for all alternatives.

The **distances** were calculated from where the streetcar route would connect with the existing South Lake Union Streetcar at McGraw Square near 5th and Olive Way to where the streetcar would connect to the First Hill Streetcar (under construction) on S. Jackson Street.

The distances include the full alignment needed to connect between the South Lake Union Streetcar and the First Hill Streetcar. Estimated distances for each alignment are:

- 4th/5th Couplet: 1.13 miles
- 1st Avenue: 1.21 miles

Adjustments were made to the cost-per-mile figures for **special circumstances** including:

- Reduced costs assumed for couplet configurations are due to increased flexibility in accommodating existing utilities and reduced construction footprint
- An existing 16" water line in 4th Avenue
- A premium for exclusive operations accounting for extra traffic signal treatments, reconfiguring parking and channelization
- Cost for special bicycle treatments such as cycle tracks

The notion that a couplet configuration would cost less per route mile than double track on a single street may be somewhat counter-intuitive and requires some further explanation. The following provides context for this cost-per-mile assumption.

Every streetcar project has unique considerations which influence costs. The cost of constructing a rail-transit couplet (one track, each direction on two parallel streets) has been found to cost less than constructing two tracks on one street. Factors that influence this cost differential include:

- **Utility Impacts**: It is usually easier to avoid major utility conflicts when establishing the alignment for one track on a street because there can be more opportunity for flexibility to re-configure the existing lane configuration (e.g., modifying lane widths, eliminating parking, etc.) or to develop alternative track alignment geometry.

  When locating two tracks on a single street, the potential to impact utilities doubles (at least). There is usually less opportunity to modify the traffic configuration when locating two tracks because of the competing need to maintain the lane configuration in both directions. The location/configuration of stops may often dictate where the tracks need to be and there is typically less flexibility available within the right-of-way to find space for utilities to be relocated. Utilities may need to be relocated in order to make space for a relocated waterline, etc. Utility relocation can be a major cost driver.
- **Traffic Signal Impacts:** Two tracks operating on a single street typically require that the entire traffic signal be rebuilt, whereas a single track in a street usually requires more limited modifications to traffic signals, often by shortening a mast arm or adding a mast arm from the opposite side of the street. While this would need to be done for twice the number of intersections (each street for each traffic direction) these modifications are usually much less expensive than the full rebuild with two-direction streetcar operations.

- **Construction Impacts:** Two tracks operating in a single street, along with the associated utility relocations, typically require significantly more traffic control and staging. Construction along a street with a single track in one direction can be constructed faster/more easily and would typically require a simpler traffic staging plan.

Order-of-Magnitude Capital Cost Estimates

Figure N.3-1 Order of Magnitude Capital Cost Estimates

Alternative	Distance	Cost Per Mile	Order-of-Magnitude Cost Estimate (Range)
4th/5th Couplet - Mixed-Traffic	1.13 miles	$50.7M	$54,270,000–$66,330,000
4th/5th Couplet - Exclusive	1.13 miles	$56.8M	$57,690,000–$70,510,000
1st Avenue - Mixed-traffic	1.21 miles	$54.7M	$59,580,000–$72,820,000
1st Avenue - Exclusive	1.21 miles	$58.1M	$63,270,000–$77,330,000

Planned Tier 2 Detailed Evaluation Capital Cost Methodology

This sections describes the planned Tier 2 Evaluation methodology for developing capital cost estimates and cost categories consistent with the Federal Transit Administration's (FTA) Standard Cost Categories (SCC), which will be available for use as the Project progresses into more detailed design in preliminary engineering and final design.

Format

This methodology will use a modified Construction Specifications Institute (CSI) format that allows development of comparative cost estimates suitable for an Alternatives Analysis. The capital cost estimates developed in this format will be ordered and summarized into major cost categories consistent with FTA 5309 New Starts Criteria and appropriate to the level of project definition. Cost categories can be expanded or reduced as needed to provide appropriate levels of detail.

Estimate Development

Estimates of Project capital costs will be developed in three general steps under this methodology. First, potential alignment alternatives identified during initial screening and scoping will be defined in enough detail to enable the necessary analysis and conceptual engineering to be performed for cost estimating purposes. Second, Project components, consistent with the application of unit costs and appropriate to the level of definition, will be identified. Quantities and appropriate unit cost data will then be developed. The capital costs will then be summarized in the various cost categories and for each alternative.

Unit Costs

Unit costs appropriate to the level of alignment definition will be developed to support this methodology. Unit costs will be developed from selected historical data including final engineer's estimates, completed projects, First Hill Streetcar bid information from 2012, Portland Streetcar Loop bid information from 2009, and standard estimating practices. Unit costs may include an aggregation of cost elements that are typically itemized in a detailed engineer's estimate. For instance, the unit cost for the track construction will likely include activities such as excavation, soil preparation, aggregate base, and rail procurement. Unit costs will also include allowances for contractor's margins such as overhead, profit and insurance costs. The capital costs will be submitted along with an update of this Capital Cost Methodology which will include a summary of assumptions/inclusions for each unit cost as well as its source of price information.

Management of Costs

Project costs can often be underestimated in the early planning stages and costs tend to grow as Project development progresses. The methodology employed in the Center City Connector Transit Study will include steps to guard against the underestimation of Project costs and attempt to reduce this problem. Steps included comparing unit costs to historical unit cost bid estimates and construction costs for comparable work; and identifying the specific year-of-expenditure. For the Project Alternatives Analysis, the expected year-of-expenditure will be 2015.

Cost Data Sources

The sources of data used to develop unit costs must be suitable for the type of work, local conditions and scale of the work proposed for the Project. Historical competitive bid data for comparable work is a reliable source. Recent information is the most reliable because it does not require escalation assumptions. Contract as-built prices are the most comprehensive sources because they include the total cost of construction at Project closeout and acceptance.

This methodology will employ recent cost information; typically contractor's bid information or engineer's estimates for recent transit projects in Seattle and the Pacific Northwest. Unit costs will be estimated in year 2015 U.S. Dollars.

Cost Categories

Cost categories will be used to summarize the Project component costs into a comprehensive total estimate for each alternative. The major cost categories are listed in Figure N.3-2 and described in detail below. There are five fixed facilities cost categories, five system-wide cost categories, and two dependent cost categories. Right-of-way cost will be determined during the Preliminary Engineering (PE) phase of the Project.

Figure N.3-2 Capital Cost Categories

- Civil Construction
- Utility Relocation Allowance
- Trackwork
- Stops
- Urban Design
- Maintenance Facility Allowance
- Traffic Control
- Temporary Traffic Control
- Traction Power
- Overhead Contact System
- Train Control and Communications
- Professional Services
- Contractor Fee
- General Conditions Requirements
- Contingency
- Vehicles

Fixed facility categories encompass site-specific Project component costs. Capital costs for these categories are typically calculated by using known unit costs and measured quantities for each component. System-wide costs are calculated on an alignment length instead of from measured quantities. A per route-foot unit cost will be developed from historical data to apply to the route length of each section.

The engineering and contingency categories are dependent on the fixed facility and system-wide cost categories. The sum of the twelve categories listed above is the total capital cost estimate for an alignment segment.

The following bullets describe each of the major capital cost categories that will be used to assemble the estimates, together with specific assumptions.

- **Civil Construction** – This category includes the capital costs for infrastructure improvements necessary for each alignment alternative. The capital costs for civil construction included excavation, landscaping, driveway reconstruction, curb and gutter, sidewalk and ramps, street closure, street reconstruction, sidewalk construction, signing and striping, lighting, and drainage. Measurement will be by unit cost or the route foot for in-street transitway.

  Conceptual design drawings and typical sections will be used to form the basis for cost derivation throughout the Project limits.
- **Utility Relocation Allowance** – This category includes a cost allowance for the relocation, upgrade or adjustment of all public or private utilities that may become the responsibility of the Project during construction. During conceptual design, it

will be assumed that most of the existing underground utilities within the immediate transitway envelope will be relocated. Exceptions may be made based on their depth and condition. Typically, three levels of utility relocations are estimated: Major, Moderate and Minor. The type, size, assumed depth and any anticipated construction complications will be considered when assigning a level to each impacted utility line. Measurement will be on a route-foot basis.

- **Transitway** *(Trackwork)* – This category includes capital costs for procurement and installation of tracks, track slab, special trackwork, crossovers, turnouts, track crossings, welding, track drains and other miscellaneous track items. Embedded trackwork is assumed as the Project standard consisting of girder rail with electrical isolation embedded in a concrete slab and located in an existing traffic lane. The type of trackwork to be used in later phases of design may vary depending on funding sources and availability of materials. Measurement will be on a track-foot basis.
- **Stops** – This category includes the capital costs for fixed facilities and amenities for streetcar stops. The capital costs for stops include platforms, shelters, lighting, signage, landscaping, furnishings and sidewalks for pedestrian access. The following types of stops will be measured by this methodology: side (incorporated into the sidewalk), center (in the roadway median), and special platform. Measurement will be for each complete stop platform.
- **Urban Design** – This category includes an allowance for streetscape improvements outside the stop areas such as sidewalks, wayfinding, lighting, and public art. Measurement will be on a route-foot basis.
- **Traffic Control** – This category includes modifications to roadway signals, signing and striping to accommodate streetcar operations. For each signalized intersection along the alignment a lump sum cost will be assigned based on one of three anticipated signal treatments; add new signal (to existing unsignalized intersection), modify existing signal (expand or upgrade equipment), or add new signal phase to existing signal.
- An allowance for anticipated improvements to roadway signing and striping will be included, with measurement on a track-foot basis.
- **Temporary Traffic Control** – This category includes modifications to existing traffic control and temporary measures to accommodate traffic operations during construction. Measurement will be by the route-foot.
- **Traction Power** – This category includes capital costs for the system to support electrical power to the streetcar vehicles. The system consists of traction power substations and the associated overhead contact system (OCS). This category includes installation and testing of the system equipment. Measurement will be by the route-foot.

  Pole foundations are included as part of the Civil Construction category.

- **Train Signal and Communications System** – This category includes capital costs for the train control and signal system consisting of track switch control equipment, signals, cables and train detection equipment, with measurement by the route-foot. Also included is an allowance for communications elements such as fiber optic cable and field and central control equipment to remotely monitor and control track switches, signals, traction power substations, and other systems equipment, with measurement by the route-foot.
- **Maintenance Facility Allowance** – This category includes an allowance for expansion of vehicle storage and maintenance facilities, and equipment needed to support each new streetcar vehicle. Anticipated facility needs will be identified as vehicle fleet and operating scenarios are developed. Measurement will be lump sum with cost based on historic costs of similar facilities.[6]
- **Professional Services** – This category includes the costs for engineering, administration and construction management services. Costs for these services are based on a percentage of the total cost of all direct capital cost categories. Cost items for this category will be as follows:
  - Preliminary Engineering – 4%
  - Final Design – 6%
  - Project Management for Design Construction – 5%
  - Construction Administration and Management – 8%
  - Insurance – 2%
  - Legal (permits and review fees by other agencies, cities, etc.) – 3%
  - Survey, Testing, Investigation, Inspection – 3%
  - Start-Up Costs and Agency Force Account Work – 1%

  The total percentage applied to all capital cost categories except contingencies will be 32%.
- **Contractor Fee** – It is currently assumed that the construction contract will be performed with a General Contractor / Construction Manager (GC/CM) method. Therefore, a contractor fee of 3.5% will be applied to those elements likely included in the construction contract.
- **General Conditions Requirements** – This category includes construction support items as required in the Project specifications such as survey, field office, and supervisory staff.
- **Contingencies** – This cost category accounts for the uncertainties inherent in Project definition and conceptual design at the alternatives analysis phase. A contingency will be added to the Project cost as a percentage of all the capital cost

[6] Both the SLU and FH Streetcar maintenance facilities have unutilized vehicle maintenance capacity; the cost estimates for the Center City Connector will include only costs for additional vehicle storage capacity and spare parts.

categories except Professional Services. Contingency costs will be calculated as 30% of all capital costs, including vehicles. Contingency should reflect the degree of risk associated with the level of design detail available and the characteristics of the design component. The contingency for future design stages will be reduced as the design process progresses.

- **Vehicles** – This category includes capital costs for procuring new streetcar vehicles compatible with the existing streetcar system and the needs identified for this Project. It is assumed that the vehicles will be Buy-America compliant. The number of vehicles will be based on the proposed operating plans.

ATTACHMENT N.4 RIDERSHIP ESTIMATES

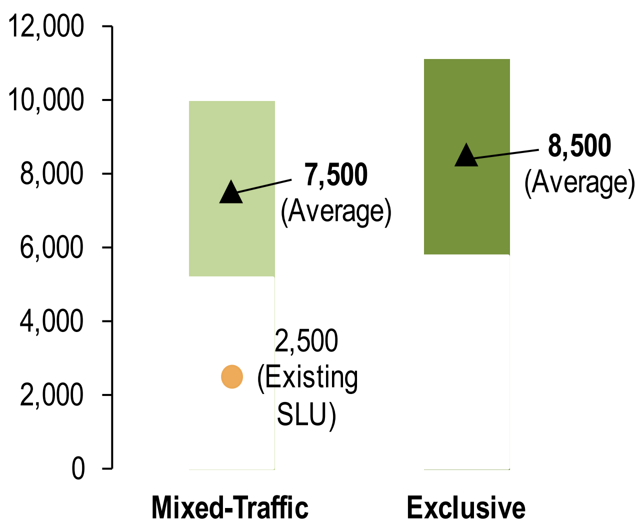
Note: This attachment supplements the evaluation results for Objective C2 that are provided in the Tier 1 Report.

This attachment describes the peer-based ridership forecasting methodology used to estimate ridership for the Tier 1 analysis. It also describes the more detailed ridership forecasting approach planned (currently underway) for the Tier 2 evaluation, using STOPS model developed by the Federal Transit Administration (FTA). Additional detail on ridership forecasting is provided in the Center City Connector Methodology Report (and Attachment N.4 of that report). The methodology report recommended against using the STOPS model, based on concerns about release availability and the risk of using a newly released and relatively untested model for Center City Connector ridership forecasting. These concerns were allayed after discussion with the FTA. The STOPS model is currently being implemented by the Center City Connector team for use in evaluating ridership in the Tier 2 evaluation.

Tier 1 Ridership Estimation Methodology

A peer-based method was used to estimate ridership potential for the Center City Connector alternatives. A similar model was utilized for the Seattle Transit Master Plan (TMP). Productivity and ridership (per mile) on comparable urban rail circulators was adjusted (up or down) based on factors including land use density, major generators, level of tourist visitation, system connectivity, frequency, and design speed/ priority. Portland, Seattle (SLU Streetcar), Tacoma, Memphis, and San Francisco were used as relevant peers. There was no significant difference between ridership for the 4th/5th Avenue and 1st Avenue alignments at this level of analysis. However, based on characteristics such as exclusive right-of-way, high-level of transit priority, longer stop spacing, etc., either Exclusive alternative had a higher level of estimated ridership than the Mixed-Traffic alternatives. Figure N.4-1 illustrates the low-end, high-end, and average ridership estimates for the Mixed-Traffic and Exclusive alternatives.

Figure N.4-1 Center City Connector Tier 1 Ridership Estimate, Average Daily Weekday Riders, Complete System (SLU, Center City Connector, First Hill)



Tier 2 Ridership Estimation Methodology: FTA STOPS Model

Over the past few years the FTA has been encouraging the use of data-driven models to forecast transit ridership as an alternative to regional modeling. These data-driven models are important to consider, especially for areas that may not have on-the-shelf modeling capabilities and/or that don't have a recently calibrated and validated model with the mode being studied. To that end, FTA developed an independent model known as STOPS (Simplified Trips-On-Project Software).

The STOPS model is a modified 4-step model that has been calibrated nationally, against six transit systems that all include fixed-guideway investments. It has been validated against count data for ten other fixed-guideway transit systems. Essentially this model predicts zone-to-zone travel by purpose and assigns trips to General Transit Feed (GTF) networks and reports out station-to-station trip tables and volumes on transit lines and links.

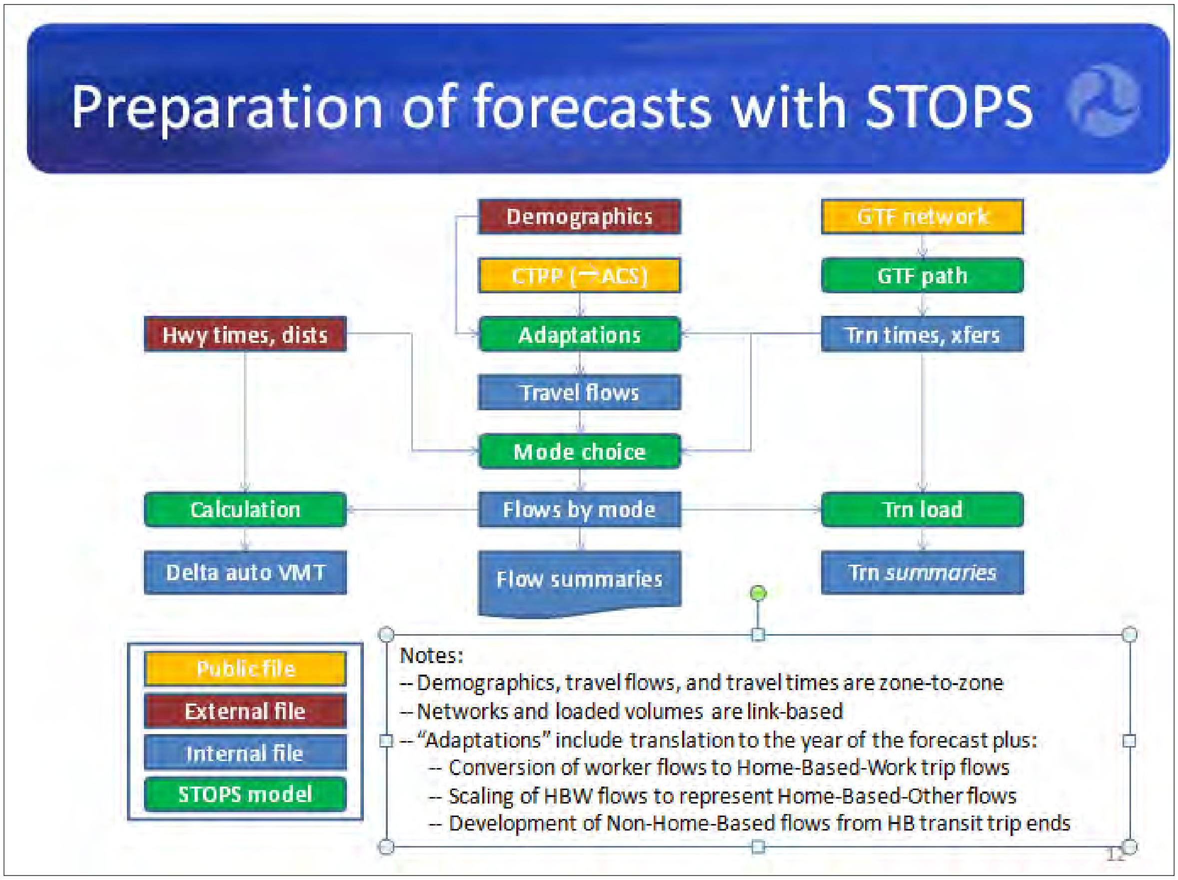
Figure N.4-2 indicates the types and sources of files that are used by STOPS to arrive at transit ridership forecasts. These include:

- General Transit Feed (GTF) files to represent transit service networks in a nationally consistent way
- CTPP (Census Transportation Planning Package) 2000 files to describe metro-area worker flows in a nationally consistent way (when year 2010 files are available for distribution, the STOPS model will be updated to use these files).

- Metro-area demographic forecasts
- Metro-area highway impedances
- A set of mode choice models that varies by trip purpose (work, home-based other, non home-based)
- Nationally developed coefficients and constants

Some of the required inputs are available through the U.S. Census Bureau and online GTF data exchange which includes files for many transit agencies throughout the country. In the case of the Seattle area, the GTF is available through this exchange for both Sound Transit and King County metro. The GTF files are only available for existing transit systems as they operate so these files will need to be modified to incorporate any modifications that may be needed to reflect future transit system changes, including the alternatives under consideration for the Seattle Center City Connector Project. Other required inputs are ones that require assistance from the Metropolitan Planning Organization, in this case Puget Sound Regional Council. These include data such as Traffic Analysis Zone (TAZ) definitions as well as demographics (for the year 2000 and any existing/horizon years that may be desired), travel times and distances for the TAZ system provided by the MPO, etc. A horizon year that may be desired for analysis is the opening year of the Project which for the Tier 2 evaluation is still being determined.

Figure N.4-2 Overview of Preparation of Forecasts with STOPS



Source: FTA

ATTACHMENT N.5 BUS OPERATIONS ANALYSIS METHODOLOGY

Note: This attachment supplements the evaluation results for Objectives E1 and C2 that are provided in the Tier 1 Report.

This Attachment describes the methodology used to assess impacts to transit operations for alignment alternatives on 4th and 5th Avenues. Alignments on 1st Avenue would have very minimal impacts to transit service, as there is currently only one route operating on 1st Avenue (Route 99). This memo includes a description of the methodology and assumptions used in generating estimates of the aggregate delay to both bus vehicles and passengers resulting from a streetcar alignment on 4th and 5th Avenues. It also summarizes analysis of potential stop capacity impacts at a critical bus zone on 4th Avenue.

Analysis methodology

Bus Volumes and Time Period

The bus delay analysis conducted for the Tier 1 Screening assessed impacts to bus routes operating on 4th and 5th Avenues on weekdays between 5 and 6 p.m. Bus volumes were obtained using published schedules and route alignments from King County Metro, Sound Transit, and Community Transit. Volumes and routing for all King County Metro routes were verified by King County Metro staff.

Additionally, because all bus routes currently operating in the Downtown Transit Tunnel (DSTT) are expected to move to surface streets when Link light rail expansions absorb all of the DSTT's capacity, all routes that currently operate in the DSTT were assigned to surface streets. Most routes were assumed to operate using 4th NB and 2nd SB, given that the 3rd Avenue transit spine is currently very near maximum capacity. Any additional capacity on 3rd caused by service restructuring associated with opening of University Link was assumed to be replaced with more service on other local routes. Routes currently operating in the tunnel that were assumed to operate on 4th NB include: 41, 76, 77, 101, 106, 150, 255, 316, 550.

Two routes that currently operate in the tunnel were assumed to operate on 5th SB: Routes 255 and 550. Route 255 currently uses the 4th/5th couplet when the tunnel is closed, and Route 550 was assumed to use the 4th/5th couplet that Route 545 currently uses.

Total bus volumes for 4th and 5th Avenues by block are shown in Figure N.5-1 and Figure N.5-2. Routes that currently operate in the DSTT are shown in red text.

Figure N.5-1 Trips per Route by Block, 4th Ave

ROUTE	Jackson-Main	Main-Washington	Washington-Yesler	Yesler-Jefferson	Jefferson-James	James-Cherry	Cherry-Columbia	Columbia-Marion	Marion-Madison	Madison-Spring	Spring-Seneca	Seneca-University	University-Union	Union-Pike	Pike-Pine	Pine-Olive/Stewart
5/21	4	4														
7	8	8														
14	4	4														
15	2	2														
17	3	3														
18	2	2														
19/24/124	4	4														
25	1	1														
131/132/28/26	6	6														
29	5	5														
33	2	2														
36	10	10														
40	4	4														
41	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
64												4	4	4	4	4
76	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
77	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
106	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
101	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
116	1	1														
150	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
212	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
217	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
250	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
252	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
255	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
257	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
260	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
265												3	3	3	3	3
268	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
301	6	6	6	6	6	6	6	6	6	6	6	6	6	6		
306	2	2	2	2	2	2	2	2	2	2	2	2	2	2		
308	1	1	1	1	1	1	1	1	1	1	1	1	1	1		
311	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
312	6	6	6	6	6	6	6	6	6	6	6	6	6	6		
316	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	

ROUTE	Jackson-Main	Main-Washington	Washington-Yesler	Yesler-Jefferson	Jefferson-James	James-Cherry	Cherry-Columbia	Columbia-Marion	Marion-Madison	Madison-Spring	Spring-Seneca	Seneca-University	University-Union	Union-Pike	Pike-Pine	Pine-Olive/Stewart
358	9	9														
402	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
405	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
410	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
415	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
417	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
422	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
424	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
510	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
511	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
512	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
513	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
522	5	5	5	5	5	5	5	5	5	5	5	5	5	5		
545	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
550	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
554	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
578												2	2	2	2	2
590	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5

Figure N.5-2 Trips per Route by Block, 5th Avenue

Route	Jackson-Main	Main-Washington	Washington-Jefferson	Jefferson-Yesler	Jefferson-James	James-Cherry	Cherry-Columbia	Columbia-Marion	Marion-Madison	Madison-Spring	Spring-Seneca	Seneca-University	University-Union	Union-Pike	Pike-Pine	Pine-Olive/Stewart
111	3	3														
114	2	2														
210	2	2														
212	8	8														
214	4	4														
215	1	1														
255	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
358	5	5	5													
510	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
511	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
512	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
545	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
550	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
554	3	3														

Study Area

The analysis included all routes operating on any block of 4th/5th between Washington Street and Olive Way. For each block, the number of trips made by each route was recorded. The study area therefore included the two blocks from Jackson Street to Main Street and Main to Washington, which are used by a number of local routes to access the 3rd Avenue transit spine traveling northbound.

Alternatives Analyzed

In the Tier 1 evaluation, bus delay analysis was conducted for the Mixed-Traffic and Exclusive Alternatives on 4th/5th Avenues (Alternatives A1 and A2). These alternatives were compared to the No Build scenario used for traffic modeling. Because 1st Avenue has very minimal transit service, streetcar impacts to bus vehicles and passengers would be minimal.

The Tier 2 evaluation will consider multiple east-west connection alternatives, , including potential transit impacts such as to regional transit operating on Stewart Street.

Bus Vehicle Delay

Average delay in seconds per vehicle by block was calculated by the traffic modeling team using a combination of Synchro and Excel. The Synchro analysis was based on the 2030 no-toll scenario from the Alaskan Way Viaduct (AWV) model. Figure N.5-4 illustrates these travel times by segment. The delay per vehicle was applied to each bus trip at the block-level within the study area to calculate the total delay per route for each segment of the alignment and the aggregate delay to all routes for each alternative. For blocks where the traffic modeling indicated an improvement in travel time compared to the No Build scenario, the improvement was calculated in the same manner as delay and subtracted from the net delay. The inputs from the traffic model are shown in Figure N.5-3 and Figure.5-4.

Figure N.5-3 Vehicle Delay by Block, 4th Avenue

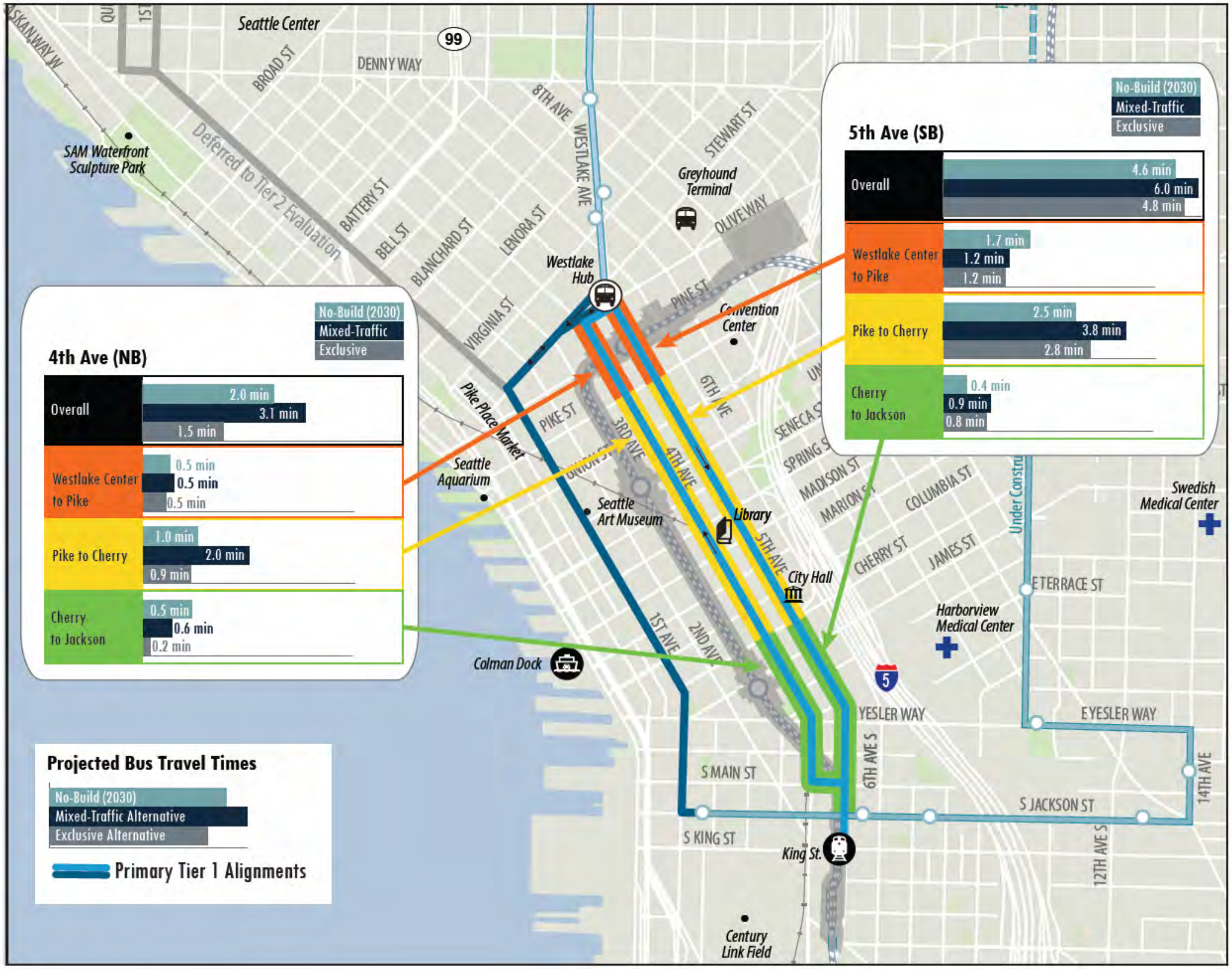
Block #	Block Name	4th Ave				
		No Build	Mixed-Traffic		Exclusive	
		Delay (sec/veh)	Delay (sec/veh)	Difference from No Build	Delay (sec/veh)	Difference from No Build
1	Main-Washington	4.7	6.1	1.4	3.0	-1.7
2	Washington-Jefferson[7]	8	13.6	5.6	0.3	-7.7
3	Jefferson-James	6.6	5.2	-1.4	1.7	-4.9
4	James-Cherry	7.9	9.0	1.1	4.3	-3.6
5	Cherry-Columbia	6.7	4.8	-1.9	4.7	-2
6	Columbia-Marion	19.9	64.3	44.4	25.5	5.6
7	Marion-Madison	7.9	8.0	0.1	3.9	-4
8	Madison-Spring	2.5	5.4	2.9	4.4	1.9
9	Spring-Seneca	5.1	7.9	2.8	3.4	-1.7
10	Seneca-University	12.7	22.6	9.9	6.8	-5.9
11	University-Union	4.4	5.1	0.7	4.6	0.2
12	Union-Pike	3.7	4.0	0.3	2.2	-1.5
13	Pike-Pine	19.2	19.0	-0.2	9.4	-9.8
14	Pine-Olive/Stewart	4.2	6.5	2.3	11.6	7.4
15	Olive/Stewart-Virginia	6.9	6.8	-0.1	6.2	-0.7

[7] Washington-Jefferson is a combined segment in the traffic data for 4th

Figure N.5-4 Vehicle Delay by Block, 5th Avenue

Block #	Block Name	5th Ave				
		No Build	Mixed		Exclusive	
		Delay (sec/ veh)	Delay (sec/ veh)	Difference from No Build	Delay (sec/ veh)	Difference from No Build
1	Virginia-Olive/Stewart	28.9	16.9	-12.0	10.9	-18
2	Olive/Stewart-Pine	12.3	18.3	6	19	6.7
3	Pine-Pike	58.4	39.2	-19.2	41.5	-16.9
4	Pike-Union	17.9	33.2	15.3	30.3	12.4
5	Union-University	13	29.6	16.6	24	11
6	University-Seneca	9.3	63.5	54.2	44.4	35.1
7	Seneca-Spring	10.4	41.6	31.2	26.9	16.5
8	Spring-Madison	42.3	22.8	-19.5	11.5	-30.8
9	Madison-Marion	39.6	18.7	-20.9	8.7	-30.9
10	Marion-Columbia	5.3	7.0	1.7	10.4	5.1
11	Columbia-Cherry	12.5	14.1	1.6	10.7	-1.8
12	Cherry-James	8.5	33.0	24.5	25.4	16.9
13	James-Jefferson	3.6	4.7	1.1	5.5	1.9
14	Jefferson-Terrace	2.1	2.6	0.5	2.9	0.8
15	Terrace-Washington	4.9	7.6	2.7	8.2	3.3
16	Washington-Main	7.4	5.7	-1.7	6.4	-1

Figure N.5-5 Bus Travel Times by Segment, 4th and 5th Avenues, 2030



Bus Passenger Delay

In order to estimate the aggregate delay to passengers, the analysis used average load for each route from automated passenger counter (APC) data from King County Metro as a high-level (likely conservative) estimate of load during the PM peak period. The delay per route during the peak was then multiplied by the average load to calculate the net delay to passengers.

Stop Capacity Analysis

In the Exclusive Streetcar alternative on 4th Avenue, the Streetcar would operate in the second lane from the eastern curb, weaving to the eastern curbside lane at stations. The transit operations analysis also considered impacts to bus stop capacity. This is particularly critical at the northern end of 4th where bus stops and streetcar stations may need to be located on the same block, i.e., between Pike and Pine Streets. Figure N.5-6 identifies the bus zone in this block as one of the critical bus zones (from a stop capacity perspective) on 4th Avenue and Metro estimates a capacity of 70 buses per hour in the PM peak. The bus delay analysis described above identified 114 buses per hour in this segment of 4th, including routes potentially moving from the DSTT.

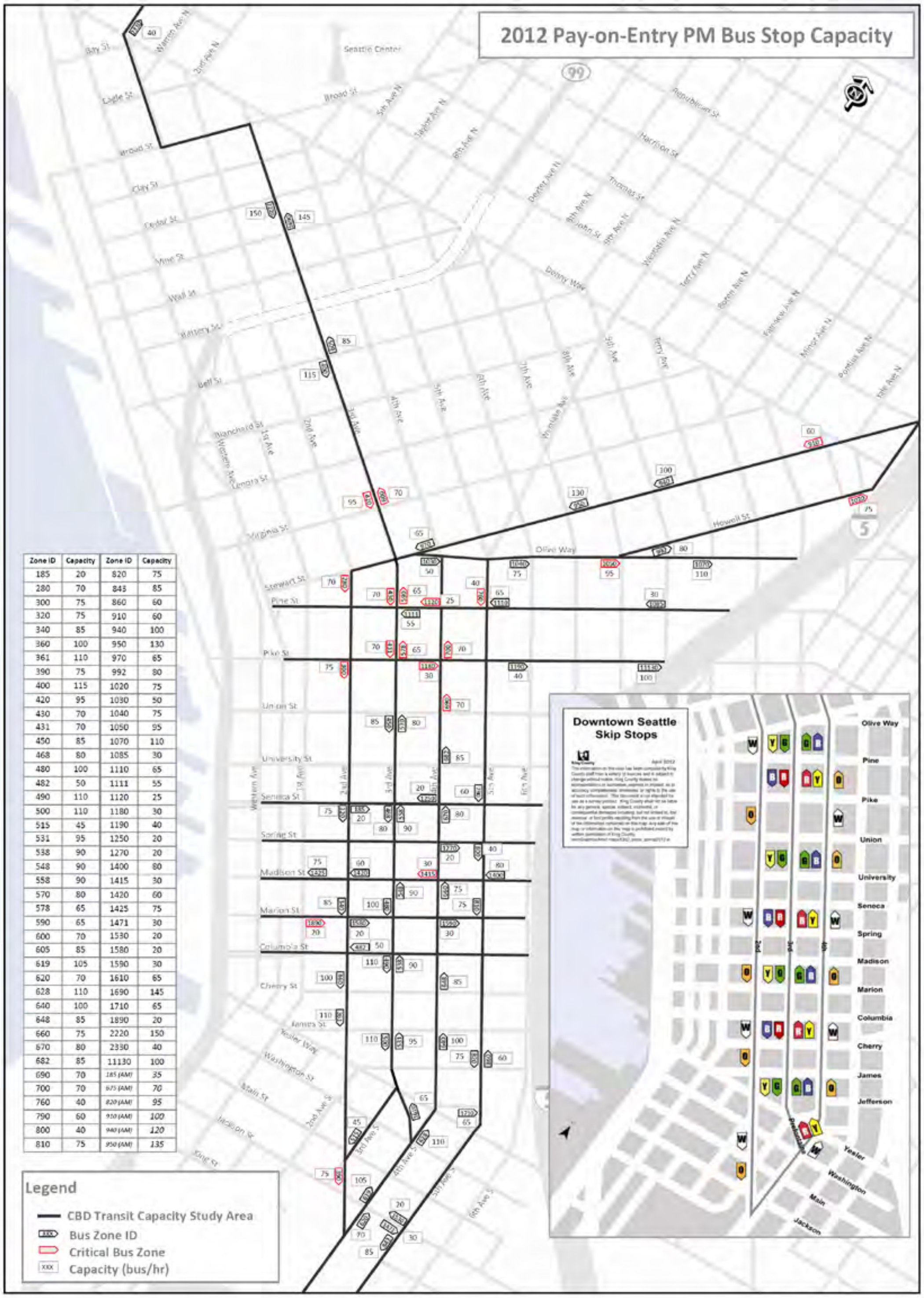
This does not include any potential reduction in stop capacity due to the streetcar, which is primarily of concern where streetcar and buses would stop in the same block of 4th between Pike and Pine. URS estimated the amount of curb space required for a curbside stop platform on 4th Avenue as well as for the streetcar to weave back to the second lane from the curb in this alternative. Figure N.5-7 shows that about 108 feet would be required for the streetcar to complete the "weave" movement, for a total of nearly 180 feet. This implies that the south end of Metro bus stops on 4th Avenue would likely need to start a minimum of 200 feet from the upstream intersection. The length of this block is approximately 400 feet and the bus stop zone currently starts about 125 south of the Pine intersection, reducing available bus stop space to approximately 75 feet without causing delay to the streetcar.

