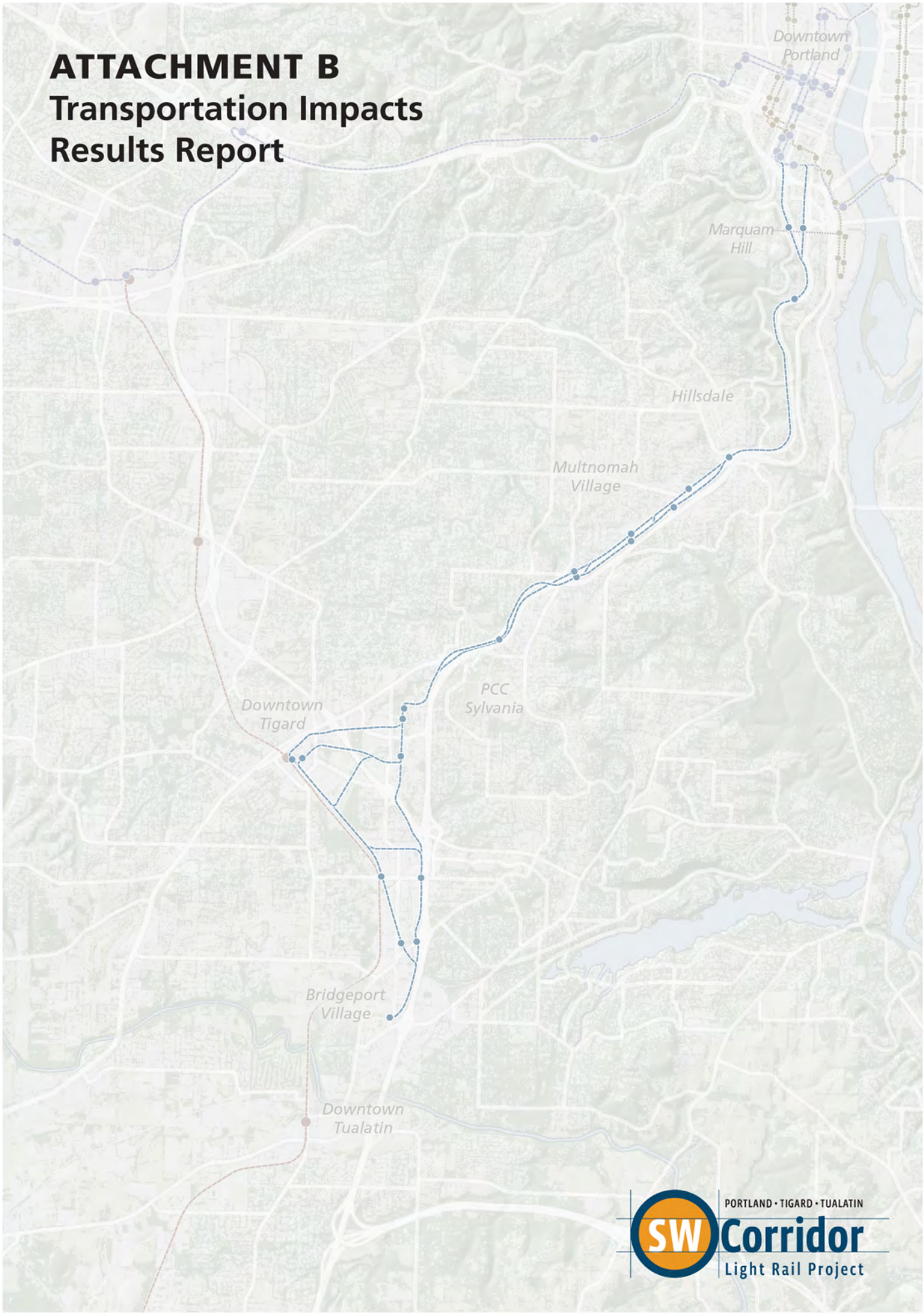
ATTACHMENT B
Transportation Impacts Results Report



PORTLAND • TIGARD • TUALATIN
SW Corridor
Light Rail Project

Southwest Light Rail Corridor

Draft Environmental Impact Statement

Transportation Impacts Results Report

May 16, 2018

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S. SUMMARY OF TRANSPORTATION IMPACTS

1. EXECUTIVE OVERVIEW

This chapter details the framework of the Southwest Corridor Light Rail Project Transportation Results Report. The project evaluated the transportation impacts (and other environmental issues) associated with the No-Build Alternative and the light rail alternatives. The transportation analysis addresses the impacts of the alignment alternatives by segment as well as related station access improvements, the Ross Island Bridgehead Reconfiguration, operations and maintenance (O&M) facilities site and other design options. Because the study area is so large and sometimes spans different jurisdictions, this report has been divided into three segments for evaluation of alignment alternatives, station access improvements and other options. The segments are defined as:

- Segment A: Inner Portland – SW Lincoln Street to SW Brier Place
- Segment B: Outer Portland – SW Brier Place to SW 68th Parkway
- Segment C: Tigard and Tualatin – SW 68th Parkway to Bridgeport Village

The alignment alternatives, station access projects and other options are summarized in Table 2.1-1 below.