Key Assumptions/Limitations

Limitations or key assumptions for this analysis included:

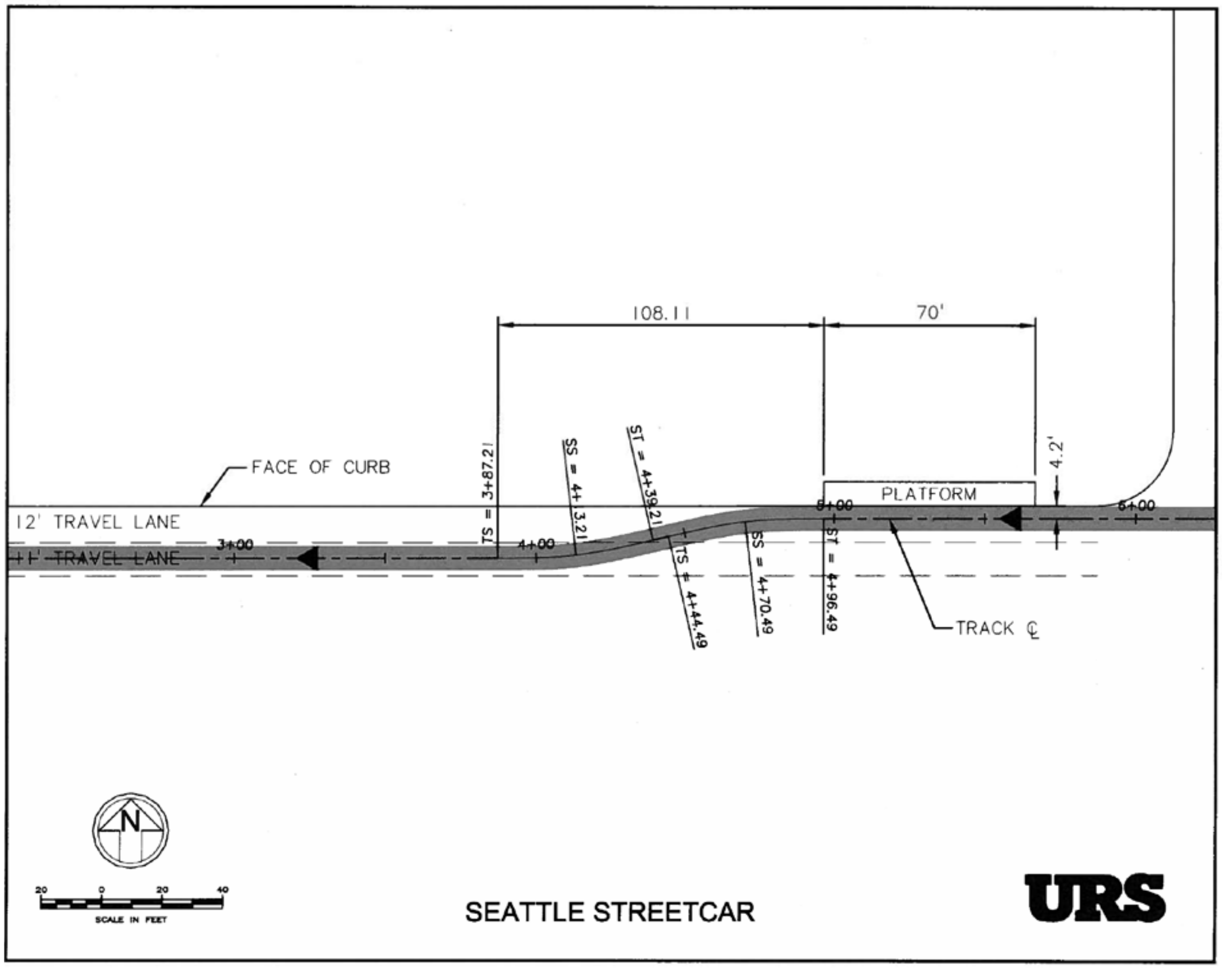
- For routes assumed to move out of the DSTT, whether they would use 4th/5th or other streets.
- Average passenger load is used as a proxy for actual passenger load by stop on 4th and 5th Avenues on bus trips between 5 – 6 p.m.
- The stop capacity analysis did not consider 5th Avenue but focused on 4th, which has higher bus volumes, and also focused on a critical stop on 4th Avenue. However, a more comprehensive analysis could be performed for 4th and 5th Avenues in Tier 2, if an alternative on these alignments is advanced for more detailed analysis.

Figure N.5-6 Metro Skip-Stop Operations, Bus Zone Capacity, and Critical Bus Zones



Source: King County Metro

Figure N.5-7 Streetcar Station Curb Capacity Require



ATTACHMENT N.6 ECONOMIC DEVELOPMENT ANALYSIS

Note: This Attachment supplements the evaluation results for Objective D1 that are provided in the Tier 1 Report.[8]

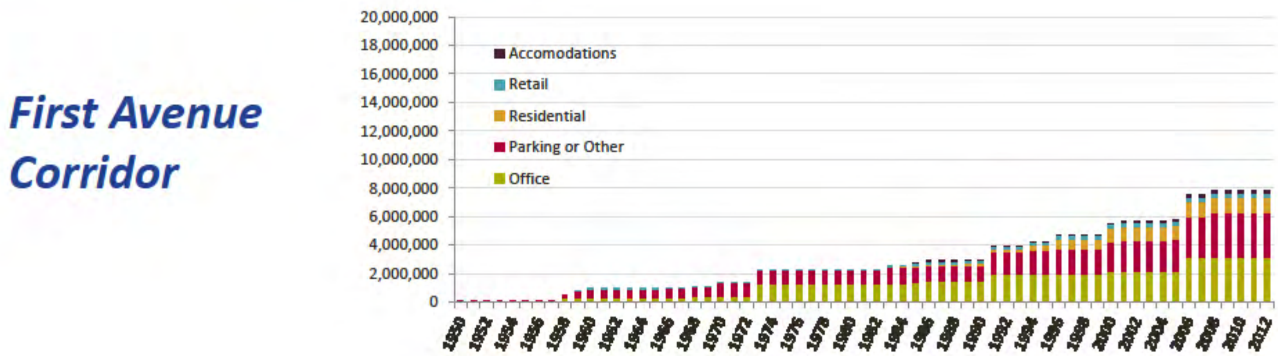
The Tier 1 economic development analysis was conducted to determine how well each corridor meets the "Develop" criteria D1: Promote new development where residents and workers have transportation options. The analysis considered the capacity for new investment, potential for transit to influence future development, and connections to jobs and housing as screening criteria for each corridor. Supplementing the supporting maps for criteria D1 that are included in the Tier 1 Report, additional background information used to conduct the analysis and develop ratings for each corridor is included in Figure N.6-1 and Figure N.6-2.

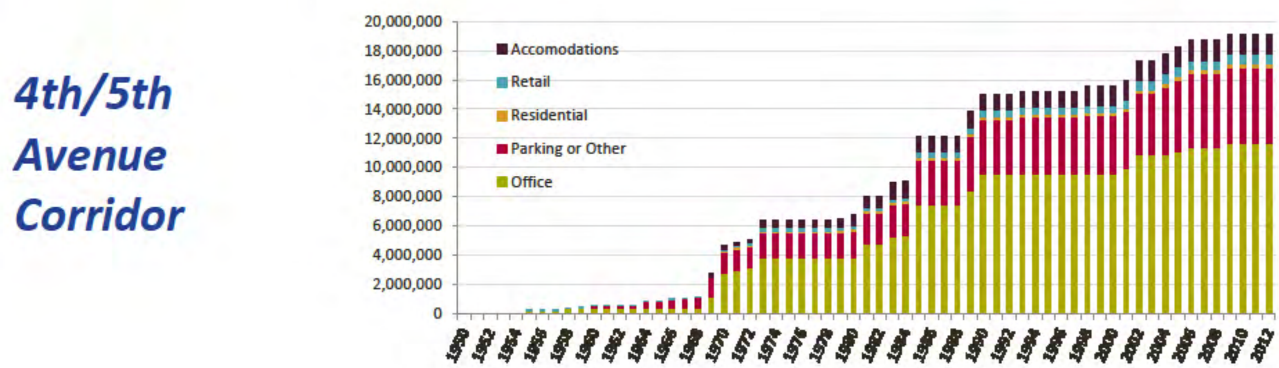
Figure N.6-1 Existing Economic Activity

Economic Characteristics	First Avenue Corridor	4th/5th Avenue Corridor
Estimated employment	37,631	65,869
Housing units	2,538	1,128
Population	3,270	1,539
Total assessed value of property	$2,428,726,800	$4,298,818,600
Property Characteristics		
Total acres	49.6	67.1
No. of parcels	188.0	145.0
Avg parcel size	11,499	20,154
Total square feet of buildings	14,120,887	26,111,056
No. of buildings	162.0	121.0
Avg building size	87,166	215,794
Avg age of structure (weighted by size)	1954	1967
Pct of of space built or renovated since 1990	50.7%	60.4%
Building Quality (pct of total buidlings)		
Low	5.6%	6.6%
Average	68.5%	53.7%
Good	25.9%	39.7%

[8] Prepared by BERK Consulting

Figure N.6-2 Historic Development Activity





ATTACHMENT N.7 URBAN FORM ASSESSMENT

Note: This Attachment supplements the evaluation results for objective S1 that are provided in the Tier 1 report.

This Attachment summarizes the urban form assessment conducted on both of the primary corridors, including 1st Avenue and 4th/5th Avenues.[9] This assessment was used to evaluate how well each corridor meets the "Sustain" evaluation criteria: "Maximize place-making opportunities" and "Enhance the safety of all roadway users."

The assessment was conducted by walking the alignment, visually observing, recording and photographing the general conditions and characteristics of the following urban design elements:

- Sidewalk paving
- Pedestrian crossings
- Transit facilities
- Adjacent uses
- Pedestrian lighting
- Pedestrian amenities
- Unique places/buildings
- Small business opportunities

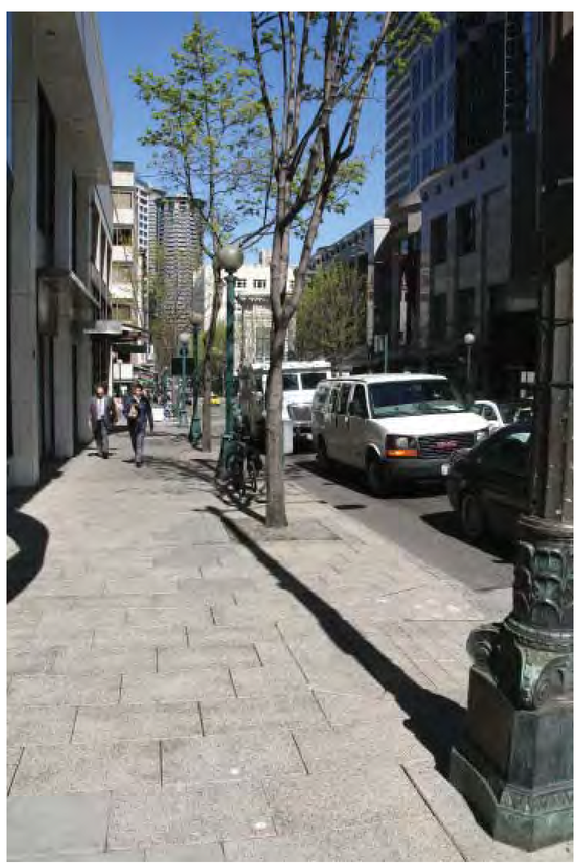
It is difficult to make a generalization about each of these elements over the full extent of each entire alignment. Generally, however, the pedestrian conditions are fair to good for almost all areas of the both alignments with only minor areas of relative deficiency. It did not appear that either particular option offered either extensively poor conditions that would need to be improved. The urban form assessment ratings are provided in the Tier 1 Report; the following pages include images and detailed descriptions of each block of each corridor.

[9] Prepared by VIA Architecture

5th & Pine
Facing south

5th & Pike
Facing south

5th & Union
Facing north



5th & Union
Facing south

	5TH AVENUE - OLIVE/PINE
Sidewalk paving	Good condition
Pedestrian crossings	At block ends
Transit facilities	Bus stop, monorail terminus
Adjacent uses	Westlake Center - display windows
Pedestrian lighting	Pedestrian-scale streetlamps
Pedestrian amenities	Canopies, bike rack, planters
Unique places or buildings	Adjacent Westlake Center plaza
Small business opportunities	Only storefront space on this block is at corner of 5th & Olive

	5TH AVENUE - PINE/PIKE
Sidewalk paving	Excellent condition
Pedestrian crossings	At block ends & mid-block crossing
Transit facilities	N/A
Adjacent uses	Retail storefronts
Pedestrian lighting	Pedestrian-scale streetlamps
Pedestrian amenities	Canopies, street trees
Unique places or buildings	N/A
Small business opportunities	Continuous retail frontage along block

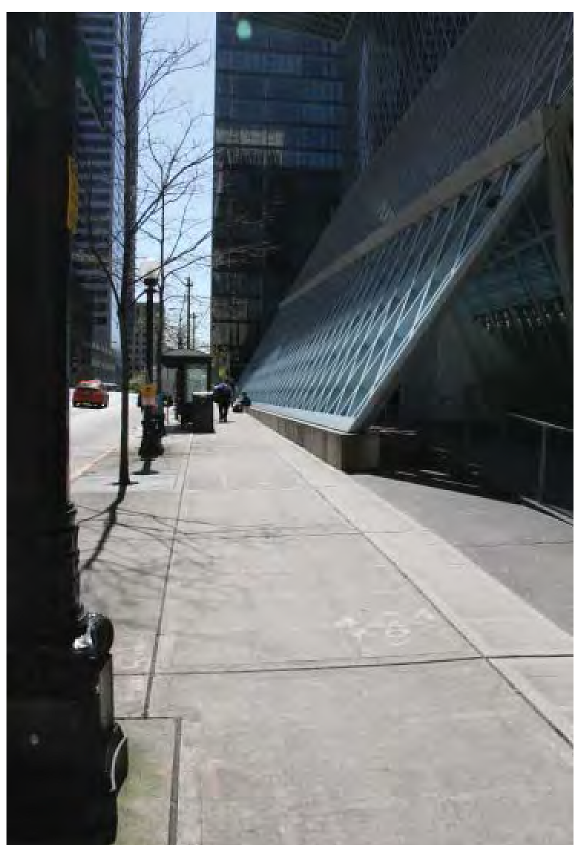
	5TH AVENUE - PIKE/UNION
Sidewalk paving	Excellent condition, large mid-block curb cut & hotel drop-off area
Pedestrian crossings	At block ends & mid-block crossing
Transit facilities	N/A
Adjacent uses	Retail storefronts, Red Lion Hotel
Pedestrian lighting	Pedestrian-scale streetlamps
Pedestrian amenities	Canopies, bike rack, street trees
Unique places or buildings	N/A
Small business opportunities	Retail frontage at north and south ends of block

	5TH AVENUE - UNION/UNIVERSITY
Sidewalk paving	Excellent condition, steep south half of block
Pedestrian crossings	At block ends & mid-block crossing
Transit facilities	N/A
Adjacent uses	Rainier Square - some retail frontage
Pedestrian lighting	Pedestrian-scale streetlamps
Pedestrian amenities	Some canopies, trash can, street trees and shrubs
Unique places or buildings	N/A
Small business opportunities	Retail frontage at north and south ends of block

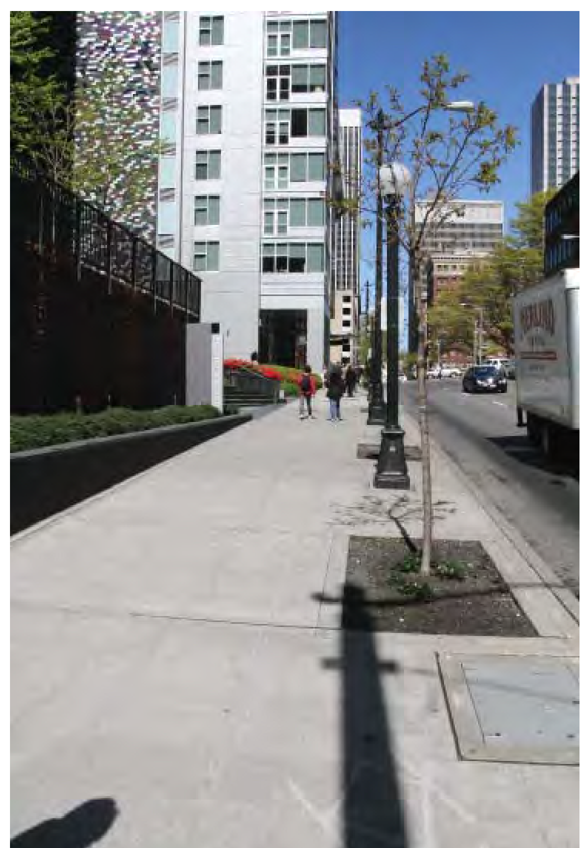
5th & University
Facing south

5th & Spring
Facing north

5th & Spring
Facing south



5th & Marion
Facing north

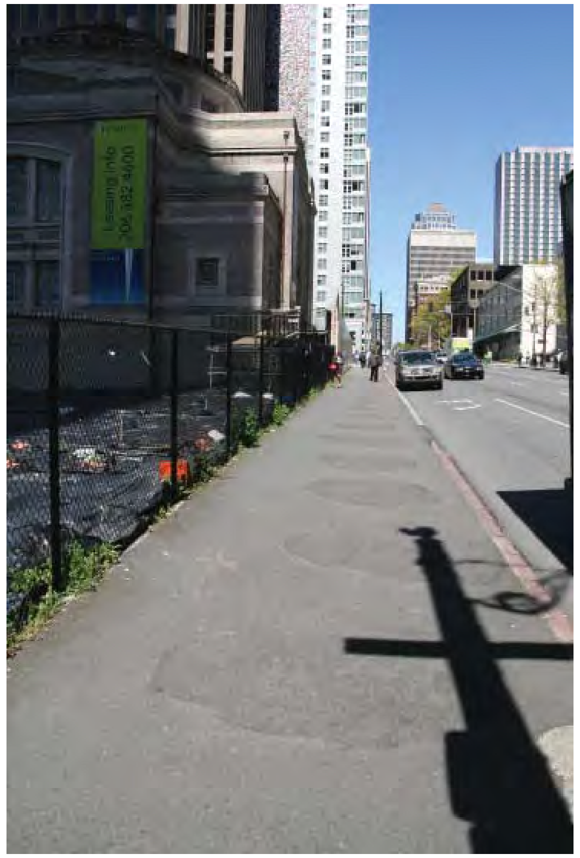


	5TH AVENUE - UNIVERSITY/SENECA
Sidewalk paving	Good condition
Pedestrian crossings	At block ends
Transit facilities	None existing
Adjacent uses	Fairmont Olympic hotel - blank facade for almost entire length of block
Pedestrian lighting	Pedestrian-scale streetlamps
Pedestrian amenities	Trash cans, street trees, bike racks, news kiosk
Unique places or buildings	N/A
Small business opportunities	N/A

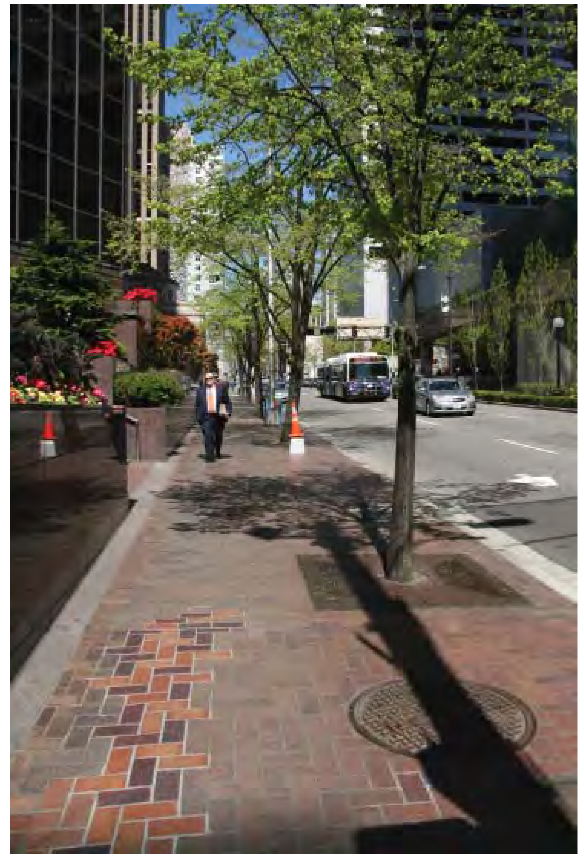
	5TH AVENUE - SENECA/SPRING
Sidewalk paving	Good condition, two large curb cuts for parking garage entry/exit
Pedestrian crossings	At block ends
Transit facilities	N/A
Adjacent uses	Olympic Garage - structured parking
Pedestrian lighting	Pedestrian-scale streetlamps
Pedestrian amenities	Street trees
Unique places or buildings	N/A
Small business opportunities	Potential for temporary use (food truck) inside parking structure along street

	5TH AVENUE - SPRING/MADISON
Sidewalk paving	Good condition
Pedestrian crossings	At block ends
Transit facilities	Bus stop with shelter
Adjacent uses	Seattle Public Library
Pedestrian lighting	Pedestrian-scale streetlamps
Pedestrian amenities	Newspaper boxes, street trees, covered walkway adjacent library
Unique places or buildings	Seattle Public Library
Small business opportunities	N/A

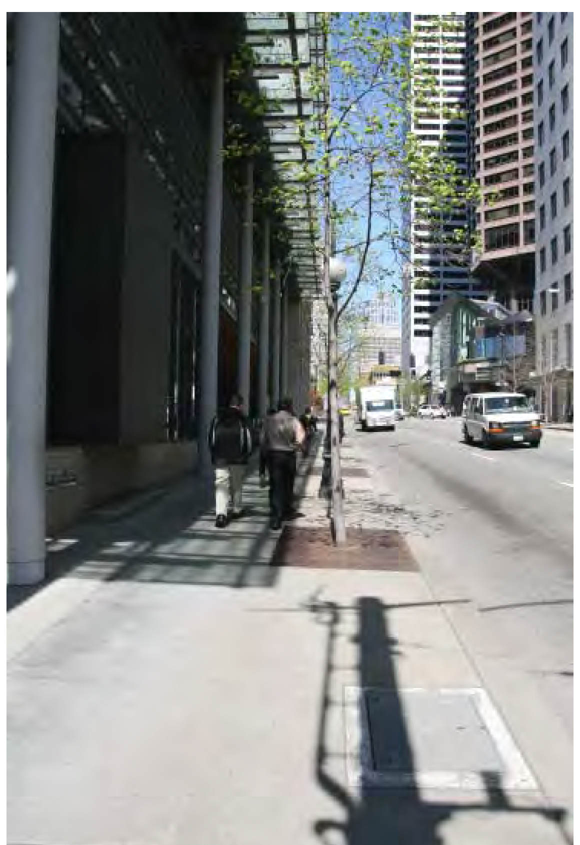
	5TH AVENUE - MADISON/MARION
Sidewalk paving	Good condition
Pedestrian crossings	At block ends
Transit facilities	Bus stop
Adjacent uses	Condo with street-level restaurant space, office building
Pedestrian lighting	Pedestrian-scale streetlamps
Pedestrian amenities	Street trees, publicly-accessible private plaza mid-block
Unique places or buildings	N/A
Small business opportunities	N/A



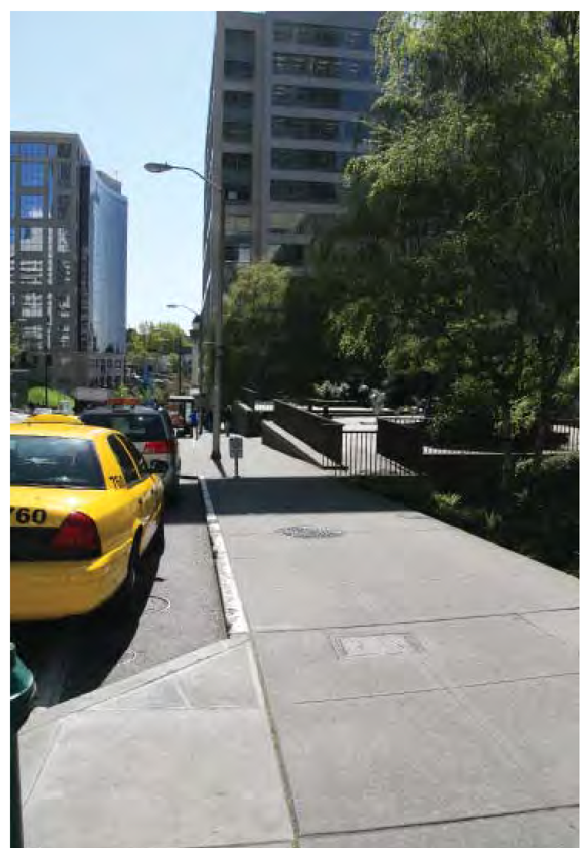
5th & Columbia
Facing north



5th & Cherry
Facing north



5th & James
Facing north



5th & James
Facing south

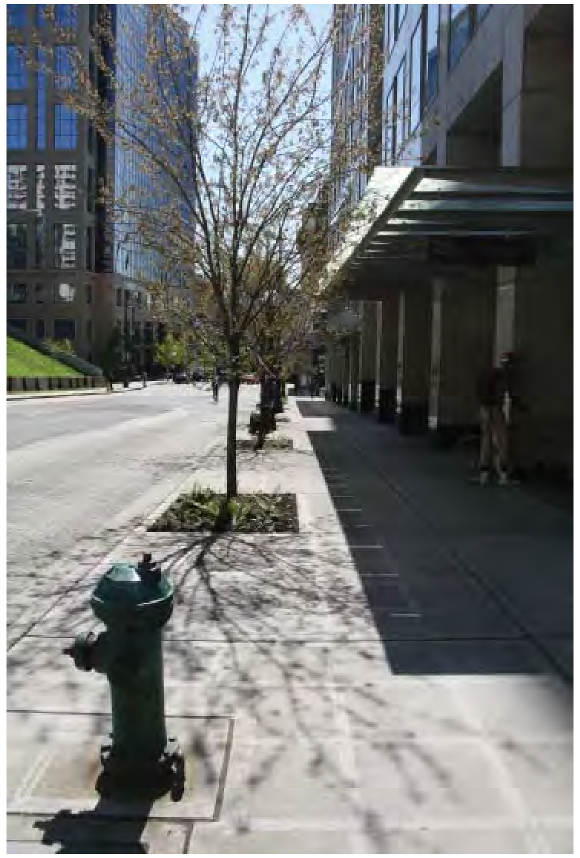
	5TH AVENUE - MARION/COLUMBIA
Sidewalk paving	Narrow sidewalk, needs repair - will be replaced with new construction
Pedestrian crossings	At block ends
Transit facilities	N/A
Adjacent uses	N/A - site under construction
Pedestrian lighting	N/A
Pedestrian amenities	N/A
Unique places or buildings	Historic Sanctuary building
Small business opportunities	N/A

	5TH AVENUE - COLUMBIA/CHERRY
Sidewalk paving	Excellent condition
Pedestrian crossings	At block ends
Transit facilities	N/A
Adjacent uses	Columbia Tower - high-rise office
Pedestrian lighting	Tall, cobra-head lamps at block ends
Pedestrian amenities	Street trees, newspaper boxes, publicly-accessible private plaza
Unique places or buildings	N/A
Small business opportunities	N/A

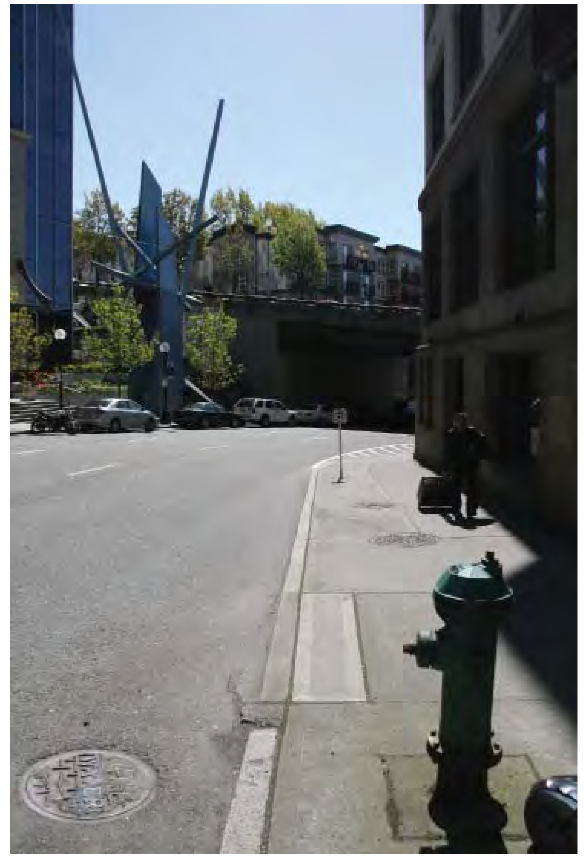
	5TH AVENUE - CHERRY/JAMES
Sidewalk paving	Good condition
Pedestrian crossings	At block ends
Transit facilities	N/A
Adjacent uses	City Hall
Pedestrian lighting	Pedestrian-scale streetlamps
Pedestrian amenities	Street trees, bike racks, trash cans, covered walkway adjacent building
Unique places or buildings	City Hall
Small business opportunities	N/A

	5TH AVENUE - JAMES/JEFFERSON
Sidewalk paving	Good condition
Pedestrian crossings	At block ends
Transit facilities	Bus stop with shelter
Adjacent uses	King County Administration Building - bldg. frontage set back from street wall
Pedestrian lighting	Tall, cobra-head lamps at block ends
Pedestrian amenities	Publicly-accessible private plaza,trees and landscaping in building setback
Unique places or buildings	King County Administration Building
Small business opportunities	N/A

5th & Jefferson
Facing south

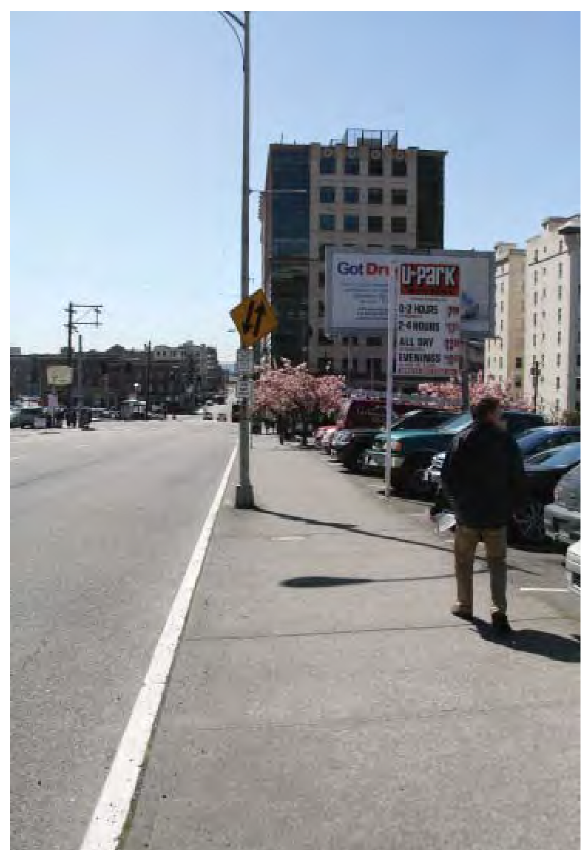


5th & Terrace
Facing south



5th & Washington
Facing north

5th & Main
Facing south



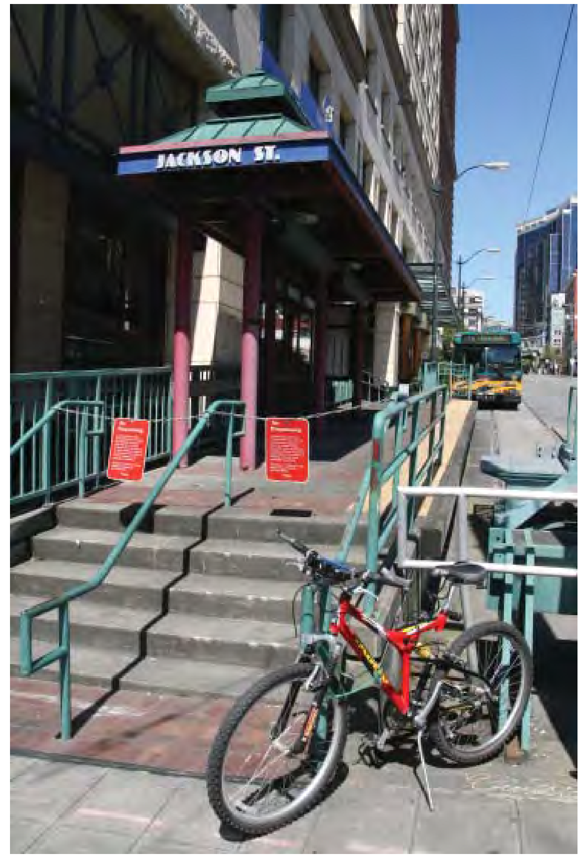
	5TH AVENUE - JEFFERSON/TERRACE
Sidewalk paving	Good condition
Pedestrian crossings	At block ends
Transit facilities	N/A
Adjacent uses	Chinook Building - government offices
Pedestrian lighting	Tall, cobra-head lamps and pedestrian-scale streetlamps
Pedestrian amenities	Street trees, bike racks, canopies
Unique places or buildings	N/A
Small business opportunities	N/A

	5TH AVENUE - TERRACE/YESLER
Sidewalk paving	Good condition - narrow sidewalk
Pedestrian crossings	At block ends
Transit facilities	N/A
Adjacent uses	Government offices
Pedestrian lighting	Tall, cobra-head lamps at block ends
Pedestrian amenities	N/A
Unique places or buildings	N/A
Small business opportunities	N/A

	5TH AVENUE - YESLER/WASHINGTON
Sidewalk paving	Good condition
Pedestrian crossings	At block ends
Transit facilities	N/A
Adjacent uses	Downtown Emergency Services Center, long blank facade
Pedestrian lighting	Tall, cobra-head lamps and one pedestrian-scale streetlamp
Pedestrian amenities	Street trees, landscaping in building setback
Unique places or buildings	N/A
Small business opportunities	N/A

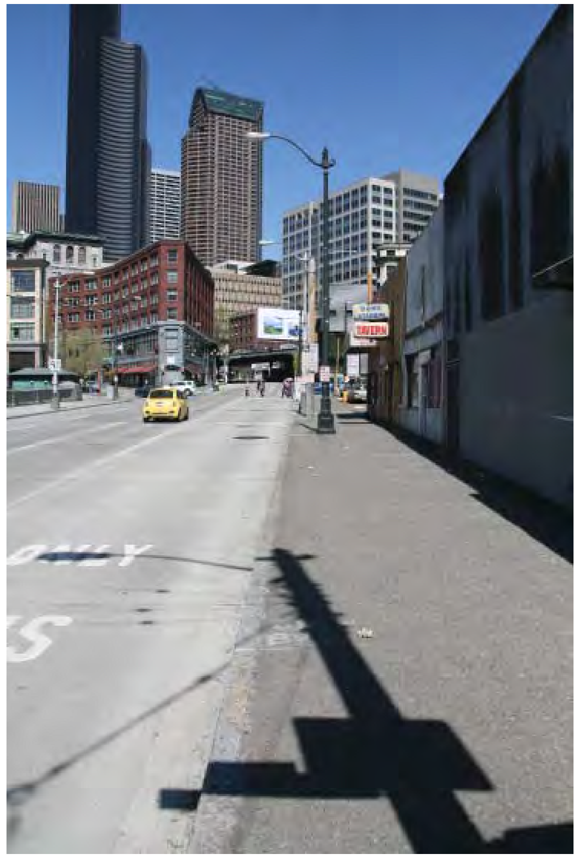
	5TH AVENUE - WASHINGTON/MAIN
Sidewalk paving	Good condition, narrow sidewalk
Pedestrian crossings	At block ends
Transit facilities	N/A
Adjacent uses	Surface parking lot
Pedestrian lighting	Tall, cobra-head lamps
Pedestrian amenities	Street trees on south end of block
Unique places or buildings	N/A
Small business opportunities	N/A (unless redeveloped)

5th & Main
Facing south

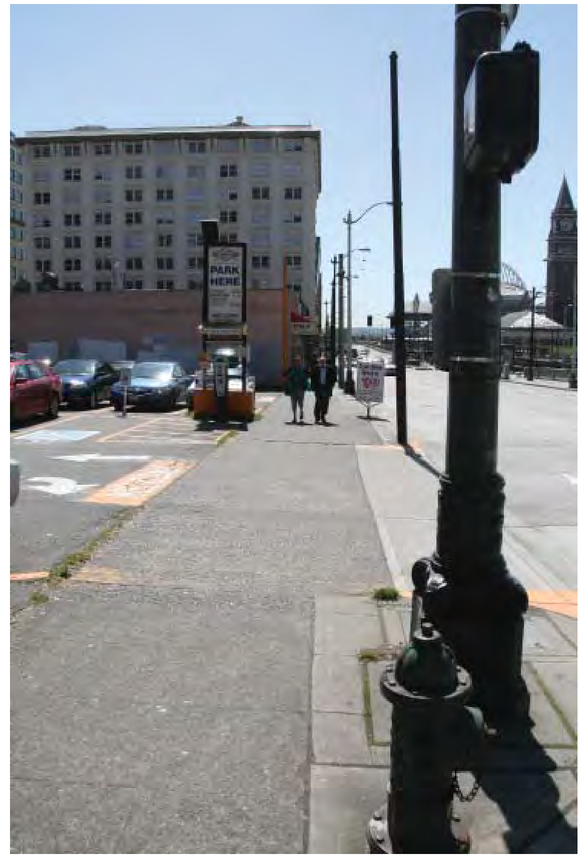


5th & Jackson
Facing north

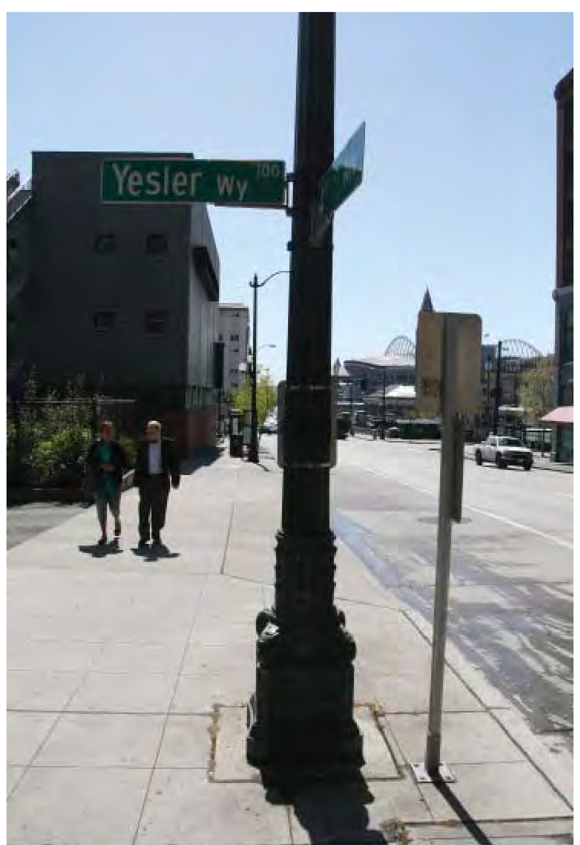
	5TH AVENUE - MAIN/JACKSON
Sidewalk paving	Good condition
Pedestrian crossings	At block ends
Transit facilities	Bus stop, streetcar stop (not in use)
Adjacent uses	Office building
Pedestrian lighting	Tall, cobra-head lamps
Pedestrian amenities	Street tree, canopy at bus stop, bike racks, covered walkway adjacent building
Unique places or buildings	N/A
Small business opportunities	N/A



5th & Main
Facing north



5th & Washington
Facing south



4th & Yesler
Facing south

5th & Jefferson
Facing south

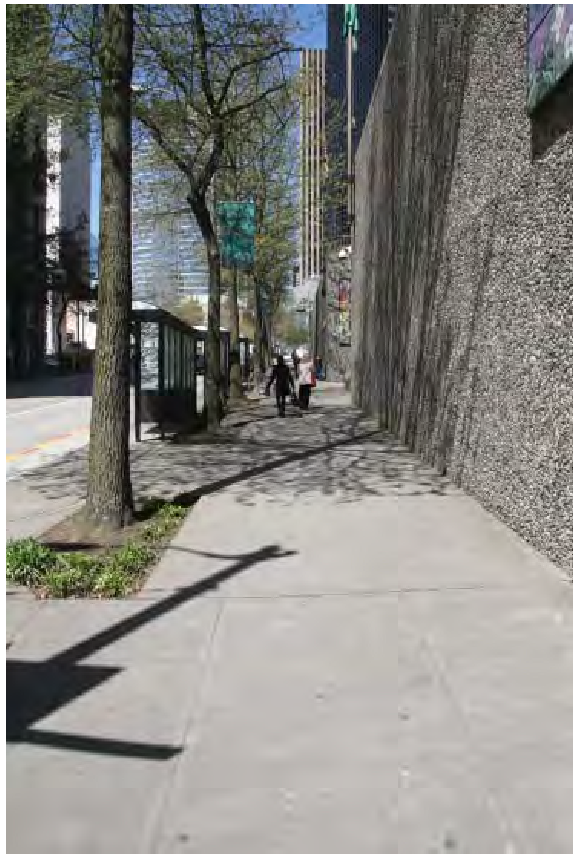
	4TH AVENUE - JACKSON/MAIN
Sidewalk paving	Good condition
Pedestrian crossings	At block ends
Transit facilities	Bus stop in median
Adjacent uses	Surface parking lot, apartment building with ground-floor retail
Pedestrian lighting	Tall, cobra-head lamps
Pedestrian amenities	Water fountain, newspaper box, mailbox
Unique places or buildings	N/A
Small business opportunities	Small retail frontages on north half of block, some vacant

	4TH AVENUE - MAIN/WASHINGTON
Sidewalk paving	Good condition
Pedestrian crossings	At block ends
Transit facilities	N/A
Adjacent uses	Retail, surface parking
Pedestrian lighting	Tall, cobra-head lamps
Pedestrian amenities	N/A
Unique places or buildings	N/A
Small business opportunities	Small retail frontages on south half of block, some vacant

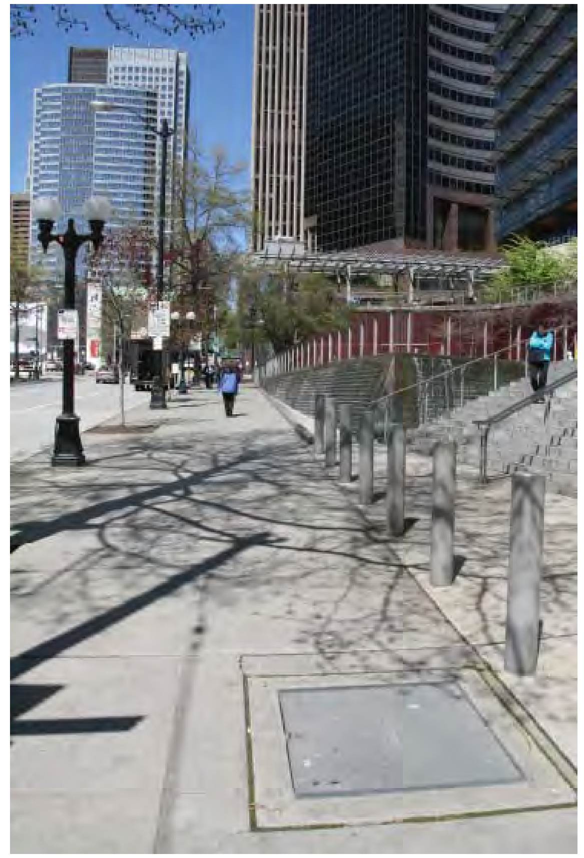
	4TH AVENUE - WASHINGTON/YESLER
Sidewalk paving	Good condition
Pedestrian crossings	At block ends
Transit facilities	Bus stop with shelter
Adjacent uses	Downtown Emergency Services Center, long blank facade; surface parking
Pedestrian lighting	Tall, cobra-head lamps and pedestrian-scale streetlamps
Pedestrian amenities	Some street trees, landscape buffer at parking lot
Unique places or buildings	N/A
Small business opportunities	N/A

	4TH AVENUE - YESLER/JAMES
Sidewalk paving	Good condition, narrow in places - large wells cut for street trees, curb cuts at parking
Pedestrian crossings	At block ends
Transit facilities	N/A
Adjacent uses	Parking garage, apartments, surface parking, low-rise office
Pedestrian lighting	Tall, cobra-head lamps and pedestrian-scale streetlamps
Pedestrian amenities	Street trees
Unique places or buildings	N/A
Small business opportunities	Minimal - small office frontage at north end of block

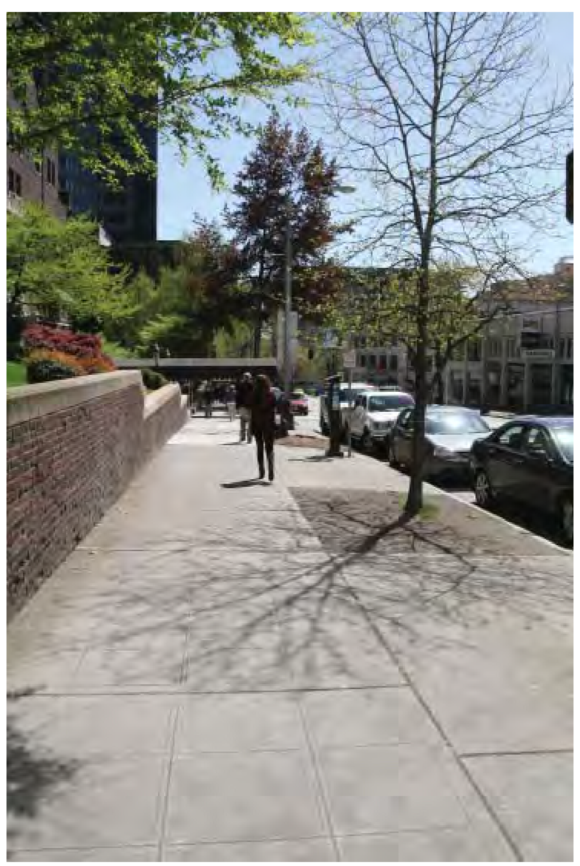
4th & Jefferson
Facing north



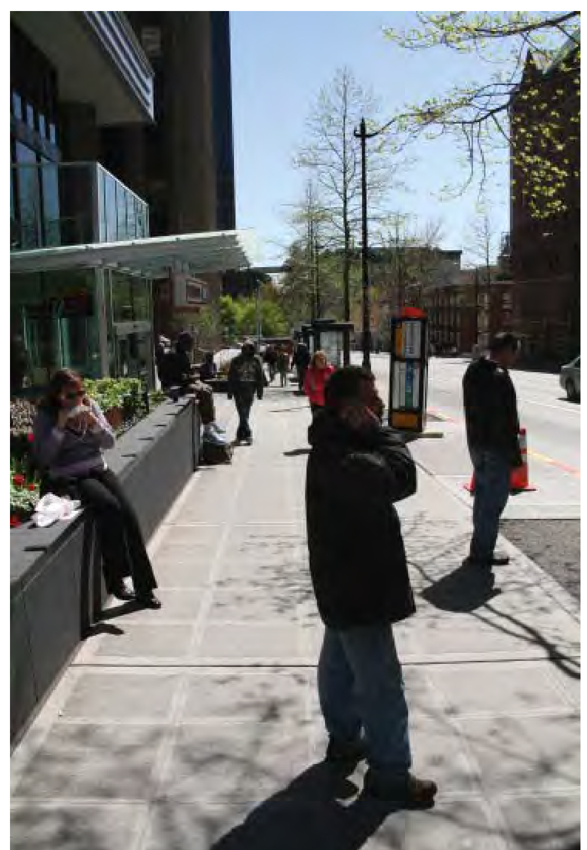
4th & James
Facing north



4th & Marion
Facing north



4th & Madison
Facing south



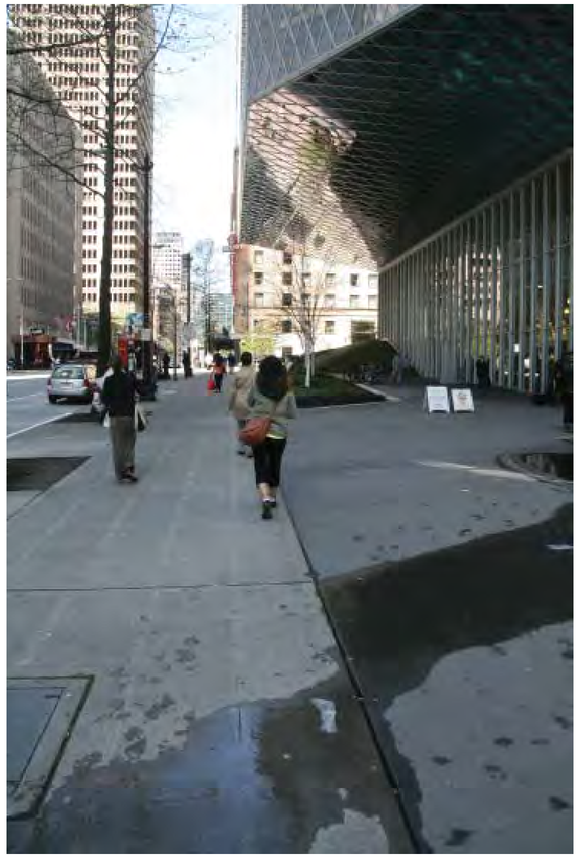
	4TH AVENUE - JAMES/CHERRY
Sidewalk paving	Good condition
Pedestrian crossings	At block ends
Transit facilities	Bus stop with multiple shelters
Adjacent uses	King County Administration Building - long, tall blank facade
Pedestrian lighting	Tall, cobra-head lamps
Pedestrian amenities	Street trees, trash cans, bike racks
Unique places or buildings	N/A
Small business opportunities	N/A

	4TH AVENUE - CHERRY/COLUMBIA
Sidewalk paving	Good condition
Pedestrian crossings	At block ends
Transit facilities	N/A
Adjacent uses	City Hall
Pedestrian lighting	Tall, cobra-head lamps and pedestrian-scale streetlamps
Pedestrian amenities	Street trees, bike racks, public plaza with water feature
Unique places or buildings	City Hall
Small business opportunities	One small retail frontage at north end of block

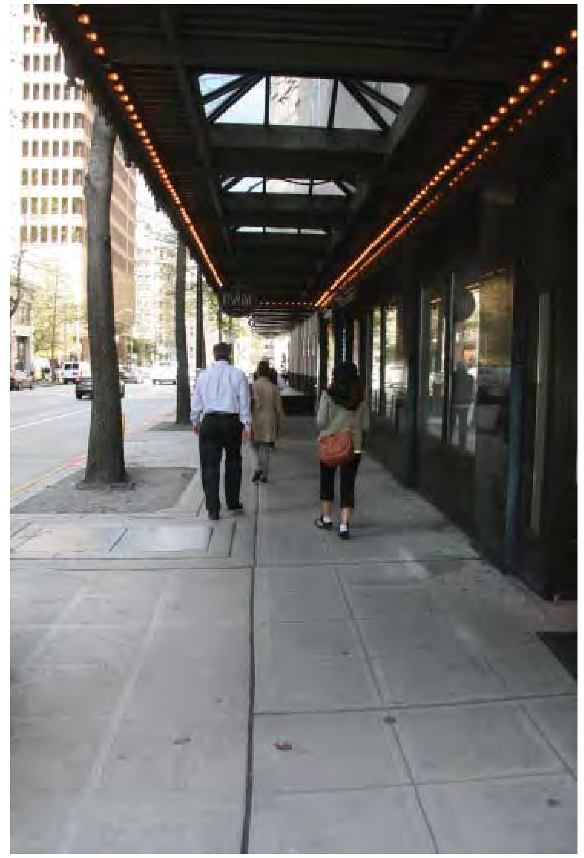
	4TH AVENUE - COLUMBIA/MARION
Sidewalk paving	Excellent condition
Pedestrian crossings	At block ends
Transit facilities	Bus stop
Adjacent uses	Columbia Tower (high-rise office), office with ground-floor restaurant & outdoor dining
Pedestrian lighting	Tall, cobra-head lamps
Pedestrian amenities	Street trees, bike racks
Unique places or buildings	Historic McCormick's building
Small business opportunities	Restaurant frontage on north half of block

	4TH AVENUE - MARION/MADISON
Sidewalk paving	Good condition
Pedestrian crossings	At block ends
Transit facilities	N/A
Adjacent uses	The Rainier Club, building set back from sidewalk
Pedestrian lighting	Tall, cobra-head lamps
Pedestrian amenities	Street trees
Unique places or buildings	Historic Rainier Club building
Small business opportunities	N/A

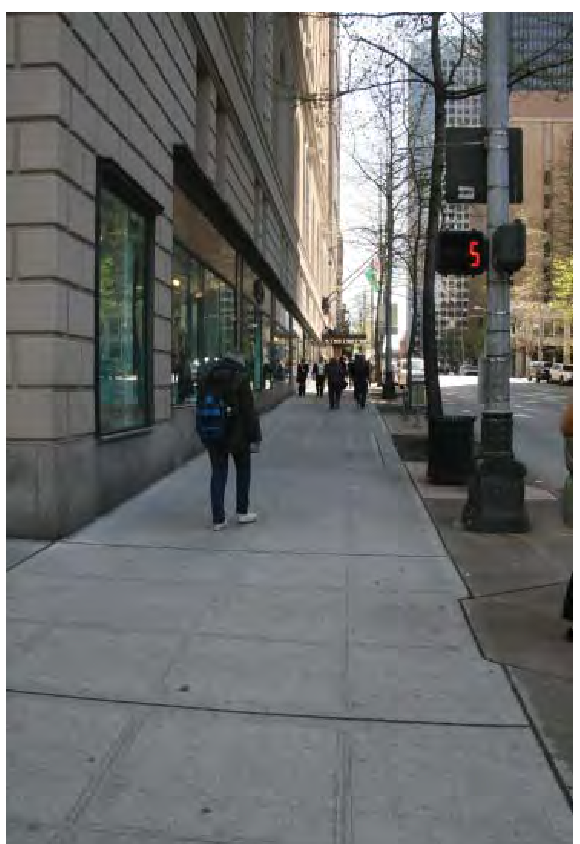
4th & Madison
Facing north



4th & Spring
Facing north



4th & University
Facing south



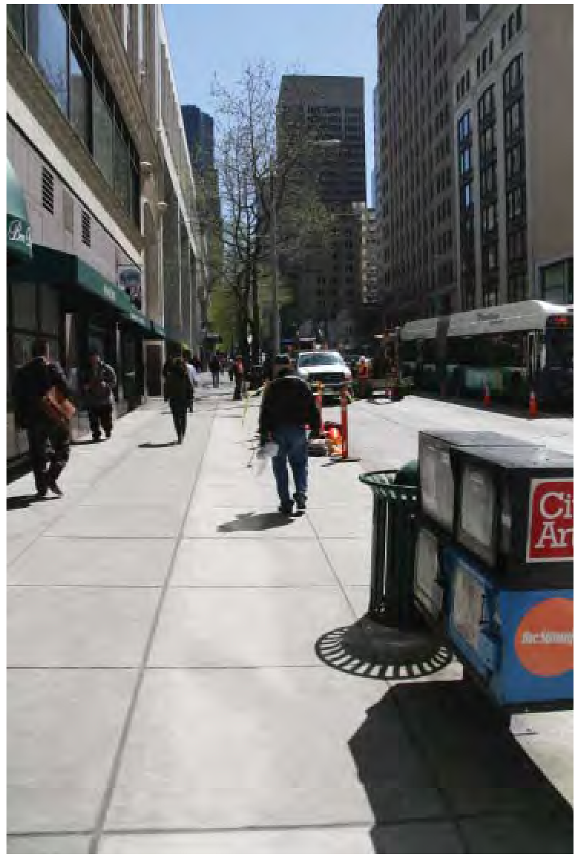
4th & Union
Facing south

	4TH AVENUE - MADISON/SPRING
Sidewalk paving	Good condition
Pedestrian crossings	At block ends
Transit facilities	N/A
Adjacent uses	Seattle Public Library
Pedestrian lighting	Tall, cobra-head lamps
Pedestrian amenities	Street trees, benches, food truck parking space, trash cans, canopy, public plaza
Unique places or buildings	Seattle Public Library
Small business opportunities	N/A

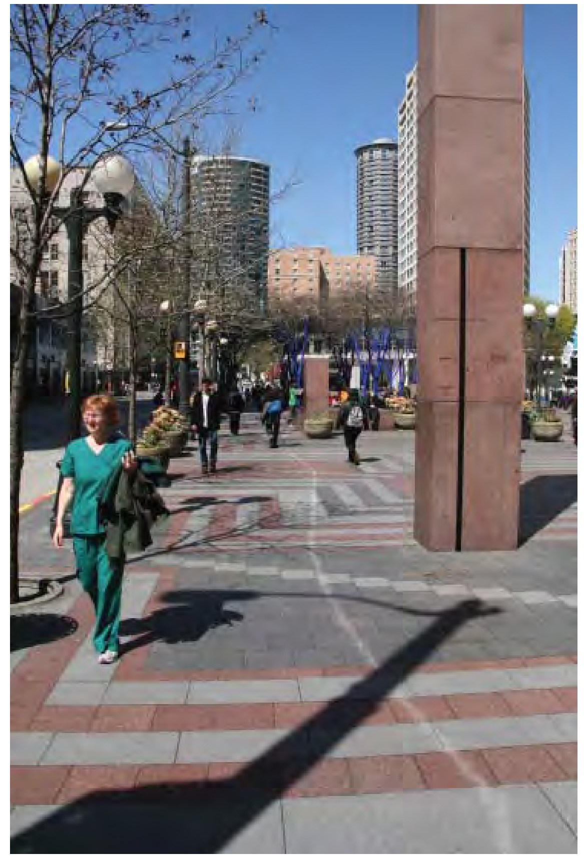
	4TH AVENUE - SPRING/SENECA
Sidewalk paving	Good condition
Pedestrian crossings	At block ends
Transit facilities	Bus stop
Adjacent uses	Coffee shop, restaurants, hotel
Pedestrian lighting	Tall, cobra-head lamps
Pedestrian amenities	Street trees, trash cans, cafe seating
Unique places or buildings	N/A
Small business opportunities	Some spaces for retail/restaurant

	4TH AVENUE - SENECA/UNIVERSITY
Sidewalk paving	Good condition
Pedestrian crossings	At block ends
Transit facilities	N/A
Adjacent uses	Hotel, ground-floor restaurants and retail
Pedestrian lighting	Tall, cobra-head lamps
Pedestrian amenities	Street trees, bike racks, trash cans,
Unique places or buildings	Fairmont Olympic Hotel
Small business opportunities	Continuous retail and restaurant frontage along entire block

	4TH AVENUE - UNIVERSITY/UNION
Sidewalk paving	Good condition, extra-wide
Pedestrian crossings	At block ends
Transit facilities	Bus stop with several shelters
Adjacent uses	High-rise office with ground-level retail, building set back from street at mid-block
Pedestrian lighting	Tall, cobra-head lamps
Pedestrian amenities	Street trees, newspaper boxes, trash cans
Unique places or buildings	N/A
Small business opportunities	Retail frontage along 2/3 of block

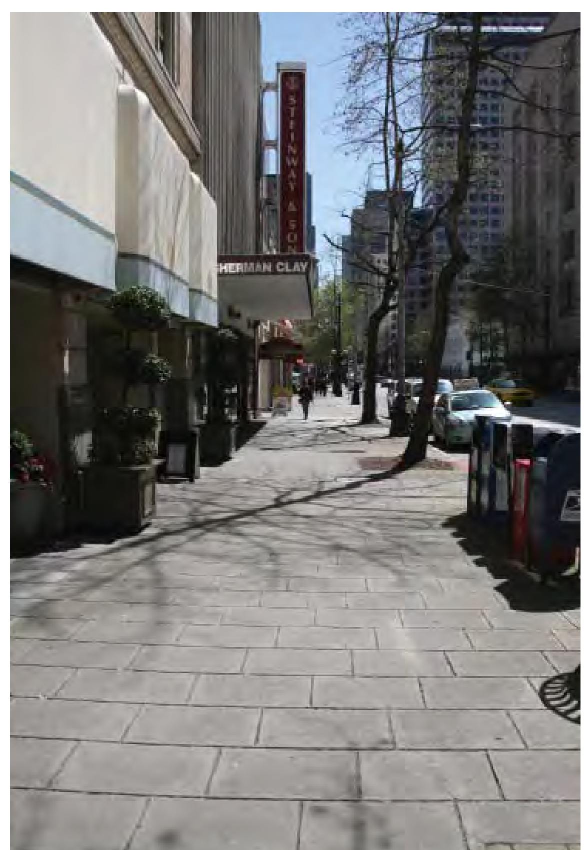


4th & Pike
Facing south



4th & Pike
Facing north

4th & Pine
Facing south



4th & Olive
Facing south

	4TH AVENUE - UNION/PIKE
Sidewalk paving	Good condition
Pedestrian crossings	At block ends
Transit facilities	Bus stop with several shelters
Adjacent uses	Office, hotel, bank, ground-floor retail
Pedestrian lighting	Tall, cobra-head lamps
Pedestrian amenities	Street trees, trash cans, intermittent canopies, newspaper boxes
Unique places or buildings	N/A
Small business opportunities	Some retail frontage

	4TH AVENUE - PIKE/PINE
Sidewalk paving	Excellent condition
Pedestrian crossings	At block ends
Transit facilities	Bus stop
Adjacent uses	Westlake Park, office with ground-floor retail
Pedestrian lighting	Tall, cobra-head lamps and pedestrian-scale streetlamps
Pedestrian amenities	Street trees, water feature, seating, trash cans, public plaza, water fountain, play area
Unique places or buildings	Westlake Park
Small business opportunities	Some retail frontage behind plaza; vendors/food carts possible in plaza?

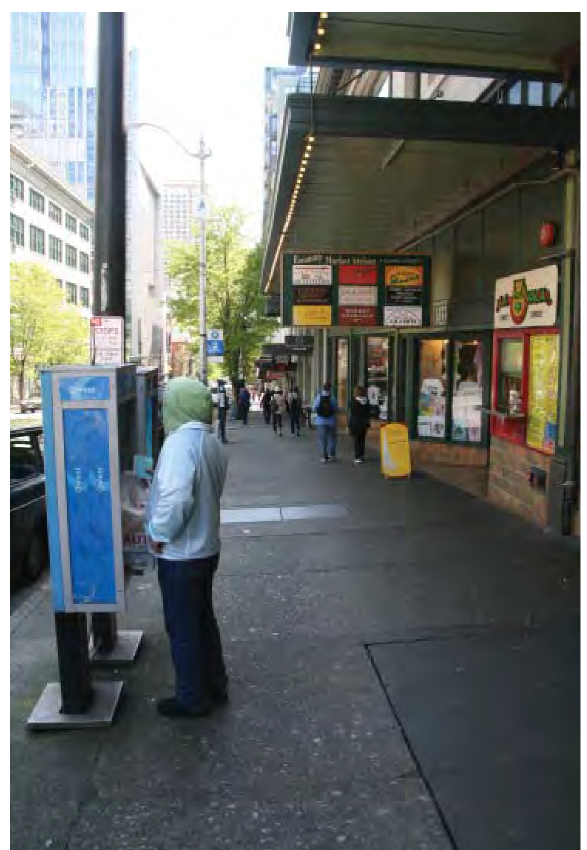
	4TH AVENUE - PINE/OLIVE
Sidewalk paving	Excellent condition
Pedestrian crossings	At block ends
Transit facilities	N/A
Adjacent uses	Coffee shop, mall, retail, restaurant, public plaza
Pedestrian lighting	Tall, cobra-head lamps and pedestrian-scale streetlamps
Pedestrian amenities	Street trees, seating, trash cans, newspaper boxes, mailbox, intermittent canopies
Unique places or buildings	Westlake Plaza
Small business opportunities	Retail/restaurant frontage along most of block

2nd & Stewart
Facing west

1st & Stewart
Facing south

1st & Pike
Facing north

1st & Pike
Facing south



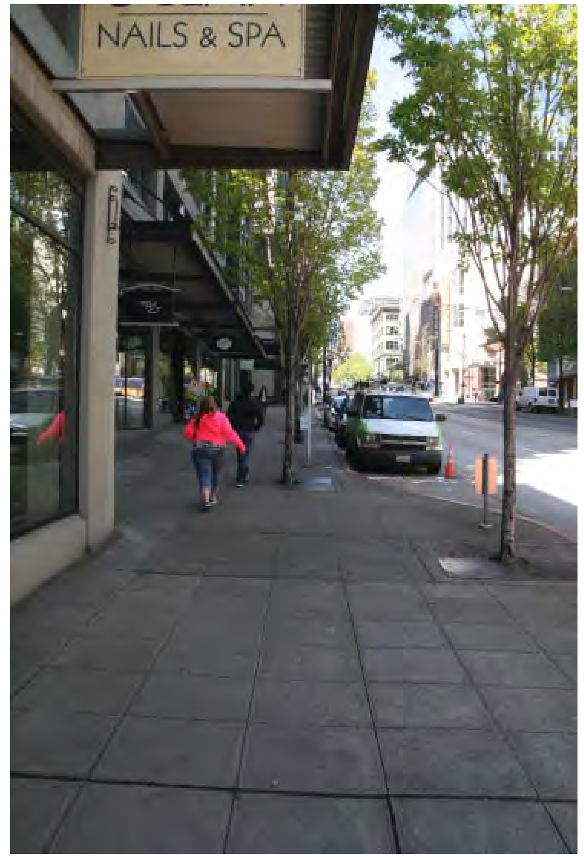
	STEWART STREET - PINE/1ST
Sidewalk paving	Good condition
Pedestrian crossings	At block ends
Transit facilities	N/A
Adjacent uses	Office, coffee shop and retail at corners
Pedestrian lighting	Tall, cobra-head lamps
Pedestrian amenities	Street trees, bike racks, cafe seating, newspaper boxes
Unique places or buildings	N/A
Small business opportunities	Limited spaces for retail/cafe

	1ST AVENUE - STEWART/PINE
Sidewalk paving	Good condition
Pedestrian crossings	At block ends
Transit facilities	N/A
Adjacent uses	Midrise apartments with ground-floor retail, restaurant
Pedestrian lighting	Pedestrian-scale streetlamps
Pedestrian amenities	Street trees, newspaper boxes, trash cans, cafe seating, canopies
Unique places or buildings	N/A
Small business opportunities	Continuous retail frontage at street level

	1ST AVENUE - PINE/PIKE
Sidewalk paving	Fair condition - could use some repair/upgrades
Pedestrian crossings	At block ends
Transit facilities	N/A
Adjacent uses	Midrise apartments with ground-level retail and public market retail and cafes
Pedestrian lighting	Pedestrian-scale streetlamps
Pedestrian amenities	Newspaper boxes, trash cans, cafe seating, canopies, mailboxes, bike racks
Unique places or buildings	Pike Place Market
Small business opportunities	Continuous retail frontage at street level

	1ST AVENUE - PIKE/UNION
Sidewalk paving	North half of block needs repair, south half of block in good condition
Pedestrian crossings	At block ends
Transit facilities	N/A
Adjacent uses	Public market, restaurant, cafe, retail; apartments above
Pedestrian lighting	Tall, cobra-head lamps and pedestrian-scale streetlamps
Pedestrian amenities	Street trees, intermittent canopies, bike racks, trash cans, cafe seating, pay phones
Unique places or buildings	Pike Place Market
Small business opportunities	Continuous retail frontage at street level

1st & University
Facing south



1st & Seneca
Facing north

1st & Spring
Facing north

1st & Madison
Facing north

	1ST AVENUE - UNION/UNIVERSITY
Sidewalk paving	Good condition
Pedestrian crossings	At block ends
Transit facilities	Bus stop
Adjacent uses	High-rise hotel and residential with ground-floor retail, theater
Pedestrian lighting	Tall, cobra-head lamps and pedestrian-scale streetlamps
Pedestrian amenities	Street trees, cafe seating, planters, trash cans, intermittent canopies, short blank wall
Unique places or buildings	Harbor Steps (at University)
Small business opportunities	Retail frontage along most of block, vacant theater building

	1ST AVENUE - UNIVERSITY/SENECA
Sidewalk paving	Good condition
Pedestrian crossings	At block ends
Transit facilities	N/A
Adjacent uses	High-rise apartments with street-level restaurants, galleries and retail
Pedestrian lighting	Tall, cobra-head lamps
Pedestrian amenities	Street trees, trash cans, intermittent canopies
Unique places or buildings	Harbor Steps (at University), stair access to Western/waterfront (at Seneca)
Small business opportunities	Retail frontage along most of block

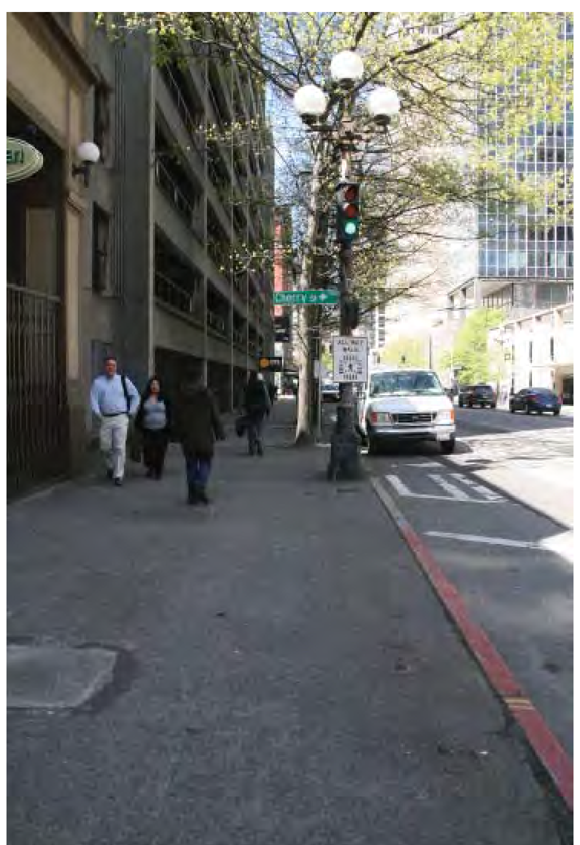
	1ST AVENUE - SENECA/SPRING
Sidewalk paving	Good condition
Pedestrian crossings	At block ends
Transit facilities	Bus stop with shelter
Adjacent uses	Mid- and high-rise apartments with retail, cafe and office at street level
Pedestrian lighting	Tall, cobra-head lamps
Pedestrian amenities	Street trees on south half of block, newspaper boxes, mailbox, bike racks,
Unique places or buildings	Stair access to Western/waterfront (at Seneca)
Small business opportunities	Retail frontage along most of block

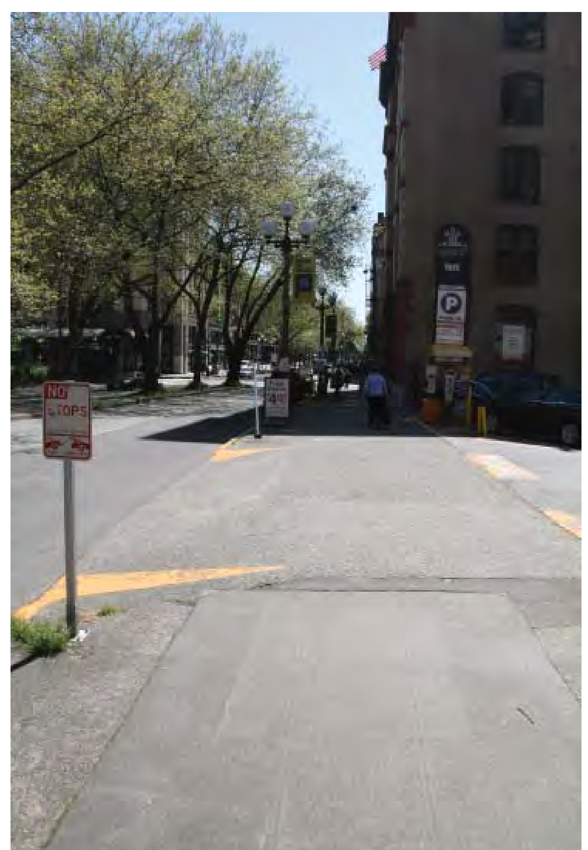
	1ST AVENUE - SPRING/MADISON
Sidewalk paving	Good condition
Pedestrian crossings	At block ends
Transit facilities	N/A
Adjacent uses	Midrise aparments and hotel with restaurant, retail and salon at street level
Pedestrian lighting	Tall, cobra-head lamps
Pedestrian amenities	Trash cans, cafe seating, bike racks, one entry canopy,
Unique places or buildings	N/A
Small business opportunities	Continuous retail frontage at street level

1st & Marion
Facing north

1st & Marion
Facing south

1st & Cherry
Facing north





1st & Cherry
Facing south

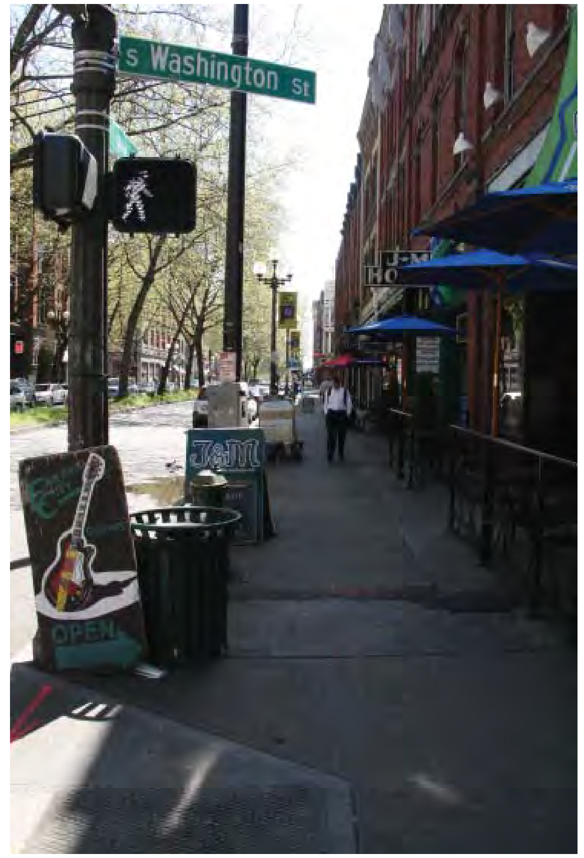
	1ST AVENUE - MADISON/MARION
Sidewalk paving	Good condition
Pedestrian crossings	At block ends
Transit facilities	N/A
Adjacent uses	Federal office building - post office; long blank facade
Pedestrian lighting	Tall, cobra-head lamps
Pedestrian amenities	Street trees, newspaper boxes, bike racks, mailboxes, wayfinding signage
Unique places or buildings	Historic Federal Office Building
Small business opportunities	N/A

	1ST AVENUE - MARION/COLUMBIA
Sidewalk paving	Good condition, areaway pavers adjacent buildings
Pedestrian crossings	At block ends
Transit facilities	N/A
Adjacent uses	Office building with restaurant and retail at street level
Pedestrian lighting	Tall, cobra-head lamps, lighting on building canopies
Pedestrian amenities	Canopies, newspaper boxes, trash cans, bike rack, cafe seating
Unique places or buildings	Character building - Colman Building; bridge to Colman Dock/ferry terminal
Small business opportunities	Retail frontage along most of block

	1ST AVENUE - COLUMBIA/CHERRY
Sidewalk paving	Good condition, narrow sidewalk
Pedestrian crossings	At block ends
Transit facilities	N/A
Adjacent uses	Bank, parking garage, small gallery/retail at south end of block
Pedestrian lighting	Pedestrian-scale streetlamps
Pedestrian amenities	Street trees, trash cans, newspaper boxes
Unique places or buildings	N/A
Small business opportunities	Limited spaces for retail

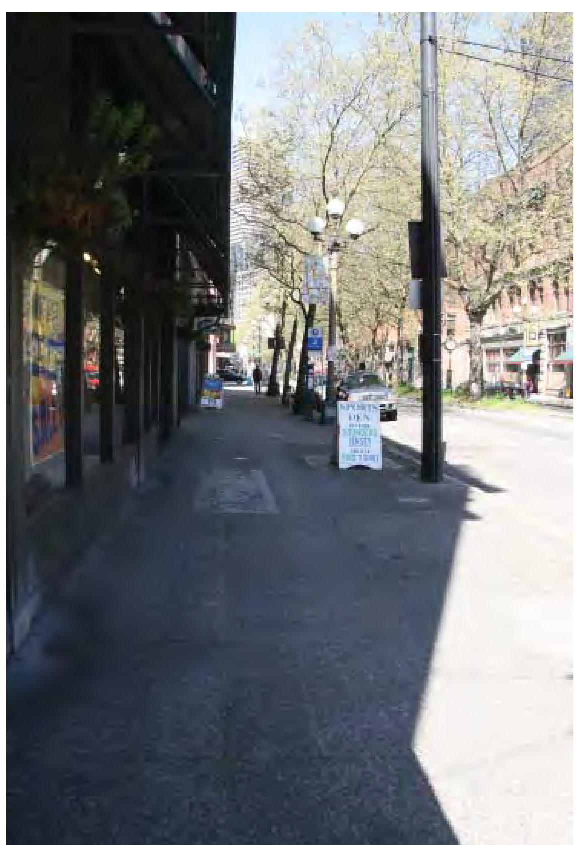
	1ST AVENUE - CHERRY/YESLER
Sidewalk paving	Fair condition, two large curb cuts for surface parking lot, areaway paving to south
Pedestrian crossings	At block ends
Transit facilities	N/A
Adjacent uses	Surface parking, office with ground-level retail
Pedestrian lighting	Pedestrian-scale streetlamps
Pedestrian amenities	Trash cans, street trees in median
Unique places or buildings	Character building - Mutual Life Building
Small business opportunities	Limited spaces for retail

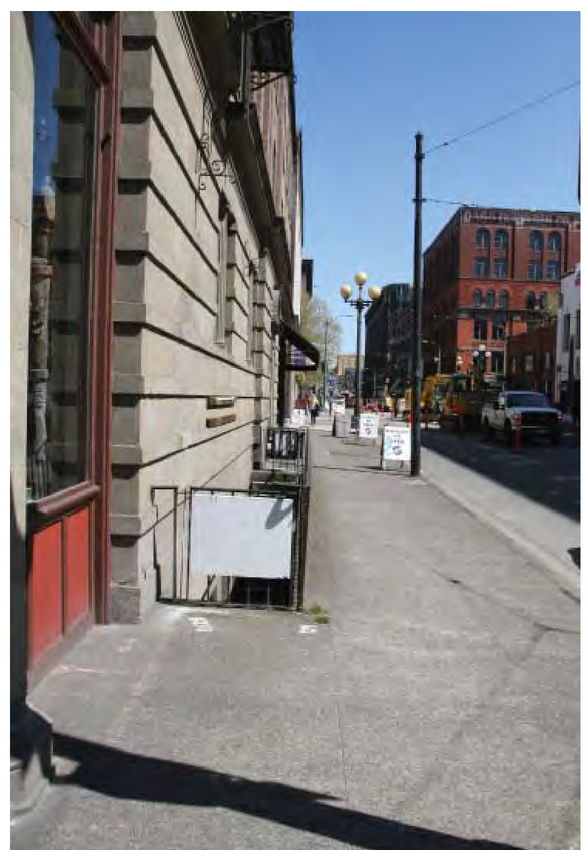
1st & Yesler
Facing south



1st & Washington
Facing south

1st & Jackson
Facing north





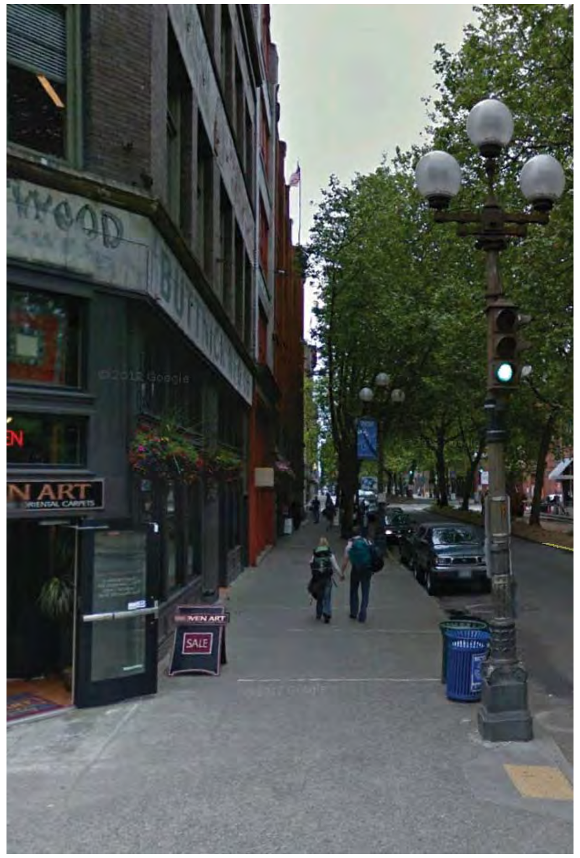
1st & Jackson
Facing east

	1ST AVENUE - YESLER/WASHINGTON
Sidewalk paving	Fair condition, areaway paving (covered over in some places)
Pedestrian crossings	At block ends
Transit facilities	N/A
Adjacent uses	Residential with restaurant and retail below
Pedestrian lighting	Pedestrian-scale streetlamps
Pedestrian amenities	Trash cans, mailbox, newspaper boxes, cafe seating, street trees in median
Unique places or buildings	Character buildings - Maynard Building, Terry/Denny Building
Small business opportunities	Retail/restaurant frontage along most of block

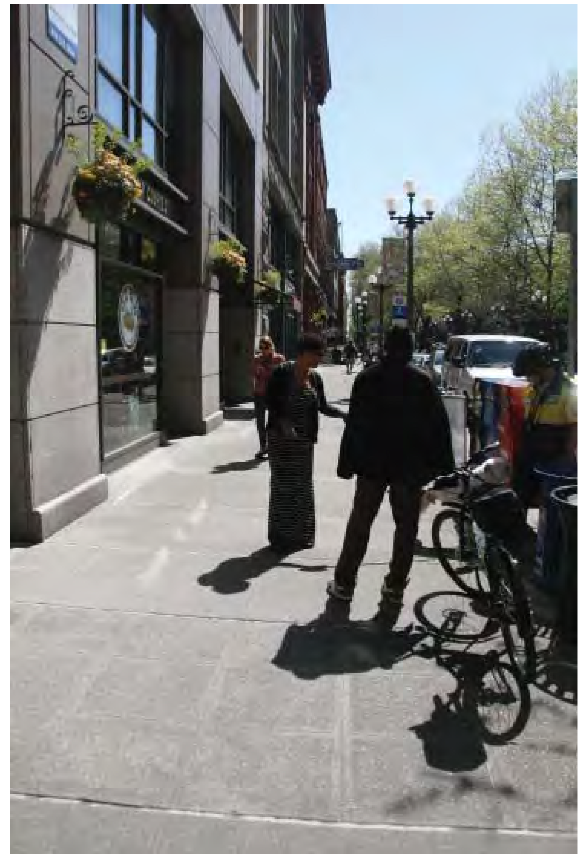
	1ST AVENUE - WASHINGTON/MAIN
Sidewalk paving	Fair condition
Pedestrian crossings	At block ends
Transit facilities	N/A
Adjacent uses	Midrise residential with retail and restaurant below
Pedestrian lighting	Pedestrian-scale streetlamps
Pedestrian amenities	Trash cans, newspaper boxes, cafe seating, some canopies, street trees in median
Unique places or buildings	Character buildings - Skagit Building, OK Cafe, Marathon Building, others
Small business opportunities	Continuous retail frontage at street level

	1ST AVENUE - MAIN/JACKSON
Sidewalk paving	Fair condition, areaway paving
Pedestrian crossings	At block ends
Transit facilities	N/A
Adjacent uses	Midrise residential with street-level retail, surface parking, Bread of Life Mission
Pedestrian lighting	Pedestrian-scale streetlamps
Pedestrian amenities	Street trees, trash cans, some canopies, street trees in median
Unique places or buildings	Character buildings
Small business opportunities	Retail frontage along most of block

1st & Washington
Facing south

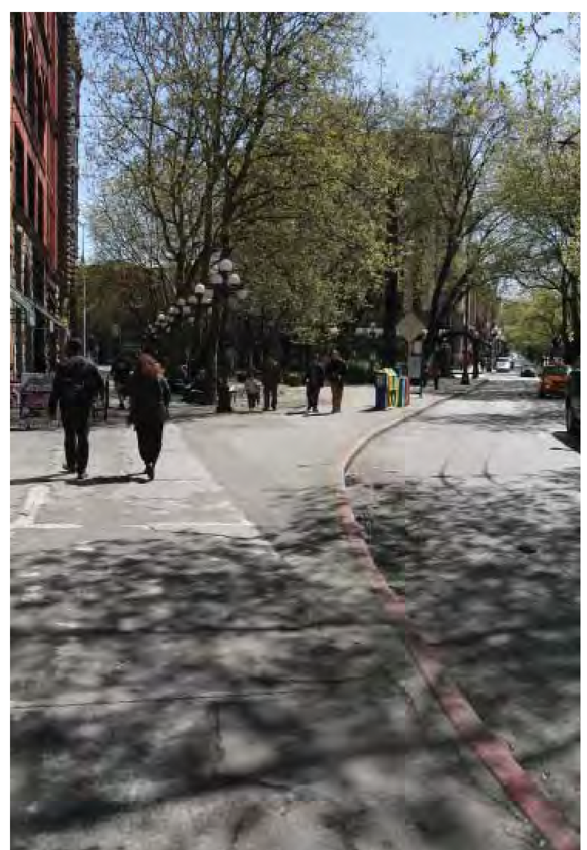


1st & Yesler
Facing south



1st & Yesler
Facing north

1st & Cherry
Facing south



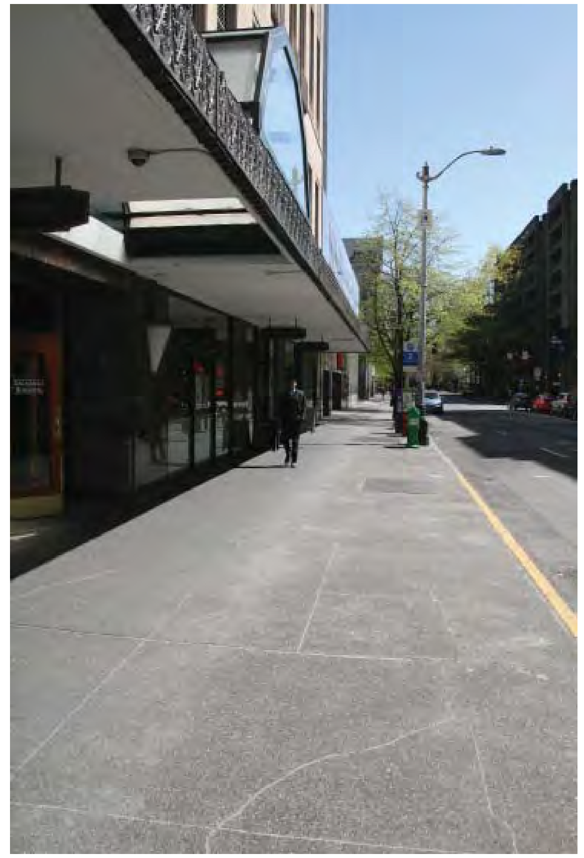
	1ST AVENUE - JACKSON/MAIN
Sidewalk paving	Fair condition
Pedestrian crossings	At block ends
Transit facilities	N/A
Adjacent uses	Mid-rise office and residential with street-level retail
Pedestrian lighting	Pedestrian-scale streetlamps
Pedestrian amenities	Newspaper boxes, some canopies, trash cans, street trees in median
Unique places or buildings	Character buildings - Globe Office Building, others
Small business opportunities	Continuous retail frontage at street level

	1ST AVENUE - MAIN/WASHINGTON
Sidewalk paving	Fair condition
Pedestrian crossings	At block ends
Transit facilities	N/A
Adjacent uses	Mid-rise office and residential with street-level retail
Pedestrian lighting	Pedestrian-scale streetlamps
Pedestrian amenities	Street trees, newspaper boxes, bike racks, some canopies, street trees in median
Unique places or buildings	Character buildings - Grand Central on the Park, others
Small business opportunities	Continuous retail frontage at street level

	1ST AVENUE - WASHINGTON/YESLER
Sidewalk paving	Fair condition, areaway paving
Pedestrian crossings	At block ends
Transit facilities	N/A
Adjacent uses	Mid-rise office and residential with street-level retail and restaurant
Pedestrian lighting	Pedestrian-scale streetlamps
Pedestrian amenities	Trash cans, bike racks, cafe seating, newspaper boxes
Unique places or buildings	Character buildings - Delmar Building, others
Small business opportunities	Continuous restaurant and retail frontage at street level

	1ST AVENUE - YESLER/CHERRY
Sidewalk paving	Good condition
Pedestrian crossings	At block ends
Transit facilities	Bus stop
Adjacent uses	Office and apartment with retail and restaurant at street level
Pedestrian lighting	Pedestrian-scale streetlamps
Pedestrian amenities	Public plaza, planters, benches, trash cans, bike racks, public art, street trees in median
Unique places or buildings	Pioneer Square Park
Small business opportunities	Continuous restaurant and retail frontage at street level

1st & Columbia
Facing south



1st & Marion
Facing south

1st & Madison
Facing south

1st & Madison
Facing north

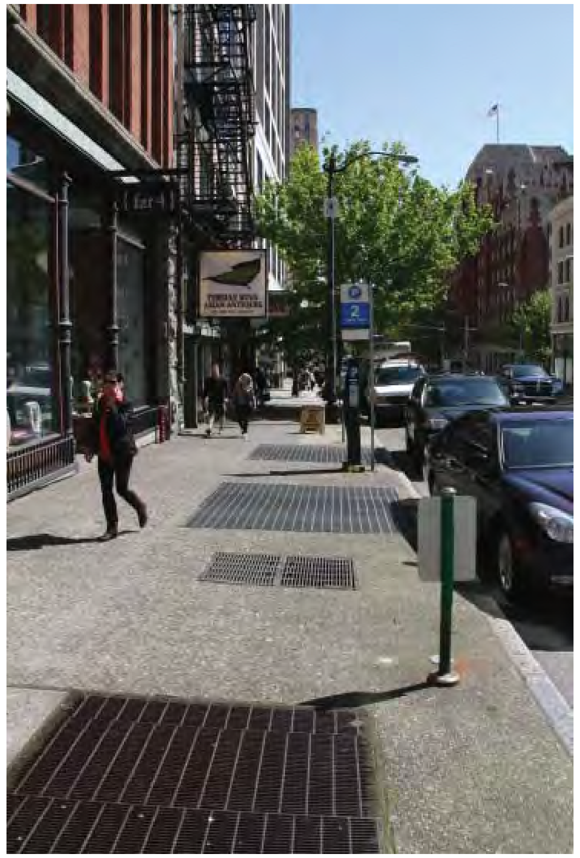
	1ST AVENUE - CHERRY/COLUMBIA
Sidewalk paving	Good condition
Pedestrian crossings	At block ends
Transit facilities	N/A
Adjacent uses	Restaurant, parking garage (long blank facade)
Pedestrian lighting	Pedestrian-scale streetlamps
Pedestrian amenities	Street trees at north end, bike racks, trash cans, newspaper boxes
Unique places or buildings	N/A
Small business opportunities	Limited spaces for retail

	1ST AVENUE - COLUMBIA/MARION
Sidewalk paving	Good condition
Pedestrian crossings	At block ends
Transit facilities	N/A
Adjacent uses	High-rise office, some retail at street level to north; long blank facade to south
Pedestrian lighting	Tall, cobra-head lamps
Pedestrian amenities	Street trees on south end of block, bike racks, newspaper boxes, trash cans
Unique places or buildings	N/A
Small business opportunities	Limited spaces for retail

	1ST AVENUE - MARION/MADISON
Sidewalk paving	Excellent condition
Pedestrian crossings	At block ends
Transit facilities	Bus stop with several shelters
Adjacent uses	High-rise office, some retail at street level to north; long blank facade to south
Pedestrian lighting	Tall, cobra-head lamps
Pedestrian amenities	Street trees, newspaper boxes, trash cans, stair to 2nd Avenue
Unique places or buildings	N/A
Small business opportunities	N/A

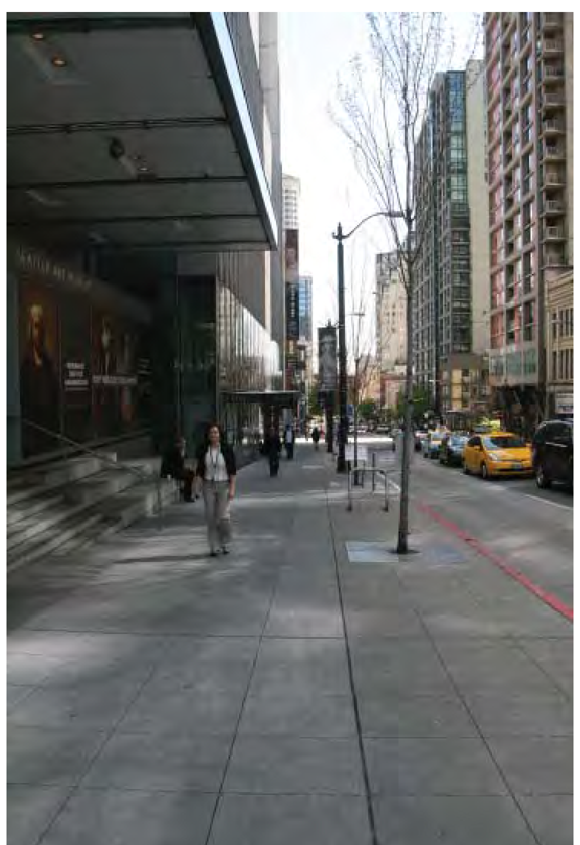
	1ST AVENUE - MADISON/SPRING
Sidewalk paving	Good condition
Pedestrian crossings	At block ends
Transit facilities	N/A
Adjacent uses	Office and residential with ground-level retail, hotel with ground-level restaurant
Pedestrian lighting	Tall, cobra-head lamps and pedestrian-scale streetlamps
Pedestrian amenities	Street trees, cafe seating, some canopies
Unique places or buildings	N/A
Small business opportunities	Retail frontage along most of block

1st & Spring
Facing south



1st & Spring
Facing north

1st & Union
Facing south



1st & Pike
Facing south

	1ST AVENUE - SPRING/SENECA
Sidewalk paving	Good condition
Pedestrian crossings	At block ends
Transit facilities	Bus stop
Adjacent uses	High-rise office, parking garage (long blank facade)
Pedestrian lighting	Tall, cobra-head lamps and pedestrian-scale streetlamps
Pedestrian amenities	Street trees, trash cans, newspaper boxes, some canopies
Unique places or buildings	N/A
Small business opportunities	N/A

	1ST AVENUE - SENECA/UNIVERSITY
Sidewalk paving	Good condition
Pedestrian crossings	At block ends
Transit facilities	N/A
Adjacent uses	Playground, retail, cafe, apartments
Pedestrian lighting	Tall, cobra-head lamps and pedestrian-scale streetlamps
Pedestrian amenities	Street trees, trash cans, some canopies
Unique places or buildings	Playground at 1st & Seneca
Small business opportunities	Retail frontage along most of block

	1ST AVENUE - UNIVERSITY/UNION
Sidewalk paving	Good condition
Pedestrian crossings	At block ends
Transit facilities	Bus stop with several shelters
Adjacent uses	Seattle Art Museum, museum store, restaurant, office tower above
Pedestrian lighting	Tall, cobra-head lamps
Pedestrian amenities	Street trees, newspapet boxes, trash cans, corner stair and plaza, public art
Unique places or buildings	Seattle Art Museum
Small business opportunities	N/A

	1ST AVENUE - UNION/PIKE
Sidewalk paving	Good condition
Pedestrian crossings	At block ends
Transit facilities	N/A
Adjacent uses	Office, retail, music venue, surface parking, restaurant
Pedestrian lighting	Tall, cobra-head lamps and pedestrian-scale streetlamps
Pedestrian amenities	Street trees, trash cans, cafe seating
Unique places or buildings	N/A
Small business opportunities	Retail frontage along most of block

1st & Pike
Facing north

1st & Pine
Facing south

1st & Pine
Facing north

1st & Stewart
Facing south

	1ST AVENUE - PIKE/PINE
Sidewalk paving	Fair condition
Pedestrian crossings	At block ends
Transit facilities	Bus stop with several shelters
Adjacent uses	Coffee shop, adult entertainment venue, surface parking, retail
Pedestrian lighting	Tall, cobra-head lamps
Pedestrian amenities	Street trees at ends of block, trash cans, newspaper boxes
Unique places or buildings	Pike Place Market across 1st Avenue
Small business opportunities	Limited spaces for retail

	1ST AVENUE - PINE/STEWART
Sidewalk paving	Fair condition
Pedestrian crossings	At block ends
Transit facilities	N/A
Adjacent uses	Office with ground-floor retail
Pedestrian lighting	Tall, cobra-head lamps
Pedestrian amenities	Street trees, newspaper boxes, trash cans, some canopies, bike rack
Unique places or buildings	N/A
Small business opportunities	Retail frontage along most of block

ATTACHMENT N.8 PUBLIC ENGAGEMENT

Note: This Attachment supports the evaluation results for objective T4 that are provided in the Tier 1 report.

This Attachment provides a brief summary of public comment and stakeholder input considered as part of the Tier 1 evaluation. The Project has held two open houses to provide project updates and to seek public comment on Project progress and alternatives. The first open house was held February 6, 2013 at Seattle City Hall and focused on the Project purpose, need, goals and objectives, and potential modes and alignments. The second open house was held June 6, 2013 at the South Lake Union Discovery Center and focused on the Initial Screening and Tier 1 Evaluation results.

Open House #1

The first open house for the Center City Connector Transit Study was held on February 6, 2013, at Seattle City Hall. A total of 101 people signed in to the meeting. All meeting participants who signed in received a handout that described the Project and provided opportunity for comment on five major Project topic areas: Project purpose, Project need, Project goals and objectives, potential street alignments, and modes. The comment card also included a full page for other comments. Additionally, participants could comment by leaving post-it notes on the display boards for each of these subject areas. A set of table top maps allowed participants to draw in potential alignments and place dots next to alignments previously identified in the Seattle Transit Master Plan (TMP) or participant-identified alignments. In total, there were 75 comments placed directly on the project boards and 30 completed comment cards. The following sections provide an overview of the comments by topic area, including examples of representative comments. Many of these findings echo comments made during the stakeholder interview process.

Note: This section is reproduced from a memo summarizing comments from the Open House, available on the SDOT website. [10]

Open House Summary Findings

Project Purpose

1. The vast majority of comments were supportive of the Project purpose and the stated goals. In particular, participants responded positively to the emphasis on legibility and transparency. A key concern was lack of continuity for travelers if a bus mode was selected.

[10] http://www.seattle.gov/transportation/docs/tmp/Seattle%20CC%20Transit%20Study%20Feb%202013%20Open%20House-%20Public%20Comment%20Summary%20FINAL.pdf

a. Legibility is an issue in the current system, particularly for visitors. Comments were very supportive of improving coordination and connections between streetcar, bus, and Link light rail.
   - "Yes, downtown needs a coordinated circulation system, not just whatever regular buses happen to overlap."

b. Several comments questioned how continuity of travel could be provided if a transfer or change of mode is required (from streetcar to bus or bus to streetcar)
   - "We need to invest in a transit system (streetcar) that is connected, not segmented."

2. In addition to the Project purposes described, a number of comments suggested including a reference to service quality measures such as speed, reliability, and frequency in the Project purpose; the Project purpose was updated based on these comments.
   - "The project purpose is mostly complete, however seeing priority and dedicated ROW mentioned would be helpful. Don't let the connector become bottlenecked in downtown traffic!"
   - "Should include the goal of making the connection between the two streetcars significantly faster than existing bus service."
3. There seemed to be some questions about the Project purpose in terms of the specific trips needs it should meet in the short-term (short trips *to* and *through* downtown) and the long-term (as a piece of another priority corridor recommended in the TMP such as Ballard-Downtown). Additionally the definition of "center city neighborhoods" may be unclear; clarifications were made to the Project purpose to clarify terminology..
4. Two comments took issue with the Project purpose, primarily on the grounds that they preferred lower-cost bus alternatives and were concerned about a new service reducing bus service hours.

Project Need

1. There was strong agreement that this Project is needed to improve downtown circulation and connections to existing service for reasons including:
   a. Alleviate congestion and accommodate future growth
   b. Current surface transit options downtown are slow and hard to navigate
   c. Reduced transit options for low-income passengers and tourists due to end of Ride Free Zone
   d. Need to connect First Hill Streetcar (FHS) and South Lake Union (SLU) Streetcar to improve usefulness
   e. Poor pedestrian routes through downtown
   f. Reduce GHG emissions and provide a competitive alternative to SOV trips

g. Improve downtown connectivity between downtown neighborhoods and destinations, such as South Lake Union to the Downtown Core, Pioneer Square, Lower Queen Anne/the Seattle Center, and SODO/Stadiums

Several comments identified needs that are not necessary met by this Project, including insufficient East-West connections downtown and connections between other (non-Center City) Seattle neighborhoods.

Project Goals & Objectives

1. Most comments were supportive of the proposed Project goals, with some specific suggestions or additions:
   a. Goal 1 is important; consider mentioning East-West connections in this goal
   b. Goal 5 is key to ridership; include wayfinding, payment, and other aspects of customer experience in the Project
   c. Add an equity goal (2 comments)
   d. Add a goal to address service characteristics (frequency, speed, reliability) and ridership
      i. Consider cost per rider

Modes

1. A strong majority of comments favored streetcar (27) over bus or trolleybus (6) modes. Another set of comments (6) suggested that the level of transit priority was of equal or greater importance than mode. The comments on this topic are summarized in Figure N.8-1.

Figure N.8-1 Summary of Mode Comments, Open House #1

Mode	Number of Comments	Comments
Streetcar	27	▪ Smoother/more comfortable ride ▪ Less likely to get stuck in traffic ▪ Easier boarding ▪ More fun/better liked ▪ Greater capacity ▪ Project purpose best or only achieved by maintaining same mode ▪ Better driver of growth ▪ More reliable ▪ Already have a lot of buses downtown
Bus	6	▪ Don't use rails when they aren't needed ▪ Electric power or CNG ▪ No tracks to hinder bicycles and wheelchairs
Priority more important than mode	6	▪ Dedicated ROW, queue jumps, signal priority are essential
Monorail	1	▪ We already own one, why not extend it
Gondola	1	

Other comments

2. Other themes and topics mentioned included the following:
    e. Address cycling routes through downtown and integrate bicycling with the Project. Center-running could be better for bikes.
    f. Consider off-board payment and ORCA compatibility .
    g. Implement priority treatments as early as possible, much more difficult to do later.
    h. Lack of clarity as to how this Project fits in with other TMP corridor studies – Ballard to Downtown, Madison, Eastlake.
    i. Incorporate universal design concepts into the Project, including tactile station maps and audible/Braille frequency information.
    j. Improve connections between DSTT and streetcar.

Potential Street Alignments

Open house participants were invited to draw potential street alignment options on maps and place dots (two per person were suggested) next to alignments previously identified in the Seattle Transit Master Plan (TMP) or alignments identified by open house participants. Participants also provided written comments on the maps, boards, or comment cards. Results of the map/dot prioritization exercise and comments on the alignment alternatives are summarized in Figure N.8-2 and

Figure N.8-3. Figure N.8-4 provides a map of the participant-identified alignments.

1. In the dot prioritization exercise:
    k. There were 59 dots placed in support of studying a 1st Avenue alignment, either to Queen Anne or connecting to the SLU Streetcar at Westlake. Participants were somewhat mixed on which should be the priority. Eight additional dots were placed in favor of a potential SODO/Stadium extension.
    l. By comparison, 21 dots were placed in support of studying a 4th/5th alignment.
    m. Twelve dots were placed in favor of further study of a Waterfront Streetcar and it was noted that coordination with the Central Waterfront project is important.
    n. Eight dots were placed in favor of a 3rd Avenue alignment.

2. Written comments on alignment alternatives primarily focused on the difference between a 1st Avenue alignment (B1, B2, or C) and a 4th/5th Couplet (A), with most comments (20) favoring 1st Avenue compared to only 3 in favor of 4th/5th.

3. Additional comments about possible alignments included a preference to avoid couplets if possible, as they are more confusing for users, and questions about whether the final alignment will connect to a streetcar line to Ballard, UW, or West Seattle. Some noted that their preferred alignment was dependent on the question of future connections, and one comment expressed hope that the line would not be incorporated as part of a Ballard-Downtown line. Participants also identified a variety of potential cross-town connections.

Figure N.8-2 Summary of Street Alignment Comments and "Dot" Prioritization – Primary Alignments, Open House #1

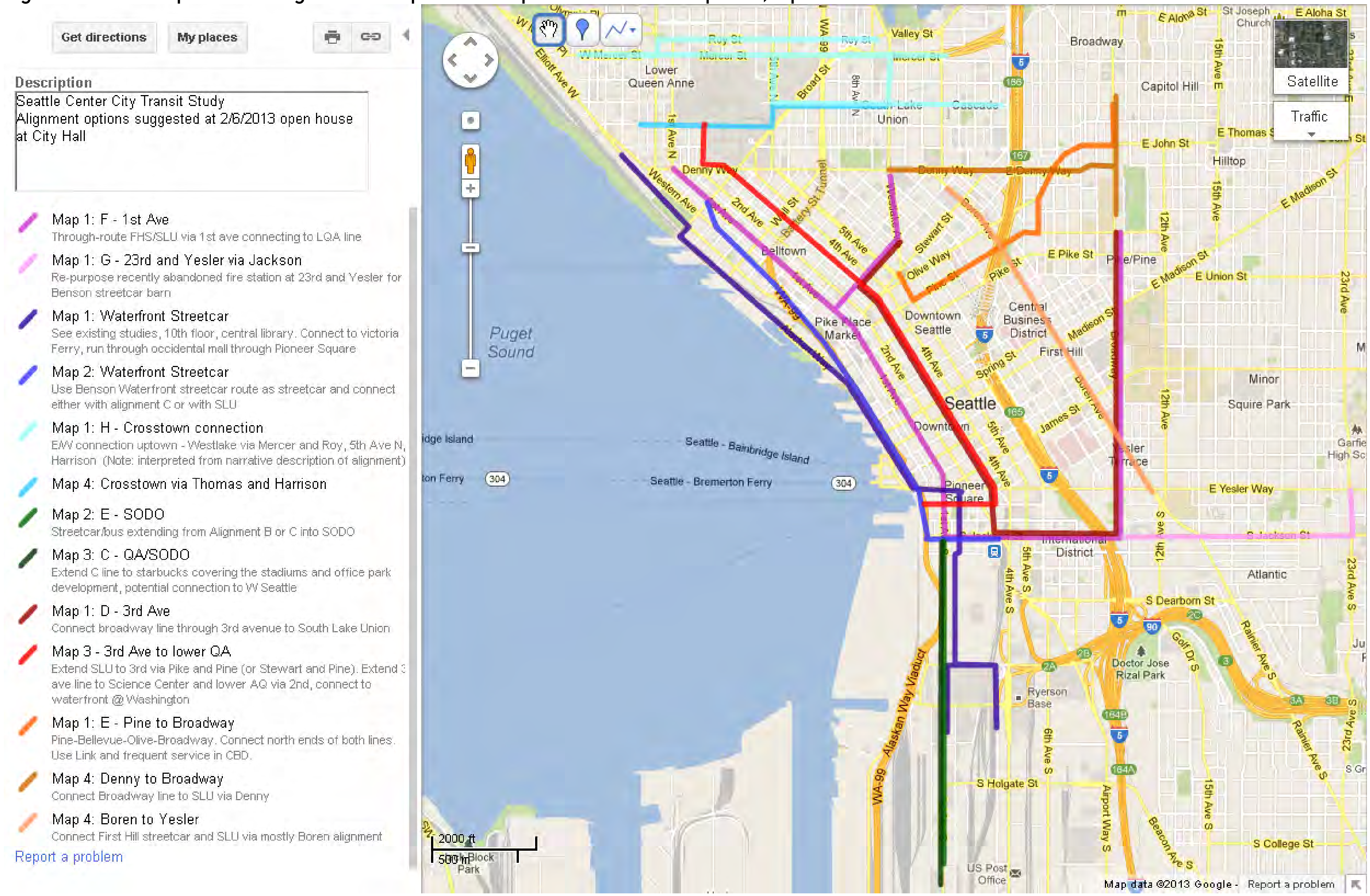
Street Alignment	# Dots	# Comments	Comments
1st Ave Alignments (Seattle TMP)			
1st Ave (General)	59 (total of C, B1, B2)	20	▪ Avoids a couplet ▪ Too much congestion on 4th/5th, which feed I-5 ▪ Strong all-day and weekend demand compared to 4th/5th, which is mostly commuter-oriented ▪ Easier to repurpose for transit use than 4th/5th ▪ More destinations along route ▪ Connects more neighborhoods together ▪ Other streets are currently better served by transit while 1st is poorly served ▪ Opportunity to connect to stadiums ▪ Late night demand not met by existing bus service
Jackson to Queen Anne via 1st Ave (C)	28	6	▪ Connection to Seattle Center ▪ Connection to Lower Queen Anne ▪ Connection to Ballard ▪ Make Queen Anne/Seattle Center first priority, make SLU connection second priority (or vice-versa)
Jackson to Westlake via 1st Ave and Virginia/ Stewart (B1)	17	1	▪ Use B1 southbound, B2 northbound (Virginia)
Jackson to Westlake via 1st Ave and Pike/Pine (B2)	14	3	▪ Provides connection to SLU line

Street Alignment	# Dots	# Comments	Comments
4th/5th Ave Alignment (Seattle TMP)			
Jackson to Westlake via 4th/5th Ave (A)	21	3	▪ Direct connection between SLU and FHS ▪ Allows locally-oriented “duplicate” of “express” service ▪ Consider 1st Ave as part of waterfront or other projects ▪ 1st Ave requires improvements to E/W connections as it is further from downtown core
Other Primary Potential Street Alignments Identified by Open House Participants			
Waterfront (Sculpture Park to Pioneer square via Elliot or Western, Alaskan Way to Jackson or Alaskan Way through Occidental Park and on to stadiums)	12	3	▪ Alignment already exists ▪ Allows more room for bicycle facilities on downtown streets
3rd Ave (Seattle Center to Pioneer Square/Waterfront, with extension of SLU streetcar to 3rd)	6	2	▪ Make 3rd Ave transit-only ▪ Think of Market Street in San Francisco
3rd Ave (Westlake to FHS via Virginia, 3rd Ave, Jackson, Broadway)	2		

Figure N.8-3 Alignment Comments and "Dot Prioritization" - Other Variations or Extensions, Open House #1

Description	# Dots	# Comments	Comments
1st Ave			
Extend B or C alignments to SODO/Stadiums	8		▪ Starbucks HQ ▪ New stadium
Broadway to Jackson to 1st to Denny or Westlake (branch at Virginia)	1		
Extend via Jackson to 23rd & Yesler	2		
Cross-Town Connections			
Westlake via Mercer and Roy, 5th Ave N, Harrison	1		
1st Ave W to Westlake via W Thomas and Harrison	1		
Westlake to Cap Hill via Pine, Bellevue, Olive, Broadway	1		
Westlake to Broadway via Denny	1		▪ Connect north ends of both lines; Link and frequent service in CBD
SLU to First Hill via Boren	1		

Figure N.8-4 Map-based Alignments Input from Open House Participants, Open House #1



Open House #2

The second open house for the Center City Connector was held on June 6, 2013 at the South Lake Union Discovery Center. A total of 61 people signed in to the meeting. Participants received a handout that provided a summary of the Tier 1 evaluation results and provided an opportunity for participants to rank and comment on the four alternatives and to rank the importance of the evaluation criteria in their preference.

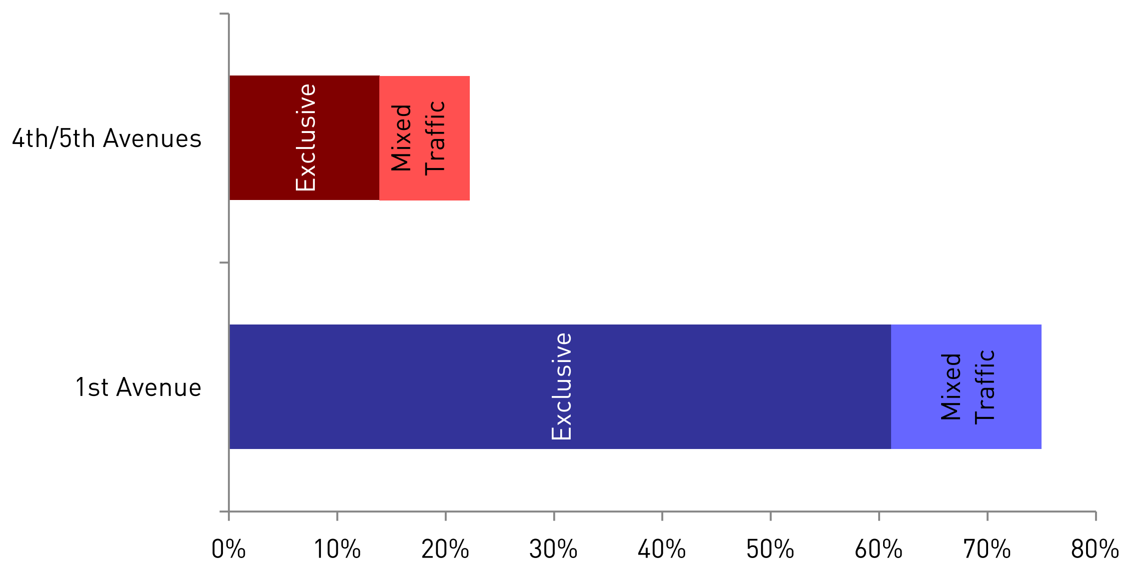
Open House Summary Findings

Alternatives

A handout and comment card distributed at the second open house asked participants to rank the four alternatives (1st Avenue Exclusive and Mixed–Traffic Streetcar, 4th/5th Avenue Exclusive and Mixed–Traffic Streetcar) from 1 (best) to 4. Figure N.8-9 reproduces the comment card.

Figure N.8-5 shows the percentage of participants who ranked each alternative as their top choice. In total, a majority of people (22) ranked 1st Avenue Exclusive as their preferred alternative. In comparison, five people preferred 1st Avenue Mixed-Traffic, five preferred 4th/5th Exclusive, and three preferred 4th/5th Mixed Traffic. In addition, more respondents chose a 1st Avenue alternative as their second choice (18), including 14 for 1st Avenue Mixed-Traffic, compared to a 4th/5th Avenue alternative (16). In addition, the First Avenue alternatives received a majority of second-choice votes.

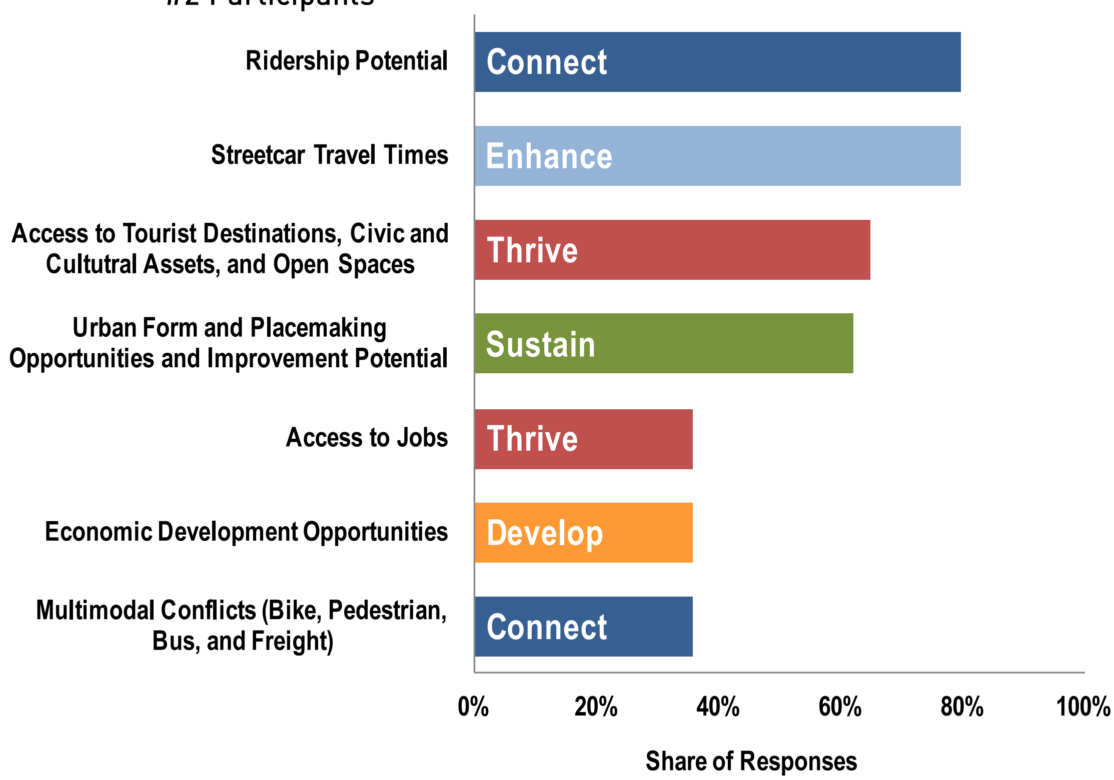
Figure N.8-5 Alternative Rankings, Open House #2



Evaluation Criteria

The open house presented a summary of 14 Tier 1 evaluation measures and asked participants to select the five measures that were most important to their overall ranking of the alternatives and allowed for additional comments on each measure. The measures that received more than 10 votes are shown in Figure N.8-6. The top-ranked evaluation measures were Ridership Potential and Streetcar Travel Times, both of which favor an exclusive alignment. The 1st Avenue Exclusive alternative had the fastest streetcar travel times based on the Tier 1 analysis. These findings support previous stakeholder preferences for a 1st Avenue alignment.

Figure N.8-6 Importance of Evaluation Measures based on Ranking by Open House #2 Participants



Preferences for Street Alignments and Overall Alternative

Figure N.8-7 summarizes comments from 8 respondents that identified a 4th/5th Avenue alternative as their top choice.

Figure N.8-7 Advantages of $4^{th}/5^{th}$ Avenue Street Alignment/Alternatives

Advantages/Comments on 4^{th}/5th	Disadvantages to 1^{st} Ave	# Comments
▪ More direct/central to downtown retail core		4
▪ Better serves Seattle residents	▪ Serves primarily tourists	2
	▪ Uphill walk to destinations	2
▪ Platform will cut into parking but there are enough lanes to handle it	▪ Too few travel lanes	1
	▪ First Ave is busy with cars now, with viaduct construction streetcars would slow down taxis, buses, and cars	1
▪ Keep bikes on a different street to avoid conflict		1
▪ Large built-in ridership		1
▪ Better connection to SLU		1
▪ Closer to existing bus/light rail infrastructure		1

Note: From a total of 8 participants that returned a comment card favoring a $4^{th}/5^{th}$ Avenue alternative

Figure N.8-8 summarizes comments from 27 respondents that identified a 1^{st} Avenue alternative as their top choice.

Figure N.8-8 Advantages of 1st Avenue Street Alignment/Alternatives

Advantages/comments on 1st Ave	Disadvantages to 4th/5th	# Comments
▪ Connects more public/cultural amenities		11
▪ Serves locals and tourists, greater off-peak demand	▪ Serves CBD daytime ridership only	8
▪ Like the possibility of an extension to Uptown/LQA & other future opportunities		6
	▪ 4th/5th too close to I-5/too congested with cars and buses, delay to streetcar and buses	5
▪ 1st Ave underserved by transit	▪ Redundancy with 3rd Ave/DSTT, 4th/5th already well served by transit	5
▪ Economic development opportunities on 1st Ave		4
▪ Possibility of through-lining SLU and FHS	▪ Harder to through-line	4
▪ Pine Street connection would provide great access to Westlake Tunnel stations and high visibility along corridor – if tunnel access is improved		2
▪ No couplet	▪ Requires couplet	1
▪ Fastest travel time		1
▪ Fared better in evaluation measures presented at open house		1
▪ Fewer pedestrians		1
▪ Can be done in conjunction with Central Waterfront project		1
▪ Connection at King Street Station		1

Note: From a total of 27 participants that returned a comment card favoring a 1st Avenue alternative

Figure N.8-9 Open House #2 Comment Card

SEATTLE CENTER CITY CONNECTOR TRANSIT STUDY

OPEN HOUSE #2

JUNE 6, 2013

SDOT

Please return this handout with your comments

We need your input to select alternatives for further study! The evaluation results presented tonight, along with your input, will be used to narrow the four "Tier 1" alternatives for the Center City Connector to the alternative(s) that will be studied in more detail in the "Tier 2" evaluation.

1. Please rank the alternatives from 1 (best) to 4 based on how well you think they meet the project purpose, goals, and objectives:

	4TH/5TH AVENUES		1ST AVENUE	
	Mixed-Traffic Streetcar	Exclusive Streetcar	Mixed-Traffic Streetcar	Exclusive Streetcar
Please rank from 1 to 4	☐	☐	☐	☐

2. Please check up to FIVE evaluation measures that were most influential in ranking the alternatives.

	Evaluation Measures	Check up to 5	Comments and/or Key Considerations
ENHANCE	Streetcar Travel Times	☐	
	Auto Travel Times / Relative Traffic Diversion Impacts	☐	
	Bus Travel Time and Reliability Impacts: Aggregate Bus and Bus Passenger Delay	☐	
CONNECT	Multimodal Conflicts (Bike, Pedestrian, Bus, and Freight)	☐	
	Ridership Potential	☐	
	Annual Operating & Maintenance Costs	☐	
	Capital Costs	☐	
DEVELOP	On-Street Parking Impacts	☐	
	Economic Development Opportunities	☐	
THRIVE	Access to Jobs	☐	
	Access for Vulnerable Residents and to Social Services and Affordable Housing	☐	
	Access to Tourist Destinations, Civic and Cultural Assets, and Open Spaces	☐	
	Public Support (based on first Open House) and Stakeholder Support	☐	
SUSTAIN	Urban Form and Placemaking Opportunities and Improvement Potential	☐	

3. Please explain your preference for a street alignment (4th/5th Avenues or 1st Avenue):

4. Please explain your preference for a Mixed-Traffic or Exclusive Streetcar alternative:

5. Do you have any other comments or questions?

THANKS FOR COMING TO TONIGHT'S OPEN HOUSE!

Please fill out the brief survey below to help us better understand who we're reaching. It will help us improve our outreach and help ensure we're including all of Seattle. All information is anonymous and your participation is completely voluntary. This sheet is subject to Public Disclosure laws.

a. What is your race? ____________

b. Are you of Hispanic origin? ☐ Yes ☐ No

c. What language do you speak at home? ____________

d. How old are you? ________

e. What is your gender? ☐ Female ☐ Male ☐ Transgender ☐ Other ________

f. Do you: ☐ Own ☐ Rent ☐ Other________

g. In what zip code do you live? ________

Thank you for your input!

Other Comments (Question 5)

The open house comment card also allowed for other comments and suggestions relevant to the Project. These comments included the following topics:

- Other streetcar lines:
  - Extend the First Hill Streetcar up Broadway.
  - Extend the SLU Streetcar to UW (2).
  - Connect the SLU and First Hill lines at their northern ends to create a loop.
  - Extend 1st Ave alignment to LQA (2).
  - Waterfront streetcar would make 1st Ave corridor redundant.
- Wayfinding and connections to transportation hubs
  - Make good connections to the Downtown Transit Tunnel.
  - Planned streetcar connection to Sounder/Amtrak/IDS is terrible and should be improved; the streetcar goes right by the new pedestrian plaza at King Street Station. Don't make this mistake at Westlake.
  - Improve wayfinding and connections between transit modes downtown, especially at King Street and Westlake.
- Operating scenarios
  - Prefer through-routing all three streetcar lines so there are no transfers.
- Streetcar vehicles
  - Use high capacity cars with more doors and quieter operation than current vehicles.
- Roadway design/multimodal conflicts
  - Hope that we can use rubber in the flange ways to reduce risk to cyclists.
  - Concern about 1st Ave alignment and street trees in Pioneer Square

Stakeholder Input

Findings from stakeholder interviews can be found in the Stakeholder Interviews Summary Memo, available on SDOT's project website.[11]

[11] http://www.seattle.gov/transportation/docs/Center%20City%20Connector%20stakeholder%20interview%20summary%20for%20web.pdf

APPENDIX O EAST-WEST CONNECTIONS ASSESSMENT

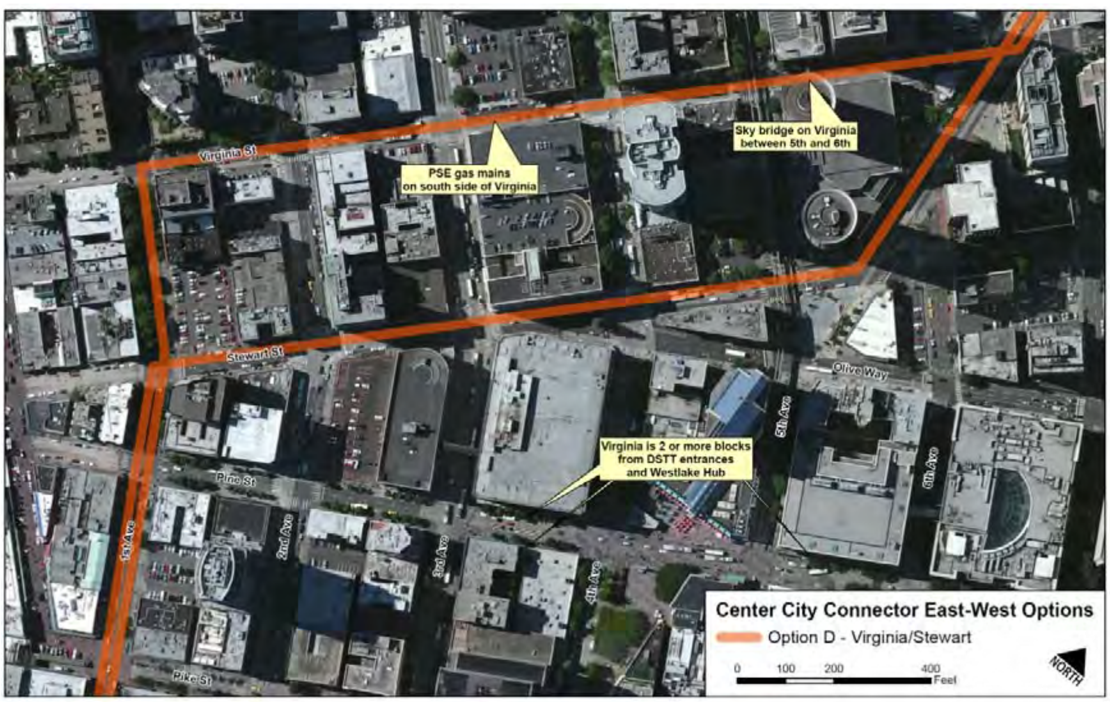
Note: This appendix provides additional details on the assessment of east-west connections described in Chapter 5 of the Detailed Evaluation Report.[1]

Additional Aerial Photo Diagrams

As described in Chapter 5 of the Detailed Evaluation Report, three of the potential east-west connection options were eliminated from consideration. This section provides aerial photo illustrations of these alignments and the location of potential impacts. Diagrams for the two alignments included in the Locally Preferred Alternative (LPA) are provided in Chapter 5 of the Detailed Evaluation Report.

Virginia Street/Stewart Street

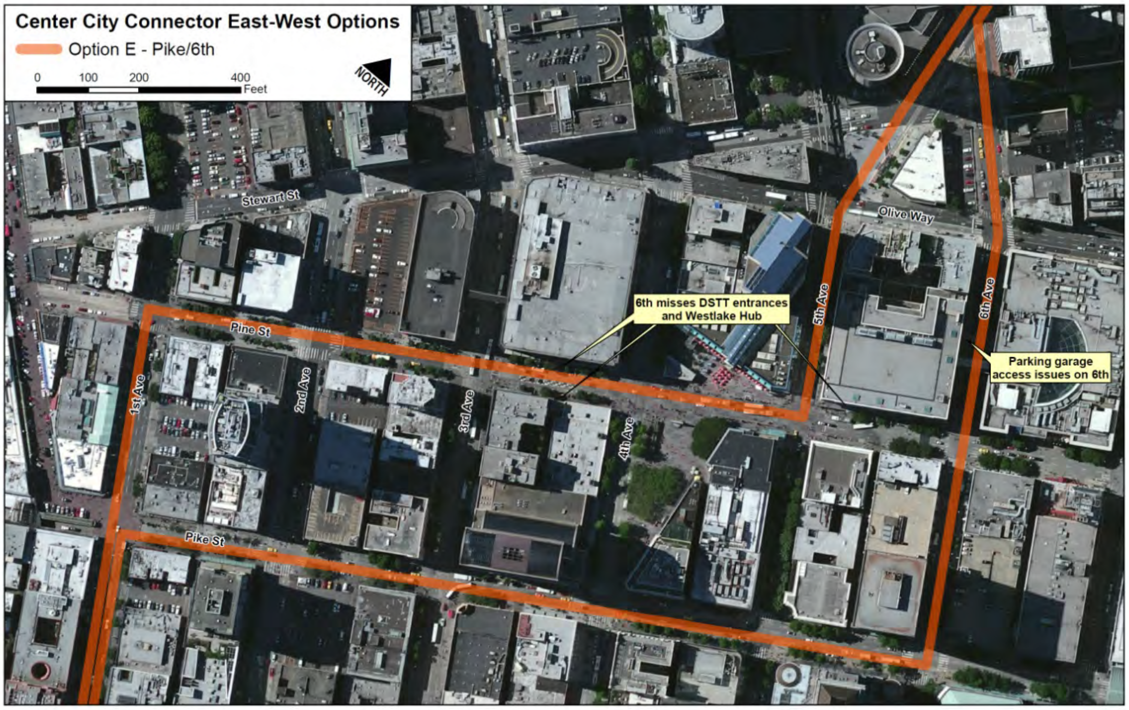
Figure O-1 East-West Alignment D: Virginia Street/Stewart Street



[1] Prepared by Nelson\Nygaard and URS

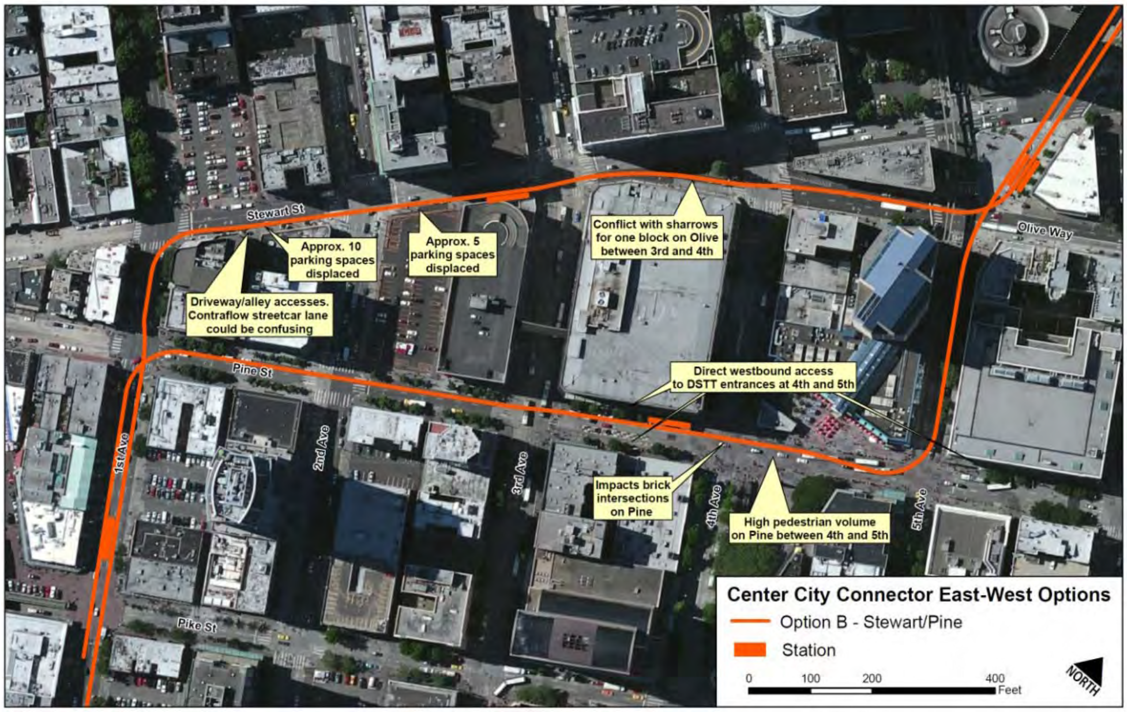
Pike Street-6th Avenue/Pine Street

Figure O-2 East-West Alignment E: Pike Street-6th Avenue/Pine Street



Stewart Street/Pine Street

Figure O-3 East-West Alignment B: Stewart Street/Pine Street



APPENDIX P TIER 2 PUBLIC OUTREACH (OPEN HOUSE #3 AND ONLINE SURVEY)

This appendix provides additional details on public input received on the Tier 2 Center City Connector alternative at Open House #3 for the Center City Connector held on October 29, 2013 and through a web outreach survey made available for several weeks following the open house. The appendix supplements a summary of the results that is provided in Chapter 8 of the Detailed Evaluation Report. It is organized as follows:

- Additional combined results for open house comment cards and online survey, including respondent demographic information.
- Results for open house comment cards only, including open-ended comments.
- Results for online survey only, including open-ended comments.

Overall Respondent Demographics

Figure P-1 through Figure P-4 show demographic information for respondents to the online survey and Open House #3:

- A total of 80% of participants were between the ages of 26 and 60; 14% were over 60, and 7% were between 18 and 25.
- The majority (88%) identified their race as White/Caucasian.
- Nearly three-quarters (73%) were male.
- About 42% rented while 57% owned their residence.

Figure P-1 Respondent Age

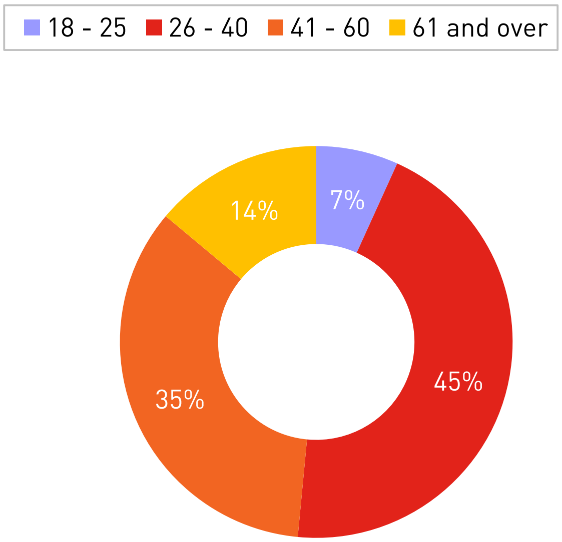


Figure P-2 Respondent Race

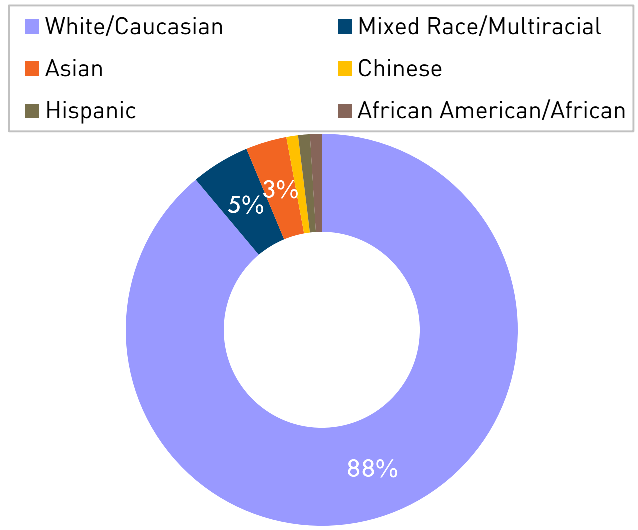


Figure P-3 Respondent Gender

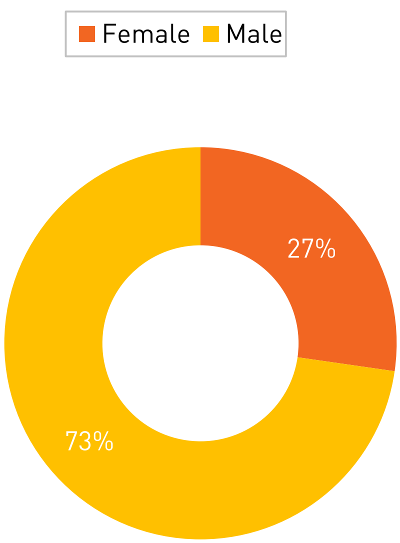
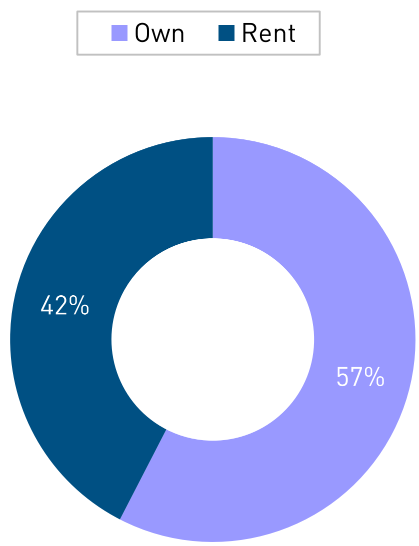


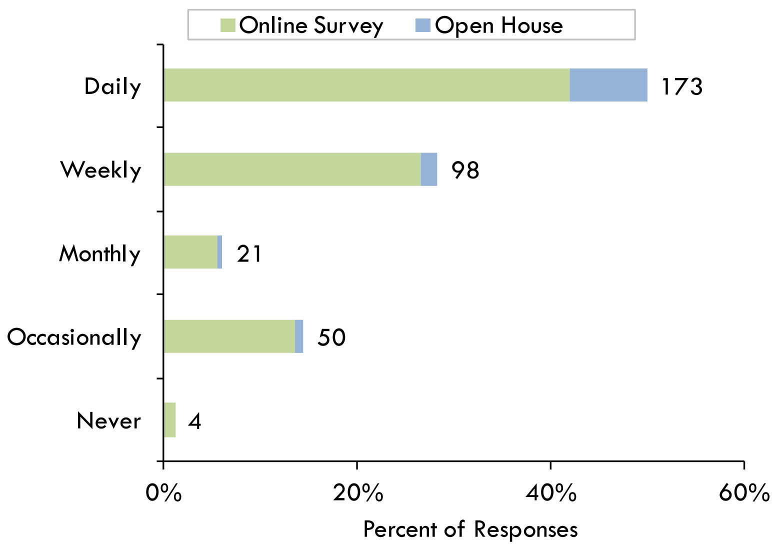
Figure P-4 Respondent Tenancy Status



Frequency of Transit Use

The frequency of transit use among respondents is shown in Figure P-5. Overall, about half of respondents were daily riders, nearly 30% used transit weekly, and 21% were monthly or occasional riders. The open house largely attracted regular riders—72% of attendees reported riding daily—while 15% rode weekly and just 13% monthly or occasionally. Online survey respondents were more balanced between regular riders (47% daily) and less frequent riders (27% weekly and 21% monthly or occasionally).

Figure P-5 Frequency of Transit Use



n=346

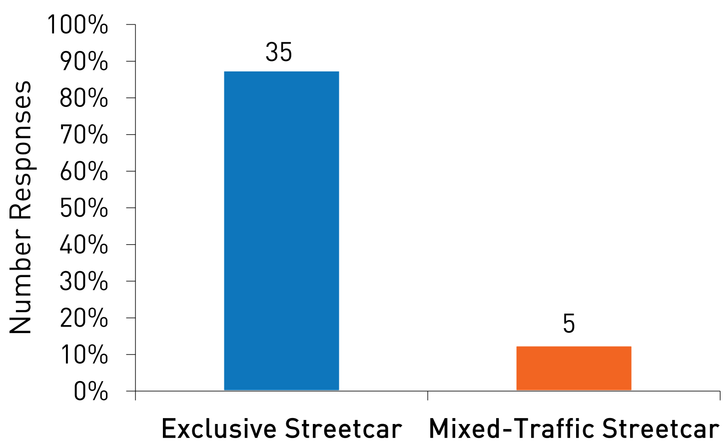
Open House Comment Card Responses

Open House #3 was held on November 19, 2013. A total of 40 attendees completed comment cards. Of these, 5 expressed preference for the Mixed Traffic Streetcar alternative, while 35 expressed preference for the Exclusive Streetcar alternative.

Comment Card Summary

Many respondents provided comments explaining their alignment preference. For those who supported the Exclusive Streetcar alignment, the factors most commonly mentioned were faster travel time, greater reliability, better ability to compete with automobile travel, and lower costs. Several attendees expressed the opinion that if the streetcar does not run in exclusive lanes, the slower travel time and reliability impacts will reduce its value enough that it would not be worth building. Those who supported the Mixed Traffic Streetcar alignment cited the impact that the Exclusive Streetcar alignment would have on several street trees in Pioneer Square[1] or impacts to other modes (one-street parking and loading zones, for example). Figure P-6 shows the total number and percentage of responses favoring each alignment.

Figure P-6 Comment Card Alignment Preference



The comment sheet distributed at Open House #3 asked attendees to rank the evaluation measures used for the Project from 1 to 8, with 1 being the most important and 8 being the least important.

Figure P-7 shows the average ranking of each evaluation measure. As shown in the first column (overall preference), respondents ranked "streetcar travel time" and "streetcar travel time reliability" as the most important and "parking/loading impacts" and "auto travel time" as the least important. The middle and far-right columns show average rankings based on overall preference for the Mixed-Traffic or Exclusive Streetcar alternatives. Attendees who preferred the Mixed-Traffic Streetcar rated "parking/loading impacts" as the most important criterion. These respondents ranked criteria

[1] The Mixed-Traffic alternative assumed curbside stops that would incur a longer travel time but avoid median street tree impacts.

related to auto travel time on 1st Avenue as more important than among respondents favoring the Exclusive Streetcar, and criteria related to streetcar travel time and ridership as less important. Because the majority of attendees who completed comment cards preferred the Exclusive Streetcar, the ranking order among these respondents was the same as the overall average.

Figure P-7 Comment Card Evaluation Measures Ranking

		Ranking of Importance (1 to 8)		
	Evaluation Measures	Overall	Prefer Mixed-Traffic Streetcar	Prefer Exclusive Streetcar
ENHANCE	Streetcar Travel Time	1.8	3.7	1.6
ENHANCE	Streetcar Travel Time Reliability	2.4	5.0	2.0
CONNECT	Streetcar Ridership	3.2	3.2	3.2
CONNECT	Annual Operating & Maintenance Costs	4.6	4.4	4.6
CONNECT	Total Capital Costs	5.2	4.0	5.4
CONNECT	Auto Travel Times	5.9	3.3	6.3
CONNECT	Increase in Delay on Parallel Corridors	5.7	5.2	5.8
THRIVE	Parking/Loading Impacts	6.6	3.0	7.1
	Number of Responses	40	5	35

Comments on Historic Streetcars

Six respondents expressed interest in the historic Benson streetcars, while four people expressed concerns about their use. Two respondents noted that they would not like use of the historic cars to negatively impact streetcar travel time, and two suggested that the Central Waterfront Project should be tasked with incorporating the Benson cars. Comments in favor of incorporating the Benson streetcars included the following:

- Keep the Benson trains in Seattle even on a seasonal basis.
- Please use the incredible old streetcars. Genius idea. Educate handicapped and the medical professionals that care for them why they are not handicap accessible. Really - I can see myself sitting on it going downtown.
- The historic Benson trolley line should be added to the new seawall/Alaskan Way shoreline promenade in addition to, not instead of the two options presented this evening. It is train traffic, cruise ship traffic, and tour bus traffic which impedes freight and private passage around Alaskan Way, NOT the passage of the historic travel.
- Incorporate the Benson trolleys! They are a valued part of our history and dearly missed.
- If you can make use of the Benson streetcars, know that other cities like NYC, Boston, Chicago, SF, et al. also use older train cars for tour events or rent them for special events.
- Do whatever is necessary to preserve and run the historic streetcars. Since the well-used and very useful waterfront option appears to be dead (I used it weekly for several years) this would be the best way to honor councilman Benson's hard work and memory.

Comments on East-West Connection

Although relatively few respondents commented on the east/west connection along Stewart Street and Olive Way that was assumed as part of the Tier 2 evaluation, several respondents expressed a preference for an east-west connection alternative using Pike/Pine Streets because it would provide direct access to the Westlake Hub and entrances to the Downtown Seattle Transit Tunnel (DSTT). Several of these respondents indicated that they would like to see further engineering work to determine whether a Pike/Pine connection could be pursued without puncturing the DSTT membrane (which was presented as a design risk of a Pike/Pine connection).[2]

Other Comments

The comment cards contained comments regarding numerous other issues:

Stops and stations:

- Move stop from Madison/Spring to Madison/Mario to facilitate access to ferries. It would be nice to have a stop near SAM.
- Add safe public toilets at all stops.
- Make sure stations support 2 cars.
- Make platforms on 1st wide enough for rapid streetcar.
- Be cognizant of intermodal connections at Occidental (Sounder) and Madison (Ferry).

Operating scenarios:

- Operate a few "end-to-end" trips.

[2] Additional analysis of the potential design risk was conducted concurrently with the Tier 2 evaluation and is described in Appendix R.

- 5 minute headways are important and should be maintained after 7 p.m.
- Integrate all three lines and charge based on travel distance, not flat rate.

Future extensions:

- Consider single-track spur line to Central Link or Safeco Field with one station for events.
- Design the line with the expectation of extending it north to LQA and south to stadiums by pre-building the track junctions.

Evaluation and planning process:

- Add public safety to evaluation criteria.
- Educate public about updated Transit Master Plan and why transit is being prioritized downtown.
- Consider holding another session and have people work/dialogue in small groups and answer questions. A person of your team would facilitate the process.
- Construction impacts will be significant – look at 24 hour closures for construction periods.

Bike safety:

- Not sure if cyclists will be safe on the roads with the streetcar, hope their safety is taken into consideration (2).
- Don't forget bicyclists on Stewart.

Transit priority:

- Maintain exclusive lanes and TSP for the entire route. Do not allow the line to be compromised segment-by-segment. It is crucial to get this right the first time. Let's learn from our mistakes with the SLU and First Hill Streetcars.
- Like the proposed changes to the SLU streetcar, currently box-blocking goes unpunished and causes major delays.

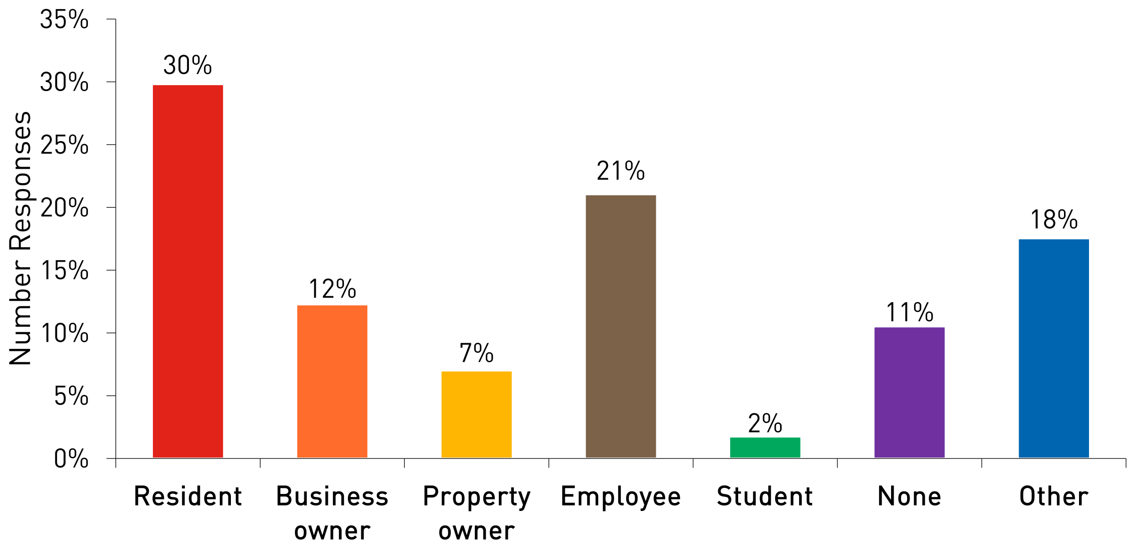
Legibility/accessibility:

- Please make sure signage and system legibility (wayfinding) is a priority.
- There should be tactile signage for schedule and audible announcements w/real time "next car" announcements. Make sure new line has effective ORCA card readers.

Attendee Relationship to Project

Question 4 on the open house comment card asked respondents to identify whether they are a downtown resident, business owner, property owner, other, employee, student, or none of the above. These results are shown in Figure P-8. Close to half (43%) identified as "residents," 30% as "employees," 25% as "other", 18% as "business owners," 15% as "none", 10% as "property owners," and 3% as "students."

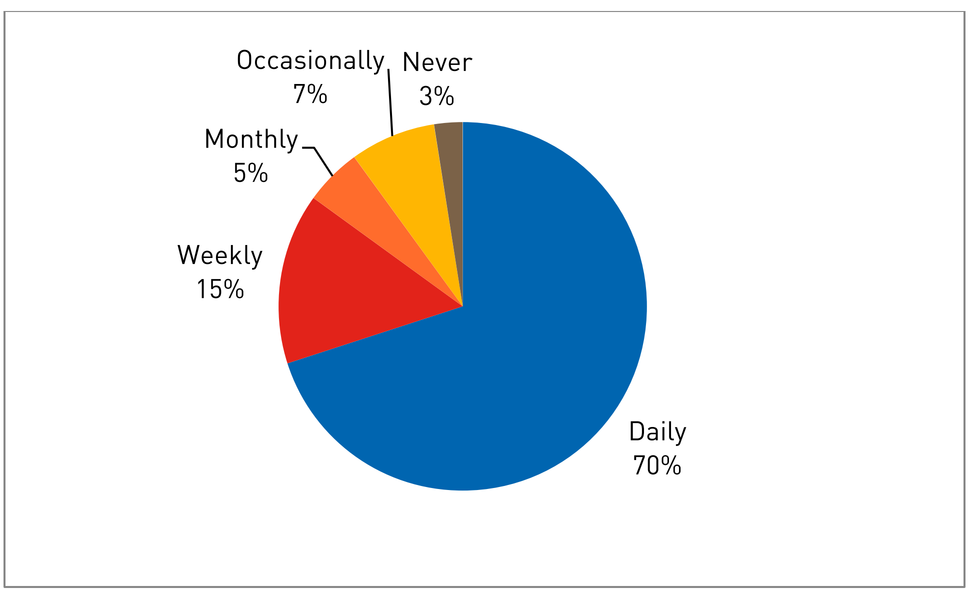
Figure P-8 Comment Card Respondent Relationship to Downtown Seattle



Note: Respondents were asked to select all applicable categories

Question 5 on the open house comment card asked respondents how frequently they use transit. Figure P-9 shows that most respondents (70%) reported using transit daily, while 15% use transit weekly, and a total of 12% use transit monthly or occasionally. Respondents who favored the Mixed-Traffic Streetcar alternative were less likely to ride daily; 40% reported using transit daily, compared to 68% of people who preferred the Exclusive Streetcar alternative.

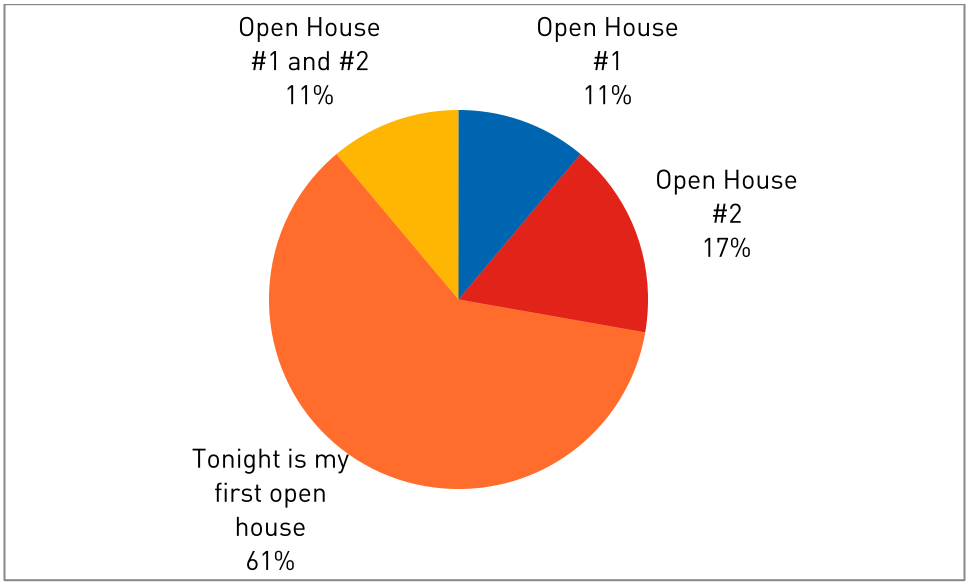
Figure P-9 Comment Card Respondent Frequency of Transit Use



Attendance at Previous Center City Connector Open Houses

Question 6 on the open house comment card asked whether respondents had attended previous Center City Connector open houses and if so, which ones they attended. Figure P-10 shows that a majority of respondents (61%) had not attended previous open houses, while close to one third (28%) had attended one of the previous open houses and 11% attended both.

Figure P-10 Respondent Open House Attendance



Note: Open House #1 was held on February 6, 2013. Open House #2 was held on June 6, 2013.

Respondent Demographics

When asked to identify their race, 68% of respondents identified as White, 5% as Asian, and 1% as Mixed; 23% declined to answer. When asked to identify as Hispanic or non-Hispanic, 73% identified as non-Hispanic, 3% as Hispanic, and 23% declined to answer. The average age of those who completed a comment card was 42.7. Seventy-one (71) was the highest reported age and 24 was the lowest reported age. The majority of respondents (60%) were male; only 20% were female; 20% did not respond. The largest share of respondents (48%) rent their home, while 35% own, 3% selected "other," and 13% did not respond.

Figure P-11 shows the zip code of respondents. A total of 19 zip codes were represented in the results.

Figure P-11 Respondent Zip Code

Zip Code	Count
98103	4
98104	4
98101	3
98102	3
98121	3
98109	2
98112	2

Zip Code	Count
98144	2
48101	1
98002	1
98040	1
98105	1
98115	1

Zip Code	Count
98119	1
98122	1
98133	1
98177	1
98201	1
98199	1

Full Text of Open House Attendee Comments

Figure P-12 contains the entirety of written comments from the comment cards received during project Open House #3.

Figure P-12 Full Text from Comment Cards

Topic	Comment Text
Mixed-Traffic Streetcar	
General	▪ 5-min headways, it's not worth it for SC to take a whole lane. That space is important for cars, buses, trucks, and others. For those who want exclusivity between IDS and Westlake, there's light rail. An empty trackway with congested traffic next to it is not a prudent use of 1st Avenue.
	▪ Need for space for the buses and trolleys that are the workhorses for a vast majority of transit users or even drivers. Such major space should not be dedicated to one streetcar. Please leave it on Virginia /Stewart to first.
	▪ Please don't design/plan as if we live in a pre-automobile city.
	▪ Preserve the exceptional street trees in pioneer square that add so much to the beauty of this historic district.
	▪ The preservation of street trees in historic pioneer square neighborhood is of exceptional importance to the character of this unique district.

Topic	Comment Text
Exclusive Streetcar	
Travel Time	▪ 6-12 min of time savings on round trip is huge. ▪ Prefer dedicated lanes, to assist in avoidance of collisions as well as speed of travel. ▪ Faster travel times benefit riders and increase ridership. ▪ Travel time is very important to me, otherwise walking is faster. ▪ Improvement in travel time more than justifies the difficulty of removing parking along 1st Ave. ▪ Keeps transit times reasonable.
Reliability	▪ Biggest issue is reliability. ▪ Reliability, no matter the urban condition is crucial. ▪ People need predictability and faster travel times to be enticed out of cars. ▪ To maintain efficiency and reliability the streetcar should not be subject to typical traffic congestion – this also creates incentive for people to choose public transit over personal vehicles. ▪ SLU is hurt by being stuck in traffic.
Frequency	▪ Add cars. Make service frequent and I truly think it will be used more. ▪ Guaranteed headways are crucial/frequency is crucial.
Exclusive Lanes/General Comments	▪ Lower operating costs and speed and reliability of the exclusive alternative make it the clear choice. ▪ Better travel times ridership, and costs. ▪ To maintain efficiency and reliability the streetcar should not be subject to typical traffic congestion – this also creates incentive for people to choose public transit over personal vehicles. ▪ Exclusive is safer, more reliable, and has lower recurring costs.
If it isn't exclusive, it isn't worth building	▪ Exclusive is cheaper, and much faster. If we can't build exclusive, then it really isn't worth it. ▪ If we have to share the lane with cars, it's not worth the money to build a streetcar instead of a bus. ▪ If the streetcar isn't exclusive, I think it's not worth building at all. With its own lane, a streetcar starts to provide genuine value; running in traffic there is no incentive not to drive your own car. I would rather see the money go to buses if we're not going to give the streetcar its own lane. ▪ It would be a waste of money to build this if it's not exclusive - this needs to provide a reliable, fast, convenient, and attractive alternative to driving and even walking! ▪ Exclusive lane streetcars would offer more reliable travel times, and fewer car/train collisions. If the streetcar has the potential to get stuck in traffic, I might as well stay in my car.

Topic	Comment Text
	▪ The exclusive option has drastically better travel times & reliability for similar capital cost, with lower operational costs, and reflects the priorities the city is likely to maintain in the future. There is not enough street space to meet demand in downtown Seattle and the streetcar will reduce the need to drive. ▪ Efficient streetcars increase ridership, safety. ▪ All the numbers point to exclusive, why build mixed? Its faster and more worth the money!! ▪ For the capital cost of building the city connector, it only makes sense for the streetcar to travel in exclusive lanes. This makes the system more usable for everyone and makes connections more reliable. The SLU streetcar has taught us how NOT to do streetcars in Seattle. ▪ Prefer exclusive ROW because of reliability, consistency, higher ridership, better than walking (often, one can walk faster than the S lake union streetcar because its not in its own ROW.
Traffic/Auto Impacts	▪ My thought is that vehicle traffic on first under any of the alternatives will be bad. So we might as well have some form of transportation on first that will work. I think the mixed option will result in bad car and bad streetcar traffic". ▪ Establishes passenger travel as a priority over autos"; "You don't need SOV cars, you can have commercial access only on 1st Ave between 5 am and 8 pm and don't allow SOV cars. It has been done in other cities globally. Time to grow up. The car is not king! ▪ Of course to maximize ridership, exclusive streetcar option is highly recommended. May take parking spots, but who really, needs to park on 1st Avenue?
1st/2nd Couplet	▪ It would be a lot less confusing to everyone if the 1st Ave was one-way northbound - this would allow for 2 lanes north, SB traffic would use 2nd. Put the streetcar on the west half of first and P NB NB P on the east half.

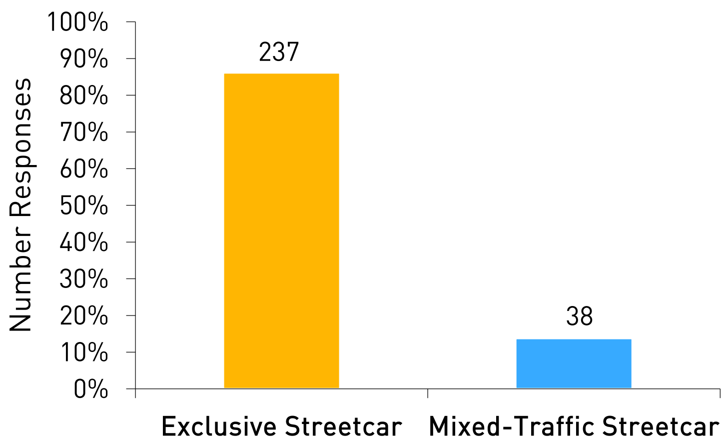
Online Survey

An online survey with questions that were very similar to those asked on the paper comment card at Open House #3 was available for approximately one month following open house. A total of 309 people responded to the survey.

Online Survey Response Summary

Overall alignment preference is shown in Figure P-13 by percentage of responses and the total number of responses. The percentage of online survey respondents who preferred the Exclusive Streetcar (86%) was very similar to the percentage of comment card respondents who preferred the Exclusive Streetcar (88%). The remaining 14% of online survey respondents preferred the Mixed-Traffic Streetcar.

Figure P-13 Online Survey Alignment Preference



As on the comment card, online survey respondents were asked to rank the importance of the evaluation measures in their overall alignment preference. For respondents who preferred the Exclusive Streetcar, the most important evaluation measures were "streetcar travel time" and "streetcar travel time reliability," while the least important measures were auto-related impacts, including "average auto travel time," "increase in delay on parallel corridors," and "parking and loading impacts." For respondents who preferred the Mixed-Traffic Streetcar, the most important criterion was "parking and loading impacts." These respondents ranked criteria related to auto travel time on 1st Avenue and diversion impacts on other corridors as more important than among respondents favoring the Exclusive Streetcar.

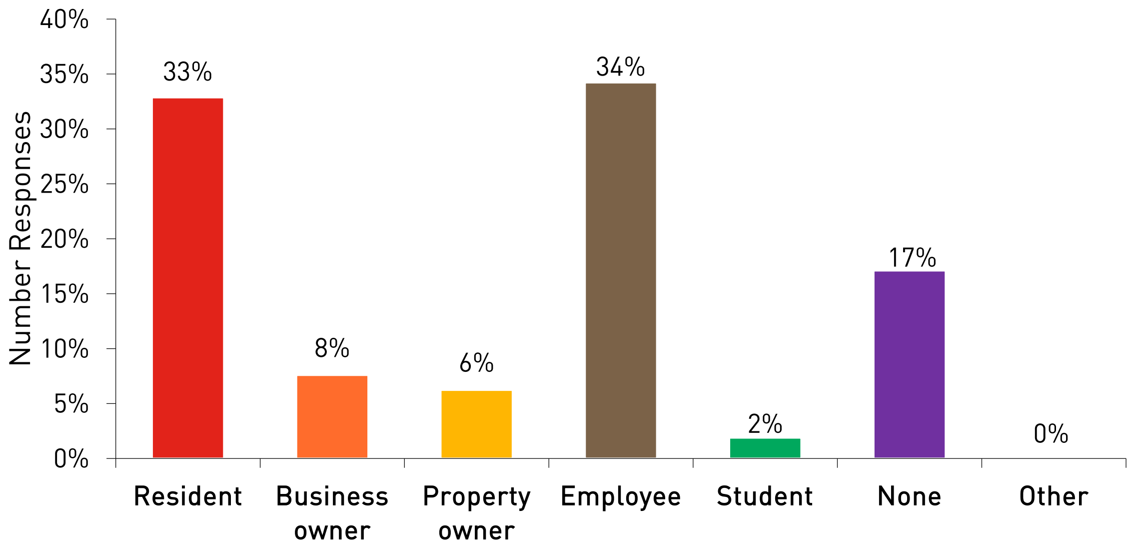
Figure P-14 Online Survey Evaluation Measures Ranking

	Evaluation Measures	Ranking of Importance (1 to 8) Overall	Prefer Mixed-Traffic Streetcar	Prefer Exclusive Streetcar
ENHANCE	Streetcar Travel Time	2.0	4.1	1.8
ENHANCE	Streetcar Travel Time Reliability	2.3	4.5	2.0
CONNECT	Streetcar Ridership	3.3	4.4	3.1
CONNECT	Annual Operating & Maintenance Costs	4.3	4.3	4.2
CONNECT	Total Capital Costs	5.1	4.8	5.1
CONNECT	Auto Travel Times	6.1	4.3	6.3
CONNECT	Increase in Delay on Parallel Corridors	6.2	5.3	6.3
THRIVE	Parking/Loading Impacts	6.7	3.6	7.2
	Number of Responses	315	43	272

Online Survey Respondent Relationship to Study Area and Transit

Respondents were asked several questions about their relationship to the Center City Connector project. Figure P-15 shows the respondent's relationship to Downtown Seattle; respondents were able to select more than one response, so the total is greater than 100%. The largest percentages of respondents were residents (33%), employees (34%), or none (17%).

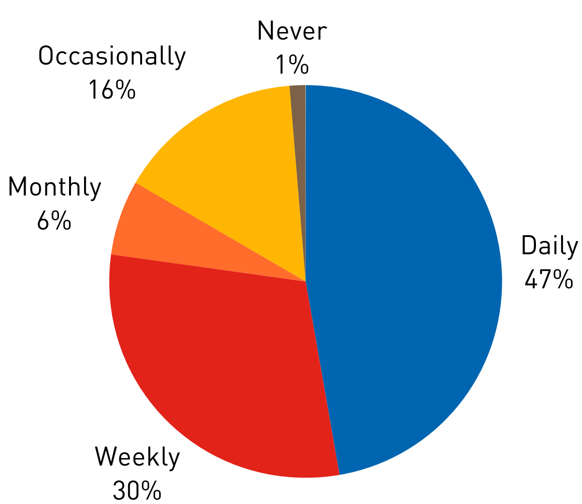
Figure P-15 Online Survey Respondent Relationship to Downtown Seattle



Note: Respondents were asked to select all applicable categories

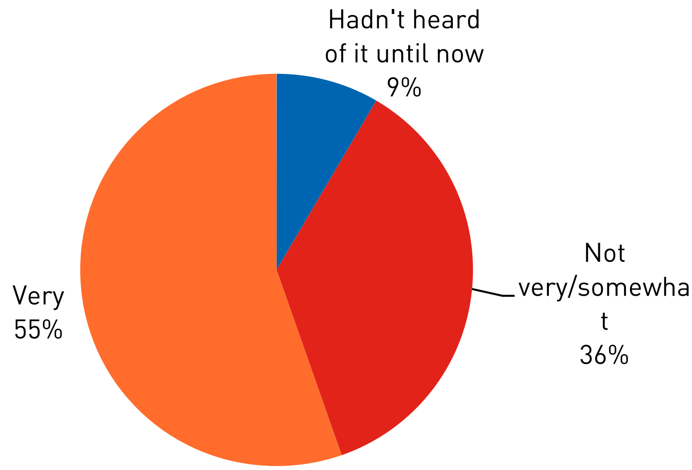
Figure P-16 shows the frequency of transit use among respondents. Online survey respondents were less likely than comment card respondents to ride transit regularly, with less than half (47%) riding daily, 30% riding weekly, 6% riding monthly, 16% riding occasionally, and 1% riding never.

Figure P-16 Online Survey Respondent Frequency of Transit Use



The online survey did not ask respondents which open houses they had attended previously, but instead asked how familiar they were with the project. Over half of respondents (55%) were very familiar with the project, while 36% were not/very or somewhat familiar and 9% had not heard of the project until they saw the survey.

Figure P-17 Online Survey Respondent Familiarity with Project



Respondent Demographics

Nearly 40 unique zip codes were represented in the online survey response, as shown in Figure P-18. The zip codes with the most responses included South Downtown/SODO (98104), Capitol Hill and the Central District (98122), and North Downtown/Belltown (98101).

Figure P-18 Online Survey Response by Zip Code

Zip Code	Count
98104	45
98122	22
98101	18
98109	17
98102	14
98121	14
98118	10
98105	9
98117	8
98103	7

Zip Code	Count
98107	7
98144	7
98112	6
98115	6
98119	5
98108	4
98125	4
98136	4
98199	4
98116	3

Zip Code	Count
98133	3
98155	2
98005	1
98027	1
98028	1
98030	1
98038	1
98040	1
98074	1
98106	1

Zip Code	Count
98110	1
98146	1
98166	1
98177	1
98198	1
98201	1
98366	1
98374	1
98501	1

Online Survey Full Response Text

The full text of all comments received through the online survey "additional comment" question is included in Figure P-20. Responses were coded and organized according to the primary content of the comment. Comments that contained multiple themes were assigned additional codes, which are listed in the right-hand side of Figure P-20. The codes and the number of responses for each topic are shown in Figure P-19.

Figure P-19 Comment Coding Key

Code	Topic	Number of Responses
1	Support for Exclusive Streetcar	51
2	Support for Waterfront alignment (including to complement 1st Avenue)	10
3	Support for extension(s) (Uptown/Seattle Center, Stadium District, or elsewhere)	11
4	Support for Stewart/Olive east-west connection	5
5	Support for (or desire to further investigate) Pike/Pine east-west connection	7
6	Suggestion/concern about inclusion of bicyclists	13
7	Design suggestion (stop placement, support for longer vehicles, track placement, intermodal connections)	19
8	Comment/suggestion on operating plan/scenarios	7
9	General support for project	17
10	Prefer Mixed-Traffic Streetcar	2
11	Preference for another corridor (e.g., 1st/2nd, 3rd, 4th/5th)	9
12	Concern about historic street trees (or other concerns related to Pioneer Square neighborhood character)	10
13	Concern about loss of parking/loading zones and/or auto capacity/traffic congestion impacts	8
14	General criticism of project	14
15	Support use of Benson streetcars	29
16	Oppose use of Benson streetcars	4
Other	Other concerns or comments	8

Figure P-20 Full Text of Online Survey Respondent Comments

Comment Text	Code
Support for Exclusive Streetcar	
Exclusive lanes are important to make it worth taking... But also spreading out the stop so they aren't so often. However, I wish this was incorporated with transit focused street. 3rd avenue needs major improvements to make it actually work. I wish they would pull the bus stops to the middle of the street and pour some money into making the bus corridor through the city really work.	1
The streetcar needs to be a exclusive streetcar - that would have its own lane for a majority of the alignment, red light priority, connections to the waterfront.	1
Please, please choose exclusive right away. Not only is it clearly the best choice from an engineering standpoint but from a political standpoint as well. If the streetcar is subject to car traffic jams and cannot bypass the normal flow of traffic, it will be seen (not incorrectly) as an immense waste of public money. Public opinion will turn against these sorts of projects and likely kill future expansion and improvement. That simply can't be accepted.	1
The City of Seattle has the opportunity of a lifetime to build a high quality rapid streetcar. The exclusive lane option is faster, has better ridership, and is cheaper to build and operate. Please stand up to the groups who are going to protest the loss of parking and travel lanes. We are counting on you to fight for the future!	1
Exclusive right of way far superior option. Hopefully local business owners can support this option!	1
Please put the streetcar in exclusive right-of-way.	1
Getting the exclusive right of way will be easier today than it will be in 10 years when congestion may have potentially gone.	1

Comment Text	Code
We really need the exclusive right of way. Otherwise you might was well use a bus. I'd love to see the permanent investment and development instigator that a fast, reliable streetcar in exclusive ROW would bring.	1
Give the streetcar its own lane, please.	1
Please give this great idea exclusive right of way.	1
This project simply MUST have exclusive right of way. This is a 100-year investment that must be done right the first time.	1
Please put this on dedicated lanes. Otherwise it will just be in traffic like everything else!	1
I routinely travel to other cities around the world, including the US, and my experience indicates that dedicated streetcar lanes are the standard and norm to be able to increase efficiency and effectiveness of moving large numbers of people.	1
It really needs its own lane! SLU is great but would be even better if it wasn't sharing lanes with cars! Let's do this one right!!	1
There is really no point to building a streetcar line instead of using buses if the streetcars are going to have to be in mixed traffic anyway.	1
I really feel that there needs to be a stop closer to the Art Museum/Benaroya - Madison and Pike are too far off beam so an additional stop is needed I think between the two proposed stops. Very favorable to the idea of the streetcar having its own grade separated lane.	1,7

Comment Text	Code
For public trans to be useful it needs to be reliable and the way to insure that is through the dedicated approach. I am not a fan of the bus system because it gets clogged in traffic as a mixed user living in town I will know when and where to avoid areas served by public trans making it effective for me in a car and for me in a street car. It would always be my preference to use reliable public trans (grew up in Boston) if it is reliable and fast.	1
Strongly in favor of exclusive lane. The SLU line needs to be upgraded too. Shouldn't be able to outrun the train on my bike without breaking a sweat.	1
If we can see to it that the CCC has exclusive right-of-way, it will help to ensure that the streetcars are not snarled in traffic on event days and busy weekends. Mixed-traffic may seem like a decent compromise, but it jeopardizes the usefulness of the streetcar when we need it the most.	1
I travel around the United States and world. Great cities have quick, reliable public transportation. It would be a shame if Seattle's public transit is stuck at the mercy of vehicular traffic. Thank you for the good work you've been doing to make our city easier to get around.	1
Only put rails in the ground if they have a exclusive use, if routes are shared with traffic run buses.	1,other
Provide priority treatment for streetcar to provide an advantage over travelling by auto.	1
Exclusive lanes please! Also, consider room for longer platforms on 1st so that the same rails may be used for high capacity streetcars in the future.	1
Exclusive lanes for the streetcar are imperative. SDOT should work with Metro to see if it makes sense from some bus routes to also use these exclusive lanes to improve speed and reliability of buses.	1,other
If the streetcar cannot by pass the car traffic it will never work.	1

Comment Text	Code
The exclusive lane option is by far my preferred choice- there are already compromises being made (such as no direct connection to Westlake) that we need to make this streetcar as useful and efficient as possible in other ways. Prioritizing the streetcar along 1st Avenue is critical.	1
I was disappointed that the survey did not include a place to rank the incentive to use transit that is created by reduced traffic flow with an exclusive streetcar lane. As today's impossible traffic on Westlake demonstrated, streetcars sharing a lane with autos experience just as much delay as driving, which deters potential riders of mass transit. But I am even more disappointed that the city did not consider a waterfront route and the resurrection of the George Benson Waterfront Streetcar. Transit already is abundantly available on Second, Third and Fourth avenues, so why add a streetcar to First Avenue? The rebuilt waterfront will not be complete without the return of the streetcar. From Stewart, it can run north on First to Broad then go down to Alaskan Way all the way to Jackson. This should be a top priority! Even if the First Avenue route goes forth, the waterfront streetcar should be returned. It could run a loop on First and Alaskan Way, providing a valuable transit link for Belltown, Lower Queen Anne, the waterfront and Pioneer Square. And one more request - PLEASE integrate the streetcar fare payment system with ORCA!	1,2
Please make this exclusive right of way so that the project is worth the investment. If it's going to be mixed then we can use buses and fund other high priorities that will make better use of our limited transit funds.	1
Why on earth would you build the mixed	1
I see no point in a shared lane. It just spells trouble. And increases likelihood of delays due to car/car and car streetcar collisions	1
Please please please please make it exclusive right of way. It is literally not worth spending so many millions of dollars for something that would get delayed in traffic.	1
Silly to even consider mixing streetcars with general traffic. May as well not build one.	1

Comment Text	Code
Building with exclusive lanes will likely not be politically palatable, but I believe that building with mixed traffic will increase the risk of long-term issues because people will perceive this as not worth the cost as there will be travel time delays to both user groups. This may impact future decisions to build/expand transit and is not an acceptable risk. Be bold now, accept the blowback, and set transit up for success in the future.	1
This project is not worth doing unless it is in exclusive right of way.	1
I think it's critical to have exclusive streetcar access lanes. I used to work in SLU and the streetcar there was truly a joke. It would have been handy if it was more frequent, reliable and not stuck in traffic. I experienced the great streetcars in Salt Lake City this summer, with their own right-of-way, and they were wonderful! I'd much rather my traffic dollars go to a project that will be as effective as possible. I'd also like to see some provisions for people on bicycles. It's an important corridor and should not become as unsafe as Westlake.	1,6
Exclusive lane streetcar on 1st Avenue will be a great addition to the city. Creating a reliable, functional, and fun transit corridor on 1st Ave will encourage more development and improve livability for the many residents that prefer to move about the City by transit or by foot (and not by car). I think it could become one of the new signature attractions downtown, much like the success of the Great Wheel on the waterfront. Also, connecting the City Connector to Seattle Center via 1st Avenue thru Belltown should be a high priority. There is tremendous residential development happening in Belltown now and the current and future residents in Belltown would be greatly served by a streetcar to connecting them to downtown. Please continue to keep the Seattle Center extension in mind as well. Thank you!	1,3
If I can walk along first avenue quicker than taking the streetcar, I don't see the point. It needs an exclusive ROW.	1

Comment Text	Code
I see the argument for preserving on-street parking to be somewhat weak, given how much paid off-street lots and garages there are, and how much space parking wastes. I would prefer we dedicate exclusive lanes to the streetcar, and build as much bicycle and pedestrian-friendly infrastructure as possible. I believe this would significantly increase the walk-ability of the area and increase foot-traffic into the various retail locations along 1st avenue.	1
Exclusive only please! Also, please make all gaps for the platforms (the space between the tracks) long enough that you can fit the High Capacity Street cars mentioned in the Ballard study. Even if there is no plan to use those here now, once the tracks are set, they will be very hard to replace later if the high capacity cars come into use. Making the gaps for the platforms longer (without making the platforms that size) leaves future room for expansion on tracks without the cost of having to build the platforms that size up front. It seems like a no-brainer to me, but maybe there is something I am missing...	1,7
The capital investment is a truly a one time cost to the taxpayers. Let's think ahead and create a system that will stand the test of the coming decades. The creation of a streetcar with a exclusive right of way is an absolutely worthwhile endeavor.	11,12, 7
Please don't listen to anyone who says short travel time, or high reliability is bad. Traffic will get better if more people take transit. More ppl will take transit if it is fast and reliable	1
Please maintain exclusive lanes and TSP for the entire route. Do not allow the line to be compromised segment-by-segment. It is crucial to et this right the first time. Let's learn from our mistakes with the SLU and First Hill Streetcars. Also, please make sure signage and system legibility (wayfinding) is a priority.	1,7
Please add signal priority to exclusive right of way.	1
Travel time reliability is a huge problem for transit in Seattle in general, and downtown specifically.	1

Comment Text	Code
Support for Waterfront alignment (including to Complement 1st Avenue)	
Still angry that waterfront streetcar is not part of these plans, and you putting the Center City Connector on first avenue is a way for SDOT to kill off the Waterfront Streetcar line. I assume that the City of Seattle will be asking for a bond issue for the waterfront park. If so, I will oppose it, unless the waterfront streetcar is part of those plans. Only a separated streetcar line on 1st Avenue is worth it, otherwise you might as well run electric trolley buses instead (wire is already there), if you chose mixed traffic mode..	2,1
Rebuild the #99 Waterfront Streetcar (benson line) and put the historic W-2s back in service.	2
It's too bad the rebuilt waterfront does not contemplate dedicated streetcar right of way. Many people enjoyed the waterfront streetcar, and I think it would be a better way of moving people north/south than using 1st Ave.	2
Why is the Waterfront Streetcar not shown or included? It needs to be included with any downtown streetcar project.	2
The historic benson trolley line should be added to the new seawall/alaskan way shorline promenade in addition to, not instead of the two options presented this evening. It is train traffic, cruise ship traffic, and tour bus traffic which impeads freight and private passage around alaskan way, NOT the passage of the historic travel.	2
Water front streetcar!	2
Bring back the Waterfront Streetcar as well, or at least retrofit the Benson cars for this route.	2
Support for Extension(s) (Uptown/Seattle Center, Stadium District, or Elsewhere)	
Bring to uptown to increase usage and eliminate auto traffic in the area	3
Would be nice if it went further north. Seattle center, uptown area	3

Comment Text	Code
The route seems rather short. If the street doesn't continue to other parts of the city it seems that route would be of limited use or make people transfer to other transit.	3
As a Belltown resident I really want the uptown connection!	3
I would like planners to consider extending the 1st Avenue streetcars from the stadium district to Seattle Center. Uptown is a booming urban center and it would be great to be have an express option for gamedays, especially when the NBA/NHL arena is constructed.	3
Please build an expansion to the Belltown neighborhood. Our current transportation system is quite disjointed. The streetcar would help "connect" and make our Seattle public transportation seem more coherent and fluid.	3
Peak period reliability is probably less than indicated in the metrics, and there is a high likelihood of bunching, especially if future headways are reduced from the planned 5 minute service level. This may be exacerbated if delay occurs on the branch routes that don't have full signal priority or exclusive ROW. Some consideration could be given to future extensions (e.g. First Hill line from downtown to the north and SLU line from downtown to the south).	3
There is a strong need for downtown residents to connect Belltown to the rest of downtown. A high priority should be given to an extra line that continues north on 1st Ave to Denny Way.	3
Please design the line w/ the expectation of extending it north to LQA and south to stadiums by pre-building the track junctions (switches) so future lines/extensions can simply be welded onto existing track minimizing disruptions. Build the switches/crossings now even if not used for a while at least they're there. This is how it is done in Europe, et al	3,7
Build larger citywide system as soon as possible	3,9

Comment Text	Code
Support for Stewart/Olive East-West Connection	
Stewart and Olive provide the best east-west connections to the SLU line It also offers a great opportunity to improve the pedestrian and development quality on a few of the underutilized properties along Stewart. I think that during the design phase, the alignment and stations in Pioneer Square should avoid removal of the large trees that compliment the unique character of the district. Also, the use of stamped, integral concrete and stamped asphalt can be used to replicate existing brick pavers that may be problematic to the construction of the trackway. Regarding the Historic Trolleys -- I suggest that the system be designed to accommodate operation of the historic trolleys and that the historic trolleys are run only on weekends or holidays as an addition to regular modern/low floor/ADA service. I also suggest that upgrades to the trolley vehicles and operation of the trolleys are not an official part of the Center City Connector project, operating and funding plan. Please design, construct and build this project as soon as possible.	4,12,15
Use the stewart/olive option for the east-west connection. Offer some "end-to-end" streetcars even if most only follow the split route.	4,8
It seems already to be the preferred choice, but I want to voice my strong preference for the "A" option of Stewart/Olive for connecting Westlake to 1st. Couplets reduce legibility and increase the risk of external impact on service. Keep the tracks together!	4
Frequency and speed is my number one concern. I don't usually ride the SLU Streetcar because I can walk faster! I can look all the way down Westlake and never see it coming. So I walk. I also like the Stewart/Olive connector. Better serves the Market area and just logical!	4,1
Without exclusive lanes, this project is an unconscionable waste of money. Also, I support Stewart/Pine as the best connection to the DSTT.	4,5,1

Comment Text	Code
Support for (or Desire to Further Investigate) East-West Connection Using Pike and/or Pine	
Please look at the Pike/Pine/4th Avenue as a preferred connector from the SLUT leg rather than Virginia/Stewart. More people near light rail will help economic vibrancy and public safety.	5
Pine/Pike should be preferred instead of Olive	5
Regarding the westlake connection, I prefer pike/pine due to the accessibility to the transit tunnel. However Stewart/Olive is an acceptable alternative if pike/pine is not feasible. 5 minute frequency is vital if you're going to draw riders from 3rd Ave. Otherwise with running time & wait you're not competitive with buses. Historical streetcars are a nice feature if they can be incorporated at minimal cost, but should not be allowed to affect frequency or reliability	5
Yes! Pike/pine corridor connection should be seriously considered. Connect w/ light rail key to success for tourists. Add public safety as evaluation criteria (see pike/pine above). More people = better behavior	5,other
I'm concerned about the multimodal interface and discoverability at westlake hub and the ferry terminal. The virginia stewart option is dead last in transfer convenience at westlake and is too far from the retail core. There is surely an engineering solution for Pine St membrane. Let's evaluate that fully. Visibility of the streetcar is optimized there and there are many tourists who contribute greatly to our economy. There's also scant mention of bicycling here. The treatment of westlake from the but to SLU park is an example #1 of what can go wrong when bicycle safety is not adequately addressed.	5,6,7

Comment Text	Code
Glad to see center lane operation. Right side island stops would allow buses to share the same stops. Might consider a stop between Pike and Pine, then add a stop near University? Question: how big a deal is it to break the tunnel membrane should Pike/Pine be used for the alignment? Pike/Pine to Capitol Hill is an awfully attractive transit corridor, and a former street railway alignment. Pine Street provides direct connection to Westlake Station. Left lane streetcar operation on Pike/Pine to Convention Center, then Pine corridor to the east, is powerful. Extended along Union Street east of Broadway this gets you to the CD and has the geography to reach Madison Valley with surface rail transit.	5,7
Concern about Inclusion of Bicyclists	
What about cyclists? There have been problems with SLU and bikers getting caught in the streetcar tracks	6
Bicycles need designated route. Connect Sculpture Park to MOHAI. Benson cars cost less and accommodate more passengers.	6,15
This connector project needs to consider the impacts of bicycle travel. First Ave is an important corridor and any Connector analysis should consider impacts, mitigation and solutions for facilitating safe and accessible bike connections through downtown (the TMP recommends taking a multimodal approach when designing and delivering projects).	6
What's the impact for a bike lane? Is there space for one?	6
How are bikes going to be accommodated? Neither of these options has a bike lane. Will the streetcar tracks be made safer for bikes? I don't want the irresponsible and dangerous situation on Westlake to be repeated on 1st.	6
Needs good bike access and skateboard racks	6

Comment Text	Code
Please provide for a cycle track or other protected bike facilities so we don't recreate the issues with biking on Westlake.	6
As a frequent bicyclist downtown, 1st Avenue is a crucial bicycle corridor that cannot be ignored. It is the most destination rich corridor downtown, has one of the mildest grades, and is heavily used by bicyclists today. Because of its unique location, it has the fewest intersections for a cycle track located west of the street to cross. I strongly urge the design team to consider separated bicycle facilities on this corridor, or at an absolute minimum, continuous bicycle lanes through the corridor.	6
I was kind of surprised that none of the plans addressed (let alone included) dedicated separate bike lanes. I'm not sure if cyclists will be safe on roads w/ the streetcar. If there are cycle tracks on the next block over fine, but for someone on a bike that wants/needs to access a business on a street w/ a streetcar, I would hope the safety of the occasional cyclist is taken into consideration.	6
Why not make the platforms on 1st wide enough for rapid streetcar? Exclusive lanes only please!! Don't forget bicyclists on Stewart.	6,1,7
Design Suggestion (e.g., Stop Placement, Support for Longer Vehicles, Track Placement, Intermodal Connections)	
Raise the boarding platform to make loading easier like in Salt Lake City.	7
Another reason I strongly support streetcars having exclusive lanes: the potential for unique pavement treatments between the tracks (brick, grass, permeable surfaces, etc.). If exclusive ROW is chosen, I would ask SDOT to explore these options in future design work. Thanks!	7,1
Keep the track alignment in the centre of the street and not weaving around like it does on Capitol Hill. Definitely don't run it in the gutter like the S. Lake Union line.	7,1

Comment Text	Code
A better configuration for exclusive lane streetcar that i've seen has the existing northbound lanes retained for autos, and converting the southbound lanes for 2 way streetcar. With the viaduct going away and 2nd being plenty wide for southbound traffic, this is worth studying.	7,1
I don't think the plan accounts for the deletion of the 99 ramps after the viaduct is demolished. For example, if there was a two-way bikeway one the west edge of the street, then exclusive streetcar ROW and then two lanes of northbound car traffic (since 2nd Ave is southbound) I think this would be worth a close look.	7
If the street car is to be used to move people around the downtown, not necessarily from one terminus to the other, but with interim stops why doesn't it command the curb lane to ease loading and unloading passengers? Auto traffic (except taxis) rarely stops.	7
A proposed stop is shown at Madison/Spring. I really think this should be moved one block south to Madison/Marion. This will facilitate commuters going to/from the Ferries that access the Marion St Ped bridge (which will be reconstructed with the waterfront redo). Move the Pioneer stop one block south if that is a problem - makes more sense I think anyway. It would be nice to have a stop near SAM, but I know that is probably not acceptable. I always look at connecting tourist locations/destination points.	7
1) Make sure stations support 2 cars. PDX's seem to be a little short, SF "F" line has one car - bu they're large. 2) Please, please, please be sure to be cognizant of intermodal connections at occidental (Sounder), Madison (Ferry) i'll hope that the 1st Hill Streetcar will handle Link Light Rail. 3) If you can make use of the Benson streetcars, know that other cities like NYC, Boston, Chicago, SF, et al. Also use older train cars for tour events or rent them for special events. 4) If there's a way to put a single-track spur line to C link or safeco field with one station for events, please consider it. 5) Integrate all 3 lines. This is the best chance for success for ridership. You should charge based on travel distance, not flat rate)	7,15, 11
Add safe public toilets at all stops (portland loos)	7

Comment Text	Code
Historic trolley would need announcements of stops and Braille signage. There is no Braille on SLU stops today. There should be tactile signage for schedule and audible announcements w/ real time "next car" announcements. Make sure new line has effective ORCA card readers	7
Comment/Suggestion on Operating Plan/Scenarios	
I think there should be one-seat service (no transfers) from Capitol Hill all the way through to South Lake Union.	8
The hub-to-hub operating plan looks the best to me.	8
Headway should be 90sec in downtown. Possibly terminate south lake union at Jackson and terminate first hill at Westlake to accommodate 90sec head ways.	8
Please provide some if not all trains as end-to-end trains.	8
The 5-minute headways should be extended into the evening (past 7 pm) if at all possible.	8
Why not directly connect the SLU and First Hill streetcar lines?	8
General Support for Project	
Streetcar rocks!	9
Please build this as quickly as possible. We need more transportation like this desperately.	9
Let's get more cars off the streets and make this a more public transit and pedestrian oriented city!	9
A thorough process is necessary of course. I do think a speedy process instead of the typical Seattle process might be nice.	9

Comment Text	Code
This is a GREAT idea. Please keep building public transportation!	9
Either mixed or exclusive streetcars would be acceptable. My preference is based on a general desire for shared streets (accommodate all users) and the feeling that some parking helps calm the street (also calms the business owners fears).	9
Can't wait for it.	9
We desperately need public transportation going north and south on 1st Ave... there are no busses currently other than the 99 very early in the AM. I am disabled and have to walk 4 blocks uphill to get a bus and then 4 blocks to get to 1st Ave. We used to have the #'s 15 and 18 going north on 1st and 21 or 22 going South on 1st ....everything was eliminated. This is a real hardship for me. If McGinn wants us to use public transportation, he should make it easier for those of us dependent on it! Metro eliminated some vital routes on 1st Ave......	9
Don't compromise. Do it well.	9
A streetcar isn't just a mode of transportation, it also adds character to the city. Roads exclusively for auto traffic are convenient only for people who drive, and since they exist in every city, add or detract very little to the character of the city. This does great things for Seattle's image.	9
You are doing good work	9
Using street cars will not only benefit those who live and work downtown, but would be a highly sought after tourist attraction.	9
Thank you for moving forward with First Ave. While I would still prefer an outside lane alignment, the inside exclusive is the next best thing. Once it becomes possible, N/S through traffic should be encouraged to use the Alaskan Way blvd.	9,7

Comment Text	Code
Why did streetcars go away in the first place?	9
Please implement sooner rather than later.	9
Very impressive progress to date. Do another session and have people work/dialogue in small groups and answer your questions. A person of your team would facilitate the process.	9
Prefer Mixed-Traffic Streetcar	
Stop spacing is good. Pay attention to truck impacts, and most of all, to perceptions of how 1st will work. Mixed is a must for this corridor!	10
The streetcar should not go on 1st avenue - it should be on 2nd or 3rd. But if it must go on 1st then it should share a lane with car traffic. This works well in Portland.	10,11
Preference for another Corridor (e.g., 1st/2nd, 3rd, 4th/5th)	
I like the 4th and 5th alignment better. 1st avenue is already messed up enough. 1st ave should be a one way street that heads north. 1st and 2nd then make sense as the main corridors for cars going through. 3rd should be really only buses all the time and really upgraded to make it really nice. Bus shelters in the middle of the street would keep people off the buildings and make the bus stops less crowded with people.	11
Not sure 1st is the best street to use.	11
1st Avenue is the wrong street for this streetcar. It should travel along a street that already is heavily transit oriented	11

Comment Text	Code
I don't know what made you think putting it down 1st is a better idea than 3rd or 4th which has more room and see's tons of foot traffic, but I guess since you've already made up your mind that's that. I live right above pioneer square in the Lowman building and the traffic and parking is awful. I don't think a streetcar down 1st is going to help, but make things worse and if you have to destroy those beautiful trees it's really detracting from part of what makes pioneer square so great.	11,12,13
Should consider making 1st Ave One-Way Northbound to pair with Southbound 2nd Ave.	11
I think the routing on 1st lacks vision. The city really needs to 1) build the Prospect Ext 2) connect the SLU and First Hill SC's, and 3) connect the SC to the Ferry Terminal. The current proposal does nothing for #1 and #3. Per #2 the First Ave routing serves more tourist type destinations and not daily commuters. It would make more sense to connect the two SC lines via a 4th/5th Couplet, and then build out the downtown system later with an additional line on 1st. I sincerely hope that Mayor Murray steps back from the decision to route on First and instead takes a more system wide approach to SC routing.	11
Concern about Historic Street Trees (or Other Concerns Related to Pioneer Square Neighborhood Character)	
DO NOT remove the historic London Plane trees on 1st Avenue in Pioneer Square.	12

Comment Text	Code
I'm concerned about the possible removal of trees in Pioneer Square - they are essential to the character of the neighborhood. If more than the 2-3 mentioned were to be removed (I assume the smallish London planes near Cherry St) I'd oppose the project. I'm also worried about the impact on parking and loading. Pioneer Square has had a drastic decrease in available parking in the last few years (both temporary and permanent with the First Hill Street car, waterfront/99, and other construction) and am worried on the impact on business (Elliott Bay books cited it as a major reason for their move). I support the exclusive right of way; transit only works if it's efficient. But as much as I support transit, I'm starting to worry about this project overall.	12,13
Please save the trees in the square	12
Your descriptions of the exclusive lane and the impact on trees in PSQ is vague at best. I feel a solution could be made that would not require the removal of 70 year old tress. The trees in PSQ are an asset not only to the history of PSQ but in a world of deforestation, to have tress in a downtown environment is a rarity and should be preserved.	12
Removing trees in Pioneer Square landmark district would diminish quality of life, neighborhood ambiance, and urban canopy -- PLEASE DO NOT DO THIS. It would seem obvious to anyone who drives 1st Ave in Pioneer Square (especially during sporting events) that this would be a terrible corridor for a streetcar -- has a comparative impact study been completed to rule out 3rd/4th Ave?	12
Your survey does not address the loss of mature London Plane trees in 1st Ave S which is a gross neglect on your part and environmentally indefensible---KEEPING THE LONDON PLANES is key consideration	12
Don't impact the road lane space, medians and overall character of a Pioneer Square.	12

Comment Text	Code
Concern about Loss of Parking/Loading Zones and/or Auto Capacity/Traffic Congestion Impacts	
Pioneer Square cannot take another economic hit. Eliminating parking & loading on 1st is a significant problem. Auto restrictions on 3rd push traffic to 4th and 5th. This would add more traffic to those corridors, creating gridlock. Why not put it on 3rd with other transpo and eliminate cars on 3rd all together? Bikes in both right and left lanes on 5th in the AM create another problem for traffic. Let's work together to have bike corridors, transit corridors neighborhood parking and efficient auto moving.	13
Don't take anymore car lanes away!	13
Will this help remove busses from downtown that jam traffic from 4 to 6 pm every night.	13
General Criticism of Project	
I don't see the need for a streetcar but it looks like you are going forward with it. As usual...	14
Too bad Murray is going to sabotage it.	14
How in the world was this even a good idea?! The traffic along 1st Avenue is already a nightmare during game days, preventing my customers from getting to my business location. And now you want to put a STREET car in the middle of it all, further clogging traffic! Who is deciding these things? I have a business in Pioneer Square, and we are already suffering with continuous street construction projects, fears of the impact of the tunnel and viaduct replacement, high street parking ($3.50/hr vs. $1.25 in lower Queen Anne), homelessness, street violence, etc.. Perhaps the time and attention to a street car could be spent more wisely on these other problems!	14,13
Stop wasting taxpayers money!! Are you going to build a tunnel for this as well? You had a "streetcar" on Alaskan. Which is now some random bus route. Why don't buses work without millions and millions of $$$ invested, traffic disrupted, etc???	14,13

Comment Text	Code
I only vote YES on this if we get 3rd Avenue back from the bus traffic.	14
Don't build any more streetcars until more experience is developed with the two lines already running.	14
This is just to serve the needs of people who will live in the new Paul Allen projects on South Lake Union, right? Who else besides tourists could it possibly benefit?	14
Pull the plug; do not do the project; instead, spend the funds on Yesler ETB overhead project, 23rd Avenue overhead project, Route 70 speed and reliability project, and electrification of diesel routes 40 and 67.	14
Why are we getting streetcars? We have trains and buses, why do we have to spend a huge amount of money and effort tearing up the streets to add a new kind of transit that doesn't have a well-defined goal of connecting the city? :'(I'm very, very pro transit - I don't own a car - but the patchwork of unconnected transit is frustrating for riders!	14
This is insane!!!!! This street cannot carry the traffic loads that it now has!!!!! If you have to waste money, waste it on second avenue, where there is room! Go look at pictures from 1910. This is the stupidest waste of resources i have seen in a long time!!!!!	14,13
Running buses on this line makes more sense.	14
This is an AWFUL survey - and an awful explanation of each alternative. As a resident who lives on 1st Avenue, I DO NOT WANT A STREETCAR!!!!!!!!!!!!!	14
Regional mass-transit system preferred. I don't see myself riding this. I live in downtown proper.	14

Comment Text	Code
I just moved downtown so I am new to the project. I really feel that this project will be a BIG DEAL when most Seattle residents start to consider it. I feel that there needs to be a concerted effort to educate people on the updated transit plan and the reasons why autos are basically being pushed out of downtown, and why autos are not a priority when considering these projects. I also feel that loss of parking and business interruption by construction will become more and more significant issues based on the Jackson streetcar construction - you need to adequately evaluate const. Impacts and alternate construction approaches to decrease disruption. Need to look @full closure of 1st with 24 hr const periods.	14
Support Use of Benson Streetcars	
Save the George Benson waterfront trolleys.	15
Bring Back the Benson Streetcars!	15
I think that the Benson streetcars would attract visitors to ride as well as more capacity for visitors and city workers.	15
We really ought to use our current fleet of Benson cars on this core route. In doing so, we will save on upfront capital costs, have cars with far greater capacity than modern designs, and keep the city's heritage alive. Let's save some money. Additionally, surface street traffic in downtown being what it is, we have to build an exclusive right of way for traffic (be it transit OR cars) to move at all-- let's develop a meaningful option that can compete with car travel, and make downtown more functional!	15,1
Please find a way to re-use the old Benson trolleys	15
For a variety of reasons including cost, capacity and historical value, I strongly advocate for the use of the Benson cars on the CCC route	15

Comment Text	Code
• A fully retrofitted Benson trolley will cost $2M less than a modern car. • Using the Benson cars to connect the two most historically significant attractions in the city - Pioneer Square and the Market - would be a wonderful way to demonstrate a commitment to embracing our heritage. • The Benson cars will seat 50% more passengers than the modern cars in use today thus providing more comfort to the riding public. • If the CCC is tied to a streetcar line on the waterfront it would be possible to ride from the Olympic Sculpture park to MOHAI- a very useful and attractive element of our transportation system.	15,2
My interest is seeing the vintage Benson streetcars restored in some aspect, as cost and attraction to tourists would both benefit.	15
Interested in the Benson Streetcar Option...where is that mentioned?	15
You are missing the point on priorities. My highest priority is to have a connector streetcar that is fun and emphasizes our great history. We need to make our old streetcars part of this strategy.	15
Please return to service of the historic "George Benson" streetcars!!	15
The lovely old George Benson streetcars should be returned to service for this line. It would truly be a shame to lose them forever!	15
Please bring back the Benson cars! Mr. Benson worked too long and hard on this for these to be scrapped.	15
Incorporate the Benson Green Streetcars. San Francisco has the ability to do this i.e. Run historic and new cars. Plus they have cable cars.	15
Bring back the historic George Benson streetcars while we still can!	15

Comment Text	Code
What about the Waterfront Streetcars??? Why not put those back into use? What about the promise that the City of Seattle made to the citizens, regarding putting the Streetcars back into use, after removing them for the very silly issue of the Olympic Sculpture Park? Come on now, we were promised those streetcars would be back in use. Stop trying to sell them off illegally and on the sly - put them back into use on the waterfront!!!	15,2
The old Australian streetcars need to be used. First of all, the city and the county both mad a commitment to bring back the Waterfront Streetcars in 2005 because people created quite the ruckus when they went out then, and second because the county already has the streetcars, and they are proven reliable and popular. Because of their antique nature and coolness, they will draw riders much more than the modern cars. A mixture of both would be ideal.	15
I'm frankly not a big fan of this project and don't find it a particularly wise use of scarce transportation dollars. Having said that, I urge that we use our heritage Benson Line cars on whatever option is finally selected. • A fully retrofitted Benson trolley will cost $2M less than a modern car. Not to mention it has style and class and presence that none of the modern cars on the SLUT do. • Using the Benson cars to connect the two most historically significant attractions in the city - Pioneer Square and the Market - would be a wonderful way to demonstrate a commitment to embracing our heritage. It'll remind folks that Seattle wasn't built yesterday, despite our best efforts to forget our history. • The Benson cars will seat 50% more passengers than the modern cars in use today thus providing more comfort to the riding public. While this would be a very different situation when talking about electric trolleybus service, where I would prefer less seating and more standing room, the majority of traffic on this line is going to be tourists and folks who are not in a hurry. • If the CCC is tied to a streetcar line on the waterfront it would be possible to ride from the Olympic Sculpture park to MOHAI- a very useful and attractive element of our transportation system. Please keep this possibility in mind as planning progresses.	15

Comment Text	Code
I urge you to integrate the historic George Benson streetcars into the Center City Connector plan. These cars are an important piece of Seattle's history and will attract new riders to the line. Retrofit them to be ADA compliant and bring them back!	15
We need to include the vintage streetcars in this project. Not only do they look great, but they're the most cost effective solution.	15
Bring back the historic Benson streetcars!	15
The use of historical streetcars on the ccc should be examined with special consideration given to the attraction these cars have to riders. Even with full retrofitting the Benson cars will cost $2m less than a modern streetcar and will be much more fitting to connect the two most important historical destinations in the city - pioneer square and the market. Being able to connect these two destinations with MOHAI adds a benefit that must be considered even thought it's intangible.	15
Incorporate the Benson trolleys! They are a valued part of our history and dearly missed	15
Historic cars would be cool mixed with new cars however I would not like it at a large expense of travel time. They might be okay during tourist season. Please clean up parts of town with old useless tracks.	15
Again, keep the Benson trains in Seattle	15
Do whatever is necessary to preserve and run the historic streetcars. Since the well-used and very useful waterfront option appears to be dead (I used it weekly for several years) this would be the best way to honor Councilman Benson's hard work and memory	15

Comment Text	Code
Oppose Use of Benson Streetcars	
Don't bring back the Melbourne streetcars. Make this a world-class, reliable, modern streetcar. Something the city can be proud of. A streetcar that serves the needs of the residents and tourists equally. The historic streetcar serves the needs of tourists over the needs of the residents. A streetcar that shares the lane with cars is not worth building at all. Where's the cycle track?	16,6
As I wrote at the open house, please reject the use of the so-called historic Benson streetcars. They are historic to Melbourne, Australia, not to Seattle. They are clunky, the ride is jerky and capacity very limited. Big bucks would be needed for ADA compliance. They belong on a renewed waterfront line when that project is being built. They are not viable for use on a modern--and serious--system.	16
Don't let the waterfront project pawn the Benson cars off on you, they should be making accommodations for a limited streetcar line on the water not inventing ways to add more traffic lanes. All projects must protect their ability to expand in the future. Stay focuses on connecting the lines with CC but make sure stops, routes, and technology all consider the long-term growth plans.	16
The Benson streetcars are historic to Melbourne, Australia, NOT to Seattle. They are jerky and clunky. The ride is not smooth at all, they should be used ONLY as a tourist line along the redeveloped waterfront, NOT on the first ave connector line!	16
Other Comments	
The least confusing I think is always the best	other

Comment Text	Code
There was no information on potential impacts on other transit service. I am also concerned about long term impacts a first hill streetcar will have on bus operations. Does Metro have plans to utilize 1st for buses that will need to be shelved? Will the center city connector allow for more buses to terminate at north or south of downtown?	other
There is a huge demand for affordable housing along this corridor. What is the plan for creating more affordable housing near all this new affordable transit?	other
I really like the proposed changes to the SLU streetcar. It frustrates me that drivers "blocking the box" on Mercer go unpunished, and hundreds of people are stuck in traffic as a result. I would love to see more tickets issued (bonus: revenue for the city)	other
Too much focus is place on maintaining street parking spots. Motivate people to use public transportation by making it more efficient and accessible than cars.	other

Public Outreach Instruments

Figure P-21 Open House #3 Handout and Comment Card

SEATTLE CENTER CITY CONNECTOR TRANSIT STUDY

SDOT
Seattle Department of Transportation

OPEN HOUSE #3

OCTOBER 29, 2013

Please return this handout with your comments

We need your input on 1st Avenue streetcar alternatives! Along with the evaluation results presented tonight, your input will help inform the project team's final recommendation for a locally preferred alternative for the Center City Connector that we will present to the Mayor and City Council in late 2013/early 2014.

1. Which conceptual streetcar option do you prefer for 1st Avenue? (please check only ONE)

☐ **Mixed-Traffic:** Streetcar would share a lane with auto traffic
☐ **Exclusive:** Streetcar would have its own lane for a majority of the alignment

2. Please explain your preference for the Mixed-Traffic or Exclusive Streetcar option:

3. Which of the following factors most influenced your preference?
Please rank in order of importance (1 being the most important, 8 being the least important).

	Evaluation Measures	Rank 1 to 8	Comments and/or Key Considerations
ENHANCE	Streetcar Travel Time		
	Streetcar Travel Time Reliability		
CONNECT	Streetcar Ridership		
	Annual Operating & Maintenance Costs		
	Total Capital Costs		
	Auto Travel Times		
	Increase in Delay on Parallel Corridors		
THRIVE	Parking/Loading Impacts		

4. Are you a downtown... (please check all that apply)

☐ Resident ☐ Employee
☐ Business owner ☐ Student
☐ Property owner ☐ None
☐ Other (please specify) ____________________

5. How often do you use public transit? (please check only ONE)

☐ Daily ☐ Monthly ☐ Weekly ☐ Occasionally ☐ Never

6. Have you attended the previous Center City Connector Open Houses?

☐ Open House #1 (February 2013) ☐ Open House #2 (June 2013) ☐ Tonight is my first open house for this project

7. Do you have any other comments or questions?

____
____
____
____
____
____
____
____

THANKS FOR COMING TO TONIGHT'S OPEN HOUSE!

The questions below are completely optional. Your responses will help us improve our outreach and ensure we're including all of Seattle. Thank you for your help!

a. What is your race? ____________________
b. Are you of Hispanic origin? ☐ Yes ☐ No
c. What language do you speak at home? ____________________
d. How old are you? ________
e. What is your gender? ☐ Female ☐ Male ☐ Transgender ☐ Other __________
f. Do you: ☐ Own ☐ Rent ☐ Other________
g. In what zip code do you live? __________

Thank you for your input!

APPENDIX Q STAKEHOLDER OUTREACH

This appendix summarizes the results of interviews that were conducted with 40 stakeholders over the course of more than two dozen meetings between November 28 and November 30, 2012.

Overview

An early step in the Center City Connector study process was to identify and conduct interviews with a range of individual stakeholders and stakeholder groups throughout the Center City study area. The consultant team, SDOT staff, and the Mayor's Office developed a list of potential stakeholders who were contacted and invited to a 60 minute interview. Most invitees accepted and were interviewed between November 28 and November 30, 2012. The stakeholder list was intended to represent a range of interests and cover key geographies that a new transit line could service or improve access to through transit connections. **It is important to note that these interviews were not intended to represent the sentiments of all Center City stakeholders, only those that were interviewed. Findings reported are those that multiple stakeholders shared in common. No individual sentiments are reported. The summary findings are not reported as facts, but are rather key themes reported during the interviews by invited stakeholders.**

Stakeholders Interviewed

The following stakeholders were interviewed:

Ben Franz-Knight	Pike Place Market PDA, Seattle Streetcar Coalition
Michael Wells	Capitol Hill Chamber
Jim Miller	Belltown Business Association
Jerry Dinndorf	South Lake Union Community Council
Cara Egan	Seattle Art Museum
Bob Cundall	Seattle Art Museum
Lindy Gaylord	Seneca Group (for Bill & Melinda Gates Foundation)
Lisa Quinn	Feet First
Rob Johnson	Transportation Choices
Chuck Ayers	Cascade Bicycle Club
Jan Drago	Historic South Downtown
Rob Nellams	Seattle Center
Layne Cubell	Seattle Center
Maud Daudon	Seattle Chamber of Commerce

Charles Knutson	Seattle Chamber of Commerce
Don Blakeney	Chinatown/International District Business Improvement Area (CIDBIA)
Kate Joncas	Downtown Seattle Association
Tom Eanes	Seattle Housing Authority
Rita Ryder	Seattle YMCA
Joshua Hicks	Plymouth Housing
Steve Woo	Century Link Field / Public Stadium Authority (PSA)
Thomas Eli Backer	Safeco Field / Public Facilities District (PFD)
John Coney	Uptown Alliance
David Freiboth	King County Labor Council
Dan McGrady	Vulcan Inc.
Leslie Smith	Alliance for Pioneer Square
Ben Schiendelman	Seattle Subway
Maiko Winkler-Chin	SCIDpda (Seattle Chinatown International District Preservation and Development Authority)
Shelly DaRonche	Fred Hutchinson Cancer Research Center
Robbie Phillips	Fred Hutchinson Cancer Research Center
Jill Morelli	UW School Of Medicine
Miranda Leidich	UW School Of Medicine
Maggie Walker	Central Waterfront Committee
Ellen Mondrad	Queen Anne Community Council
Kirk Robbins	Queen Anne Community Council
Martha Choe	Bill & Melinda Gates Foundation
Lara Hirschfield	Amazon.com
Heidi Westling	Amazon.com
Jamie Cheney	Commute Seattle
David Perez	Queen Anne Chamber of Commerce
Tom Waithe	Kimpton Hotels

Stakeholder Interview Summary Findings

The interviews were designed to follow a general "script," which is attached to this document. The findings described below represent common themes expressed over many interviews. Where there were clear dissenting viewpoints, these are also represented.

Perhaps the most dominant theme gathered from the stakeholder interviews is the substantial consensus for connecting the existing streetcar lines with a Center City circulator streetcar on a 1st Avenue alignment. Most stakeholders see the 1st Avenue streetcar as operating primarily in mixed flow traffic to maintain capacity on that street. The findings included below document that consensus and provide many insights from more than two dozen stakeholder interviews.

It is important to note that the opinions expressed in this memo simply restate the views expressed in stakeholder interviews. There has been no attempt to "fact check" or change the opinions expressed in these interviews.

Benefits/Purpose of a Center City Transit Improvement

1. Virtually every person interviewed agreed that a Center City circulation improvement is necessary and will result in substantial benefits. Key purpose and benefits identified by respondents regardless of the alignment selected included:
    a. Provides local connection services which will increase mobility and access in the Center City, particularly between employment centers, retail, attractions, and residential populations.
    b. Ties together and leverages current and short-term investments in streetcars and rail service and to a great extent bus service as well. Nearly all stakeholders described the need to complete the connection between SLU Streetcar and First Hill Streetcar lines as the highest priority.
    c. Provides added capacity in the Center City necessary to meet increasing demand for local trips. This is seen as especially important as more people use light rail and other transit services to access the Center City. Further, planned residential and job growth will necessitate most Center City trips be made by walking and transit.
    d. Provides better connections and thus greater accessibility for casual riders.
    e. Will provide critical link between isolated portions of the system (SLU and First Hill streetcar lines).
2. Many stakeholders felt that a Center City investment would improve current transit options which are commonly viewed as inadequate, confusing, and uncoordinated across multiple modes. Stakeholders felt that a Center City circulator was necessary or could go a long way to improve reliability, ease of use, legibility, and certainty. This was particularly true if the circulator was a streetcar investment.
3. Additional benefits were identified by many respondents specifically for the 1st Avenue corridor, including:
    a. Ties together many important attractions in the western part of the city that are currently poorly served by transit including Pike Place Market, Seattle Art Museum, the Waterfront, Colman Dock (Ferry terminal), cruise ship

terminal, newly developing stadium area, Pioneer Square, Belltown, Queen Anne, and Seattle Center.

b. Keeps key attractions from becoming isolated from the retail core of downtown. 1st Avenue is the "bridge" that knits together the waterfront and the business core and retail district.
c. Catalyzes and extends economic development anticipated for the waterfront after the removal of the Alaskan Way Viaduct.
d. Helps to replace significant loss of bus service in the 1st Avenue corridor when buses were removed from 1st Avenue and shifted to 3rd Avenue.
e. Enhances underperforming retail districts in Pioneer Square, Pike Place Market area, Chinatown/International District, and Belltown and supports the revitalization of a street that is "uniquely Seattle" and supports many local businesses.
f. Encourages more in-fill development that is good for the City.

Preference for Specific Modes

1. Nearly everyone interviewed immediately gravitated to a streetcar solution. Many expressed hope that it would not be necessary to study a bus solution. Specific reasons for this preference included:
   a. Overall preference for rail transit and for modern streetcar specifically. Respondents cited added comfort, route certainty, ease and simplicity of use, and legibility of a streetcar system.
   b. Economic development potential is seen as greater with a fixed rail system. The potential for economic development is closely aligned to the potential for local funding for the line, which is also seen as being possible only with a rail investment.
   c. Because this project is seen as a connector, many respondents emphasized the need for a streetcar investment that is through-routed to the existing lines, providing a seamless connection. Stakeholders voiced concern about the need to transfer from a streetcar to a bus connector. Several stakeholders described the plan for a "crescent" of streetcars.
   d. Stakeholders expressed a general lack of belief that buses can be fast or reliable or can be branded in a way that will attract core groups of Center City riders or build transit patronage over time.
   e. Stakeholders noted the high levels of tourism and visitor travel in Seattle and anticipate dramatic increases in visitors to the Central Waterfront. Many stakeholders believe that visitors would be more likely to use a streetcar and believe that a streetcar would do more to spread economic benefit generated

by visitors to other Center City neighborhoods including the International District.

f. Several respondents expressed hope that the waterfront historic streetcars could be operated on the circulator route for special occasions, festivals, or summer weekend service. Stakeholders did not believe that the historic trolley service would be likely to return to the waterfront and that even if it did, the historic waterfront trolley would not substitute for a modern urban circulator line/system.

2. The only significant skepticism of streetcars came from human service providers and affordable housing representatives who felt their clients were knowledgeable about and comfortable with bus services operating in the Center City and were concerned a Center City circulator would draw operating resources from the bus system.

   In addition, several stakeholders questioned whether current single car streetcars would have enough capacity on a line that connected SLU and First Hill streetcars through downtown and served multiple visitor destinations along 1st Avenue.

Preference for a Specific Alignment

1. The vast majority of stakeholders interviewed had a strong preference for a 1st Avenue alignment. Reasons cited for this preference included:
   a. There is a very strong feeling that the 4th/5th corridor is already well served by transit, with bus and light rail service operating in the Downtown Seattle Transit Tunnel (DSTT) and bus service on the 3rd Avenue Transit Spine. There is a gap in higher capacity attractive transit options on the west side of the Center City.
   b. 4th and 5th Avenues are seen as key auto and transit carrying streets and introduction of a streetcar could reduce valuable and very limited capacity for those modes. Many people's reaction was "it makes so much sense to put a streetcar on 1st Avenue, why deal with the many challenges and conflicts on 4th and 5th Avenues?"
   c. Many stakeholders noted that streetcars/circulators work best where they act as "pedestrian accelerators" serving routes where people are already inclined to walk and to make short trips or trips that represent a "long walk." They noted that 1st Avenue is more suited to this type of travel than 4th and 5th Avenues.
   d. 1st Avenue was seen has having wider array of uses and markets which would create all day demand from both local travelers and visitors. Stakeholders cited the emergence of a revitalized waterfront and removal of the Alaskan Way Viaduct as creating new mobility demands.

e. Stakeholders noted that buses were removed from 1st Avenue and businesses and stakeholders in this corridor feel the need for a new service.
f. Stakeholders believe the opportunity for economic development is much greater on 1st Avenue compared with 4th and 5th Avenues, which are already more fully and newly developed. Lack of north-south access and mobility is perceived as a current barrier to development 1st Avenue.
g. Several stakeholders noted that the 1st Avenue alignment is better suited for extension to the Stadium District and to other major employers like Starbucks.
h. Stakeholders believe there is an opportunity to support cultural and economic resources that are "uniquely Seattle" located in the 1st Avenue corridor, compared to a 4th and 5th Avenue alignment, which supports larger stores, chain retail, office uses, and has a more modern development pattern.
i. Citing the need for local funding, stakeholders believe there is potential to tap into Local Improvement District (LID) funding either through a planned Central Waterfront LID which could be extended to or beyond 1st Avenue, through a new LID, and/or through an LID in the stadium area, which could extend this line south. Stakeholders from the Stadium District were interested in examining a streetcar line that served the district, but also had concerns about where it would run. (Discussed further in the funding section of this memo).
j. The 1st Avenue alignment is seen as having the best opportunity to tie together both local riders and tourists by touching many major tourist attractions, including many local recreators from throughout the region, and encouraging either park-once or leave-the-car-at-home travel. In particular, service to the Market and the Art Museum were cited as critical. The 1st Avenue alignment would also serve the growing cruise passenger market. In contrast, stakeholders felt a 4th and 5th Avenue alignment would be attractive primarily to commuters and would not have substantial all-day ridership.
k. The 1st Avenue alignment would presumably operate later than current bus routes providing service in the evening hours, which is seen as exceptionally poor now.
l. Several stakeholders felt that connecting south downtown neighborhoods (Pioneer Square, Stadium District, and ID/Chinatown) to 1st Avenue attractors is a priority due to its potential to boost economic return in these neighborhoods.
m. Connections to Washington State Ferries (WSF) via the Marion Street pedestrian bridge would be well served by a 1st Avenue alignment. There is a

significant population of WSF commuters that work in SLU and Capitol Hill.

2. Of those who preferred 1st Avenue, the majority of stakeholders expressed preference for Pike and/or Pine Streets as the connection to Westlake and the existing South Lake Union Streetcar alignment. The connections on Pike/Pine were cited for their opportunity to add "eyes to the street" and reduce negative social issues on those streets. Other specific reasons for preferring the Pike/Pine connection included revitalization of the corridor, connections from residential districts north and south of downtown to retail including Westlake Center and the new Target store, and the iconic potential of a streetcar operating on Pike Street between Westlake and the Pike Place market.
3. Other stakeholders cited the direct connection to the front door of the Market and the opportunity to tie the Market into the rest of downtown and the Center City as crucial.
4. Two stakeholders expressed preference for making the connection to Westlake as far north as possible, citing the directness of the route as important and having an interest in penetrating Belltown. Two stakeholders expressed preference for avoiding Pike and Pine Streets because of the existing pedestrian hub at Pike and 1st Avenue.
5. A small number of stakeholders expressed priority for an east-west connection between Uptown/Lower Queen Anne and South Lake Union, with the potential to extend an east-west connection directly to Capitol Hill as an equal priority to connecting at Westlake. This was seen as important to a number of employers and businesses with developing demand in those areas.

Potential Conflicts

1. Conflict with traffic congestion/flow was most often cited by the stakeholders as a concern. In particular, traffic congestion on 1st Avenue after Viaduct removal and also on 4th Avenue were cited as problematic. A majority of stakeholders believe that conflicts on 4th and 5th Avenues would be significantly worse than on 1st Avenue. Stakeholders recognized that outcomes of WSDOT discussions around SR99 tolling levels and resulting traffic diversion could have a significant impact on the viability and performance of streetcars on 1st Avenue.
2. Bike safety was often cited as an issue to contend with, particularly bikes traveling in parallel with streetcar tracks (there was no concern of bike travel perpendicular across tracks). This was of more significant concern on the 4th and 5th Avenue alignment where improved bicycle facilities are planned. Stakeholders felt that 1st Avenue is a much less important bikeway and would not require bike treatments since there are quality parallel routes either built or planned.

3. Loss of parking was cited as a potential problem, primarily for small merchants. There was mixed opinion about whether this would be a significant issue, as much of the existing parking is restricted to midday.
4. Historic London Plane median street trees in Pioneer Square and visual issues from streetcar wires were cited as potential issues in the historic Pioneer Square area. Additionally, stakeholders felt changing the "boulevard" feel of 1st Avenue in this district could be controversial.
5. Safety and security on Pike/Pine Streets and crime in Belltown were cited as potential issues, primarily in the context of how streetcar could improve these situations.
6. Resistance or potential resistance from Belltown residents and businesses was expressed by several respondents, although the Belltown representative said that opinions were changing among residents and business owners in this neighborhood.
7. Stakeholders had broad agreement that 2nd Avenue should not be considered for streetcar/circulator operations due to importance for regional transit and for a next generation bicycle facility (i.e., cycle track).
8. A question (and potential concern) was raised as to where the car maintenance facility would be to house added streetcar vehicles.

Right of Way Management/Service Characteristics

1. There was general consensus that an exclusive right of way was not achievable on either corridor because the conflict with auto traffic would make it impossible to take a lane or remove significant street parking in the corridor. Many stakeholders indicated a preference for anything that would make a streetcar more reliable including queue jumps or short segments of exclusive right of way where feasible, priority signals, and anything else that would assist the streetcar's reliability.
2. Several stakeholders expressed concern at the slowness of the South Lake Union streetcar and hoped that anything developed through this study would be faster.
3. A number of stakeholders indicated that parking removal could be controversial, particularly in areas like Pioneer Square that are losing parking with the removal of the Alaskan Way Viaduct. However, there was general agreement that downtown businesses understood the value of higher-capacity transit in delivering customers and would be willing to accommodate some reduction of on-street parking for a transit improvement.
4. Several stakeholders indicated that frequency is critical since people value their wait times more than the time spent moving on a rail vehicle. Several stakeholders indicated that people don't expect to go fast through downtown but they do want to know that a streetcar is coming soon.
5. Most stakeholders who expressed a preference preferred close-spaced stops, especially on the 1st Avenue alignment from Pioneer Square to Westlake to serve as a people-

mover and to promote lingering along the line, rather than serving as a rapid transit function. Several stakeholders indicated the need to examine block by block, and suggested wider stop spacing in some segments (2 or 3 stops in Belltown for example) and closer spacing in areas with many visitor attractions.

Market for a Transit Investment

1. Most stakeholders indicated that a transit investment should serve a combination of local and tourist/visitor markets and should have a long service day where it would be useful to many different kinds of trips.
2. Several stakeholders emphasized that 1st Avenue would have the best opportunity to serve both local and visitor trips and would be viable as an all-day/extended-day service. The 4th and 5th Avenues alignment was cited several times as a commute market useful primarily during the work day.
3. Several stakeholders citied the advantage of a streetcar in capturing lunchtime work trips. One stakeholder noted that Chinatown/ID lunch business has dropped with the elimination of the Ride Free Area and that creating a highly legible service for workers to access Chinatown/ID could help to increase lunch time business.
4. Social service and affordable housing representatives felt that their clientele would use streetcars and would appreciate ride quality and access benefits; however, they stressed their concern about putting limited transit resources into a service that was structured for short downtown trips and that might be routed to serve tourist markets.
5. Waterfront, Pike Place, 1st Avenue, and Stadium District stakeholders were all interested in the role of a streetcar/circulator in enhancing "park once" opportunities in the Center City. All felt that a 1st Avenue alignment would do a lot more to connect parking assets – particularly those underutilized at off-peak times – to major attractors. This is particularly important given recent parking reduction from the AWV project and other future street use demand that could reduce on-street parking further.

Priority Segments

1. Virtually all stakeholders said that a first phase that connects the First Hill and SLU Streetcars is critical. "Tie together the ends first and then extend from there" was a sentiment that was commonly expressed. One stakeholder's comment echoes a common sentiment, "To not complete the connection between isolated segments of the streetcar system (SLU to First Hill streetcars) would be the biggest failure."
2. Several stakeholders expressed concern that Belltown would resist a streetcar, although that could not be confirmed by the Belltown representative who thought there was a broader mix of opinions now. Stakeholders concerned about acceptance

in Belltown felt that a first phase between Pioneer Square and Westlake could still be built, giving Belltown more time to prepare for a future extension.

3. Seattle Center representatives stressed the need to get the streetcar north to Seattle Center to connect the sculpture park and the Center with the rest of the City. They provided information about visitation, including many evening events and expressed a strong desire to market a transit connection. Current services are inadequate, not legible to occasional users and stop running before events typically end.
4. Belltown and Art Museum representatives stressed the value of the 1st Avenue segment north of Virginia/Stewart (or Pike/Pine depending on the east-west connection) as a later phase as it connects key community assets but also provides connections to the Cruise Ship Terminal and significant existing and planned residential development. They stressed that for Seattle Center and Seattle Art Museum (SAM) to thrive in a time when driving to the Center City is increasingly unattractive, they need customers delivered from downtown housing and major transit hubs.
5. Both SLU and Seattle Center representatives expressed a desire to keep the east-west connection between Uptown/Lower Queen Anne and South Lake Union in study considerations, at least as a future phase. They agree that there is a need to get the streetcar network more fully planned so that other decisions can be made around future alignments.
6. Several stakeholders felt that alignment options through Westlake on 6th and 7th Avenues should be explored to provide service closer to the Convention Center, key hotels, and to a burgeoning office district in the Denny Triangle. Several stakeholders also thought there was opportunity to improve streetcar to light rail connections (relative to the current Westlake terminus connection) by creating a new station with a more transparent and proximate connection to a Westlake Station tunnel entrance.
7. Six stakeholders mentioned the need to consider an extension south to the stadium area, proposed arena/entertainment district, and connecting to Starbucks HQ. At least one stakeholder felt that the property owners in this area were willing to consider an immediate LID and would contribute to construction. While there was support for this alignment, stakeholders most familiar with the Stadium District and recent master planning efforts there expressed concern that finding a suitable alignment could be challenging. In their planning efforts, Occidental has been taken off the table as a potential alignment and 1st Avenue has a number of competing demands on the right-of-way.

Funding

1. Several stakeholders expressed belief that the Central Waterfront group considering an LID would be interested in extending the LID to provide funding for the 1st

Avenue line and would consider a 1st Avenue streetcar, as well as quality connections from the waterfront to 1st Avenue, as priority investments . Stakeholders felt this was the best opportunity to generate local funding since it seemed unlikely that a second and separate streetcar LID could be imposed in this area. They also felt that given the high demand for funding for Central Waterfront projects, a streetcar portion of the LID would be relatively modest and other funding sources would be needed to support the majority of the project.

2. Stakeholders expressed concern that the relatively limited development potential in the downtown area would make it difficult to raise local revenue from a LID, especially for a 4th and 5th Avenue alignment.
3. One stakeholder felt that downtown businesses and property owners along the alignment should not shoulder the cost of streetcar construction and that funding should come from a citywide source, particularly since all residents share the value of Center City investments.
4. Stakeholders indicated that it would be necessary to look at a more diverse capital funding package than the one developed for the South Lake Union Streetcar.
5. Several stakeholder expressed concern that operating funds should be a priority so that frequency could be provided to attract riders. There was a desire for a frequent streetcar service that would not reduce bus service in other parts of the community.
6. Several stakeholders expressed belief that the stadium area property owners would consider an LID to extend the 1st Avenue line south of Jackson.
7. One stakeholder though that a new LID that would include properties on an east-west line from SLU to Seattle Center would be possible.
8. Many stakeholders said it would be much harder to get local funding for a line on 4th and 5th Avenues.
9. Many stakeholders expressed hope that the State would come up with a new transit funding source.

Current and Potential Development Projects

1. Several stakeholders mentioned the Lake to Bay trail and wayfinding effort which could extend the reach of the streetcar.
2. Many stakeholders mentioned parcels either planned or potential for development on the waterfront and between the waterfront and 1st Avenue. Economic development in this area was often cited as a reason to align a streetcar in the 1st Avenue corridor.
3. Most stakeholders indicated that 1st Avenue and surrounding neighborhoods like Pioneer Square and West Edge to Waterfront are likely to see much more creative class development in employment and residential tenancy than 4th and 5th Avenues.

This burgeoning class of users was seen as a significant potential market for a streetcar route on 1st Avenue.

4. It was broadly recognized that redevelopment potential in either corridor is much lower than the South Lake Union line. Both corridors present opportunity for infill development and some redevelopment, but not at the scale that streetcars in Portland's Pearl District or South Waterfront or Seattle's South Lake Union helped catalyze.
5. Multiple stakeholders with 1st Avenue interests noted that elimination of Metro bus service from 1st Avenue had hurt some retail businesses and reduced vitality on those streets. They believe a streetcar could be part of reversing these trends along with other mechanisms (such as expansion of the Metropolitan Improvement District (MID) to Belltown).
6. There is substantial growth still planned in SLU and west to Seattle Center. The Gates Foundation is planning another building and will double their employment; the University of Washington School of Medicine has expansion plans and construction underway; and Amazon continues to grow.
7. Several stakeholders mentioned the planned bike sharing program which could coordinate with streetcar implementation.
8. Planned residential development in Belltown was mentioned. The new arena and development of neighborhoods in the stadium area and south of the stadiums was cited by several as important enough to consider extending the streetcar south.
9. Numerous stakeholders were excited about the idea of running streetcars east-west in the Pike/Pine corridor to leverage redevelopment of a few strategic sites, strengthen the retail environment, and reduce social problems.
10. Several stakeholders pointed to rapid growth in the Denny Triangle and residents' need access to services, retail, and recreation.
11. Yesler Terrace project will increase housing and bring market rate housing to this area. Additional market rate housing is planned in Chinatown/ID, which will change the demographics and travel patterns in this area, which currently houses many senior citizens.
12. North stadium lot development will increase residential, hotel, and commercial population south of Jackson.
13. Mid-rise commercial development is planned just south of Chinatown/ID to the immediate south of Dearborn Street.
14. Pioneer Square Historic District has seen $1.7 billion in annual revenue reported in the last year.

Other Comments

1. Please come speak to the SLU Community Council which meets on the 2nd Tuesday of each month in the evening.
2. Extend the 1st Hill streetcar to Volunteer Park (several comments).
3. Uptown Plan is currently under development and should be considered.
4. 2008 Seattle Center Plan had a detailed access plan and will be sent electronically.
5. Key Arena attendance is nearly back to pre-Sonic departure levels. The need for transit continues to be a major concern for Seattle Center.
6. A parking and construction mitigation strategy will need to be a key part of any streetcar project development, particularly to garner business support.
7. City did some work on economic potential of streetcars in 2008? Could be useful.
8. One stakeholder said that waiting for transit in the middle of the street is problematic and creates a barrier effect. Put streetcar at the curb.
9. One stakeholder expressed concern about accessible pathways in the Pioneer Square Area.
10. See Trevor at SDOT for development maps.
11. NY Times reporter told stakeholder: "Seattle more than any other city reminds me of Manhattan as it is landlocked and linear – you have the opportunity to strangle yourself or become a very dense city."
12. Streetcars to Stadium District would be more useful to stimulate off-event activities than for game day transportation. They would not provide enough capacity to make a significant contribution meeting game peak access demands.
13. City needs to be proactive in communicating with the business community about the benefits and tradeoffs of this project. Many will perceive it as a threat (i.e., lost parking and access) without an extensive conversation about the long-term benefits and construction impacts.
14. Project is an important step toward developing a much needed modern transit system. Believe incrementalism and missed opportunities are going to kill economic growth and this and other transit projects needed to be expedited.
15. Several major employers in the study area have offered to provide us with employee zip code data, transportation management plan reports, conduct employee and visitor streetcar user study, employee home-location maps.

Figure Q-1 Draft Alignment Options Map

Source: Adapted from Seattle Transit Master Plan, 2012, Figure 3-16 (page 3-29).

Stakeholder Question Guide

Introduction

Background

Seattle's recently completed Transit Master Plan identified priority corridors throughout the city that would need to see improvements to meet projected ridership demands. In particular, the Center City is expected to see significant growth in employment and residential density, which will result in a greater need for even better transit service downtown. The TMP identified options for improving center city transit circulation, including two specific corridors that could be served by a frequent bus or streetcar circulator. The Center City Connector Transit Alternatives Analysis will give us an opportunity to further examine potential alignments and develop a plan to move this idea closer to an on-the-ground reality.

[Provide map (Figure Q-1) showing TMP Center City Alignments CC1 and CC2]

Study Overview

[Interviewer will provide 5 minute overview of study purpose, role of an Alternatives Analysis, study schedule, and study goals]

Primary goal of the study is to:

- Identify the best alignment and technology that connects Uptown or South Lake Union with South Downtown and potentially the South Lake Union Streetcar line with the First Hill Streetcar Line (now under construction on Jackson Street). The study will consider transit modes including **streetcar and enhanced bus service** [unique branding, service design focused on Center City circulation, etc], and will review several alternative alignments (i.e., 1st Avenue, 2nd Avenue, 4th Avenue, and 5th Avenue). A decision making process will be conducted to identify the best transit solution to be developed as the LPA for adoption by the City and for inclusion in PSRCs long range transportation plan – Transportation 2040.

  [NOTE: Recommend we bring to each interview a simple map of corridors and possible alignments.]

During a 14-month period, the study will:

- Identify a series of performance measures including mobility needs and land use/economic development goals to be supported by the preferred alternative.
- Compare different transit modes (including streetcar, enhanced bus) and service alternatives/alignments to identify the best alternative or combination of alternatives for the corridor.

- Use a three-tiered evaluation process to gradually screen alignment and design options against a defined project Purpose and Need.
- Provide a transparent and inclusive public engagement process that will involve all stakeholders in the decision making process.
- Facilitate a local decision making process that identifies a locally preferred alternative that can attract federal transit funds or other state grants.

Meeting Purpose

- To discuss stakeholder perceptions of transit in Seattle's Center City and then opportunities, issues, and challenges associated with developing a new urban circulator transit line for this corridor. Information from this interview is intended to identify issues that will be addressed or considered in the subsequent analysis.

Confidentiality

Individuals may speak to us in confidence. Any quoting of outcomes will be done anonymously. Our main purpose is to allow stakeholders to speak freely.

Discussion Topics

[Note: not all topics or questions are relevant for all stakeholders]

Stakeholder Name:

Organization/Role:

Contact Information:

1. What do you think the benefits of an enhanced Center City transit connection might be?
2. How do you think an enhanced transit service in this corridor will affect neighborhoods, land use, economics, urban form along the corridors? Are there specific neighborhoods or districts that could particularly benefit from enhanced service? Those that may experience unwanted consequences?
3. What are major challenges this study could face with regard to transportation in general? This could include traffic congestion, bicycle/pedestrian issues, transit, safety/security, etc. What other challenges are important?
4. What is your opinion of existing transit service (bus, light rail, streetcar) in these corridors today? Specifically, how do you feel about the effectiveness of the service, service quality, marketing, ease of use, etc., especially for trips that start and end in the Study Area?
5. What do you think should be the primary purpose of a new, higher quality transit connection in this corridor? Should it:

a. Provide frequent access, travel in mixed traffic and operate less reliably at relatively slow speeds?
b. Provide more limited stops, seek priority over traffic where feasible, and seek to achieve faster travel speeds and more reliable service (including streetcar only segments), at the potential expense of reduced street capacity for automobiles?

6. Are there segments of the corridors shown on the map that should be prioritized/deprioritized? And why?
7. While a future system could both connect the SLU and First Hill Streetcars and provide service to Seattle Center/Belltown/Lower Queen Anne, it may be difficult to achieve both in the near future. If given the choice between connecting the SLU and First Hill lines or connecting Seattle Center/Belltown/Lower Queen Anne with downtown, which do you think is a higher priority (and why)? [Note: we will provide a map and further explanation of options and challenges]
8. What impact do you think a streetcar operating in mixed traffic on 1st, 4th or 5th Avenues would have on street operations, business access, and pedestrian and bicyclist safety?
9. Competing priorities for downtown street space for various modes will require a number of hard discussions about allocating limited rights-of-way. In specific, there are stakeholders interested in maintaining on street parking, introducing new protected bicycle facilities, and/or adding transit. What is your position on the City's ability to accomplish all these things simultaneously? (why ask this – to do so is an impossibility) To what degree are you willing to see general purpose traffic lanes or parking lanes removed to allow these projects to be constructed?
10. We are collecting demographic, land use, and planning data for this study. Is there anything we should be aware of with respect to land use or employment changes in the two corridors? Any data you have available? Any surveys you have conducted? Any development projects that we may not be familiar with?
11. What haven't we covered that's important to you?
12. Any other comments, questions or concerns?

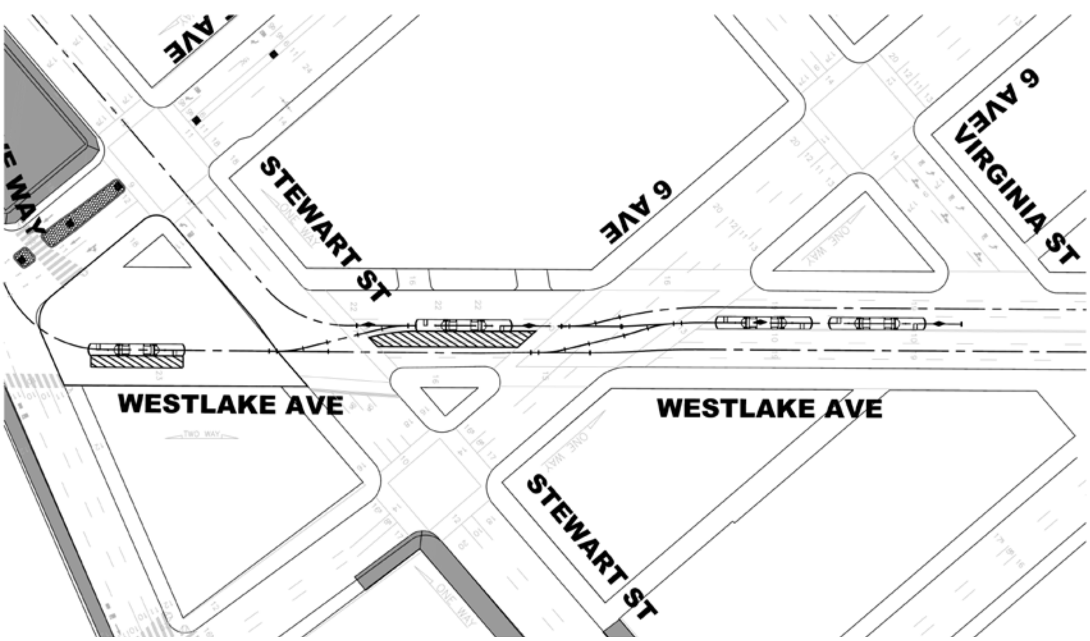
APPENDIX R ADDITIONAL CONCEPTUAL DRAWINGS

This appendix provides conceptual illustrations to supplement the Detailed Evaluation Report, including turnback and storage tracks and a discussion of design risks affecting a Pine Street east-west connection between 1st Avenue and Westlake.

Turnbacks/Vehicle Storage

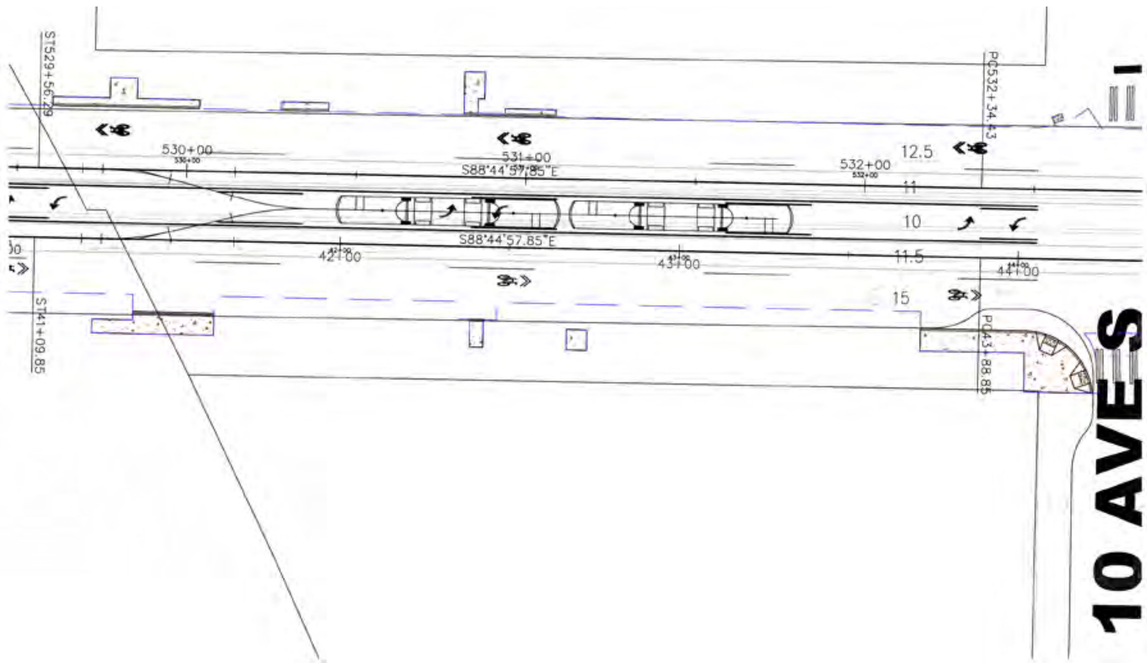
This section provides conceptual drawings of streetcar turnbacks and vehicle storage facilities that would facilitate streetcar operations in the Hub-to-Hub operating scenario. This scenario would provide overlapping service between the King Street and Westlake Intermodal Hubs (see Chapter 6 of the Detailed Evaluation Report). Under this scenario, Westlake would be the final stop for vehicles originating on the First Hill line. Figure R-1 illustrates a conceptual layout for turnback tracks that would be constructed at this stop to enable northbound streetcars to off-board passengers and cross to a pocket track located north of the platform between the north and southbound tracks. Streetcars could then reverse direction and pickup southbound passengers. The pocket tracks would also facilitate layovers while allowing through movement of streetcars serving the South Lake Union (SLU) portion of the streetcar system on both north and southbound tracks. The pocket tracks would be designed to accommodate multiple vehicles.

Figure R-1 Westlake Pocket Track



A similar turnback/storage facility would also be required on Jackson Street east of the King Street Intermodal Hub/International District stop. Figure R-2 illustrates a conceptual layout for pocket tracks in the median of Jackson Street west of 10th Avenue that would enable vehicles originating in South Lake Union to turnback after dropping off passengers at the King Street Intermodal Hub/International District stop.

Figure R-2 Jackson/10th Pocket Track

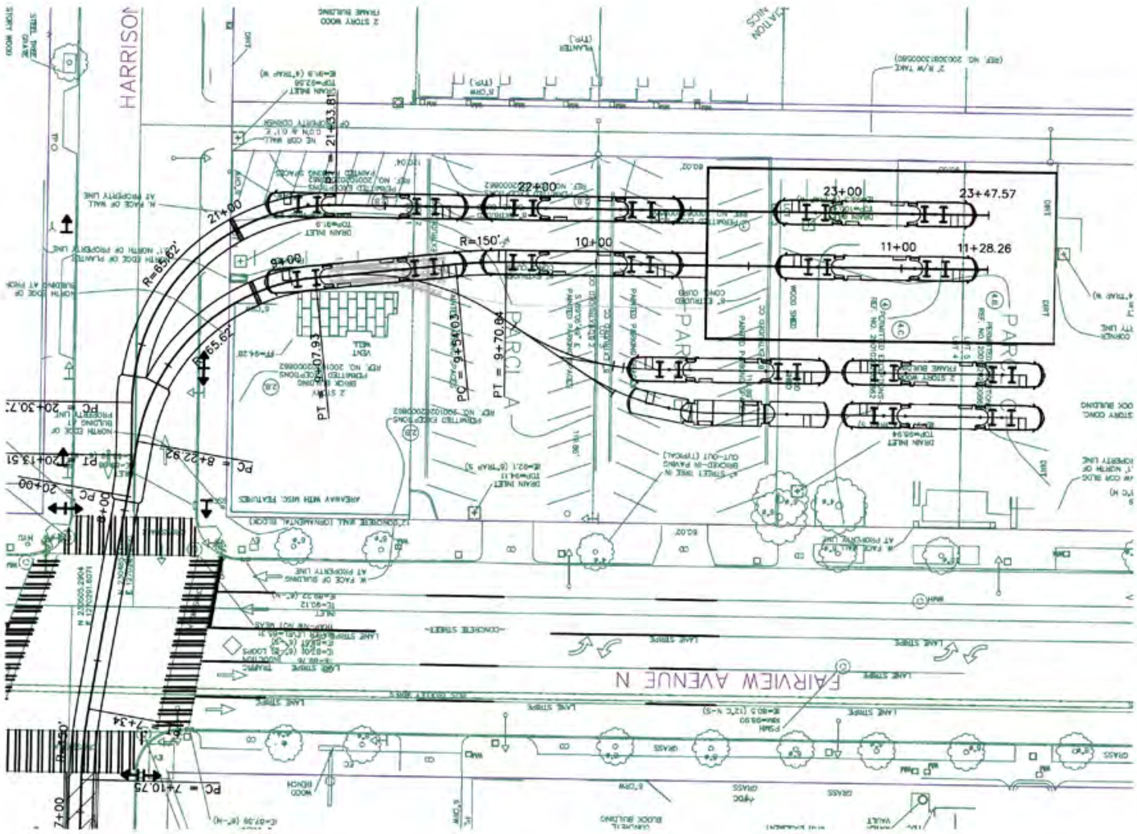


Maintenance Facility

As described in the Detailed Evaluation Report and Appendix E: Capital Cost Estimates, storage for four additional streetcar vehicles is assumed in the Center City Connector capital cost estimates. This expansion could occur at either the existing Harrison Street maintenance base for the South Lake Union streetcar or the First Hill streetcar maintenance base located near Charles Street and 8th Avenue (further analysis will be conducted and a recommendation developed in the next study phase).

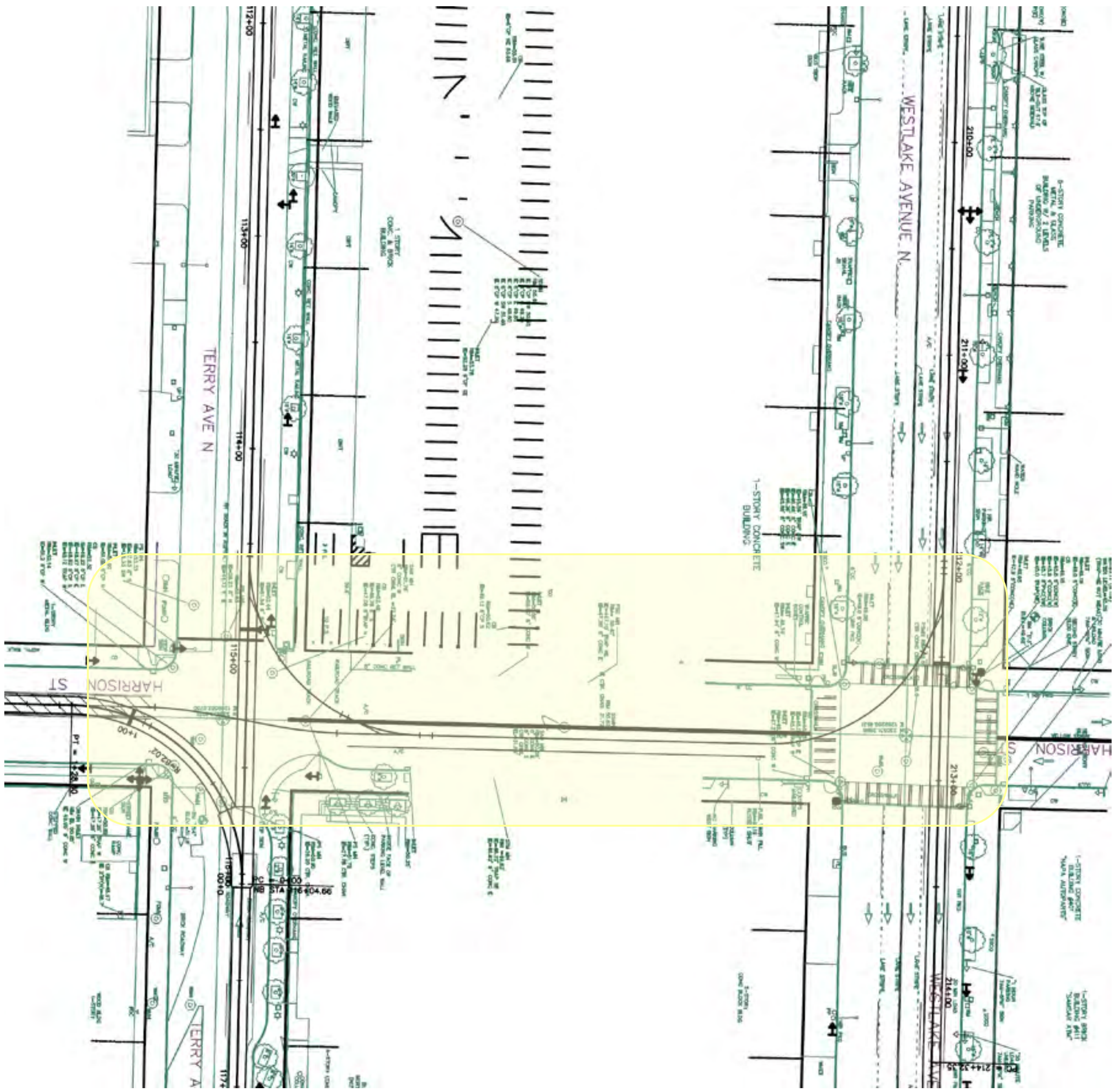
Figure R-3 provides a conceptual illustration of the addition of storage tracks to accommodate the additional vehicles required to operate the integrated system with the hub-to-hub operating plan, in this case assuming expansion of the SLU maintenance base. Additional right-of-way would be required at either of the existing maintenance bases and an allowance for land costs is assumed in the Center City Connector capital cost estimate.

Figure R-3 Illustrative Maintenance Facility Expansion



Irrespective of the location selected for expanding vehicle storage capacity, a connection between the Harrison Street maintenance facility for the existing SLU line and southbound tracks on Westlake would likely have benefits for Center City Connector streetcar operations. Figure R-4 provides a conceptual illustration, with the additional track connections within the yellow-highlighted area.

Figure R-4 Harrison Street Maintenance Facility Tracks to Southbound Westlake



5th and Pine Intersection

As described in the Detailed Evaluation Report, Chapter 5 (East-West Connection Assessment), two key design risks were identified for east-west connections using Pine Street between 1st Avenue and Westlake: (1) impacts to granite pavers and (2) potential impacts to the Downtown Seattle Transit Tunnel (DSTT) waterproofing membrane. This section provides additional detail on investigation of these design risks, conducted concurrently with the Tier 2 evaluation, which assumed a Stewart Street-Olive Way east-west connection

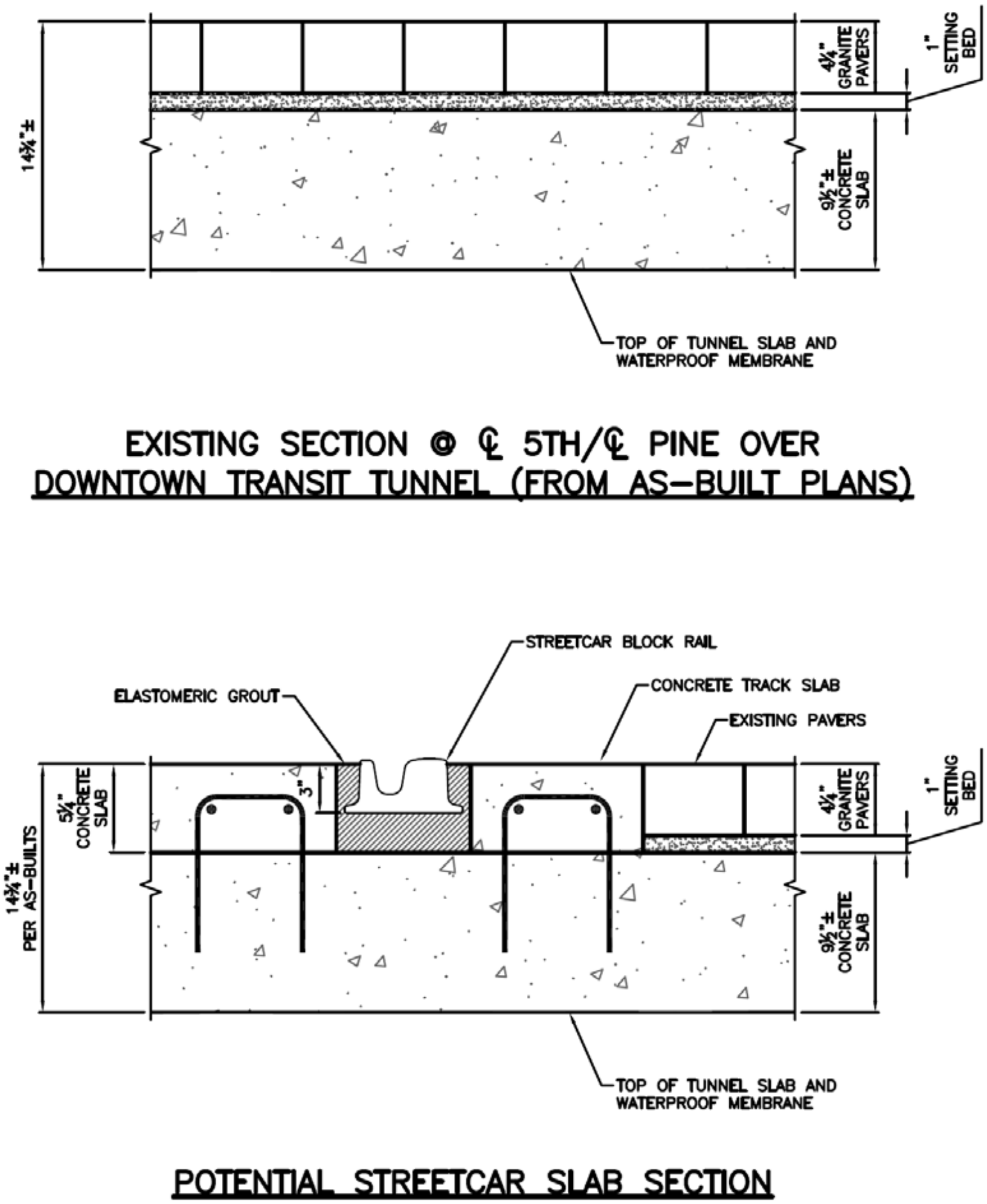
The top cross-section drawing in Figure R-5 shows the existing decorative granite pavers in a sand bed on top of a 9 ½ inch concrete base slab, installed in 1991 for the Westlake Park Project. The top of the DSTT slab is located below the base slab and is surrounded by a continuous waterproof membrane. The standard existing base slab is typically 12 inches thick but according to as-built plans at the location shown (centerlines of 5th Avenue and Pine Street) there was insufficient clearance for a standard slab on top of the DSTT slab and waterproof membrane.

The bottom cross-section drawing in Figure R-5 shows one option for introducing a streetcar track slab to this location. The granite pavers and setting bed would be removed and replaced with a 5¼-inch concrete track slab dowelled into the existing base slab. Low-profile "block" rail would be placed in rail trough voids and encapsulated in elastomeric grout. Utilization of this special track slab maintains the integrity of the existing base slab and DSTT waterproofing membrane.

The design risk associated with the pavers is related to cutting and installing small, triangular transition pavers to accommodate the edge of the track slab, and ensuring future stability of the pavers.

Additional investigation of existing conditions at this location and methods for cutting and reinstalling the granite pavers adjacent to the proposed track slab is ongoing and will be evaluated in more detail in the next study phase.

Figure R-5 Cross-Section of 5th Avenue and Pine Street over Downtown Seattle Transit Tunnel



Source: URS

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