Table 2.1-1. Alignment Alternatives Summary

Alignment Alternatives	Station Access Projects	Other Segment-Related Options
Segment A: Inner Portland		
• A1: Barbur • A2-BH: Naito Bridgehead • A2-LA: Naito Limited Access	• SA01: 1st Bikeway • SA02: Grover Bikeway • SA03: Hamilton Sidewalks and Bikeway	• Marquam Hill Connection Options • Ross Island Bridgehead Reconfiguration • Barbur Side-Running Multi-use Path Design Option: SW Hamilton St. to SW Brier Pl. • A1-BH and A2-BH-LT Design Options
Segment B: Outer Portland		
• B1: Barbur • B2: I-5 Barbur TC-60th • B3: I-5 26th-60th • B4: I-5 Custer-60th	• SA04: Terwilliger Bikeway • SA05: Chestnut Bikeway • SA06: 13th Sidewalks and Bikeway • SA07: Custer Sidewalks • SA08: Custer Walk/Bike Bridge • SA09: Capitol Hill Sidewalks and Bikeway • SA10: 19th Bikeway • SA11: Troy Bikeway • SA12: Spring Garden and Dolph Sidewalks and Bikeway • SA13: 24th Sidewalks and Bikeway • SA14: 26th Sidewalks and Bikeway • SA15: 30th Sidewalks • SA16: Taylors Ferry Sidewalks and Bikeway • SA17: 40th Sidewalks and Crossing • SA18: Capitol Sidewalks and Crossings • SA19: Luradel Walk/Bike Bridge • SA20: 53rd Walk/Bike Bridge • SA21: Pomona Sidewalks and Bikeway • SA22: Pasadena Sidewalks and Bikeway	• Portland Community College (PCC) Sylvania Shuttle Options: o Barbur Transit Center o Baylor/Clinton Shuttle • Barbur Side-Running Multi-use Path Design Option: SW Brier Pl. to SW 2nd Ave.

Alignment Alternatives	Station Access Projects	Other Segment-Related Options
	• SA23: Barbur/PCC to Triangle Connection	
Segment C: Tigard and Tualatin		
• C1: Ash-I-5 • C2: Ash-Railroad • C3: Clinton-I-5 • C4: Clinton-Railroad • C5: Ash-I-5 Branched • C6: Wall-I-5 Branched	• SA24: Baylor Sidewalks • SA25: 72nd Sidewalks and Bikeway • SA26: Hall Sidewalks • SA27: Bonita Sidewalks and Bikeway • SA28: Carman Sidewalks and Bikeway • SA29: Lower Boones Ferry and Boones Ferry Walk/Bike Improvements (project scope not yet determined)	• Operations and Maintenance (O&M) Facilities Options o Hunziker Facility (three variations) o 72nd Facility (two variations) • Both 72nd variations and two of the Hunziker variations would also include an expansion of the existing Ruby Junction O&M facility. • Beveland Street roadway bridge over OR-217

The transportation analysis methods chapter (Chapter 2) outlines the evaluation methodology by mode and describes threshold criteria for mitigation of adverse impacts of the light rail alternatives. Chapter 2 also outlines the process for coordination with other jurisdictions and the process for developing future forecasts for 2035 and 2045.

The following three chapters (Chapters 3, 4 and 5) focus on Segments A, B and C, respectively. Each chapter evaluates the existing conditions for both motorized and non-motorized modes of travel, as well as the light rail alignment alternatives for each segment in comparison to the No-Build Alternative. Several different measures of effectiveness were applied to study area intersections during the evaluation of the light rail alternatives. These measures of effectiveness were based on operational parameters, safety, warrants and access. For each impact identified for an individual alignment alternative, a potential mitigation strategy is suggested.

In addition to evaluating traffic impacts, Chapters 3, 4 and 5 evaluate and summarize additional impacts for non-motorized modes and other transportation-related subjects such as parking, freight and potential construction impacts.

2. TRANSPORTATION ANALYSIS METHODS

The *Southwest Corridor Light Rail Project Draft EIS Transportation Analysis Methods Report* (see Appendix A) describes the methods used to collect data and conduct transportation analysis for vehicle traffic, pedestrians, bicycles, freight trucks and parking for the Southwest Corridor Light Rail Project. This analysis was developed to comply with the National Environmental Policy Act (NEPA), and local and state policies, standards, and regulations, and to respond to community concerns raised through environmental scoping. A copy of the *Southwest Corridor Light Rail Project Draft EIS Transportation Analysis Methods Report* can be found in Appendix A. This Chapter 2 provides an overview of the report.

2.1. Methods Overview

Methods used to analyze transportation impacts range from system-wide measures developed through regional travel forecasts to focused analysis of intersection and corridor operations. The intersections analyzed in the transportation impacts analysis are referred to as the study area intersections. The local traffic analysis identifies and evaluates the long-term impacts of the project on the following:

- volume-to-capacity (V/C) ratios or level of service (LOS) at study area intersections affected by the alternatives and options
- signal progression
- 95th percentile queuing at freeway off-ramps and mainline approaches for study area intersections in Vissim and SimTraffic model areas[1]
- access and local traffic flow changes caused by intersection reconfiguration, street closures and/or driveway consolidation, the addition of new traffic signals and new at-grade rail crossings created by the proposed transit improvements
- truck freight movement within the corridor, including loading dock access
- on-street parking impacts attributable to the alignment alternatives
- bicycle and pedestrian access and circulation
- safety, including high-injury locations.

The transportation analysis also identifies short-term impacts to vehicular, bicycle and pedestrian traffic resulting from the project's construction activities.

2.2. Study Area

The project alternatives are organized into three segments and serve as the basis for the Draft Environmental Impact Statement (EIS) technical analysis. The results of the transportation technical

[1] Vissim traffic analysis software was used to build models for analyzing traffic operations in the southern portions of downtown Portland, the Ross Island bridgehead area, the vicinity of the SW Barbur Blvd/SW Hamilton St intersection and in the vicinity of the SW Barbur Blvd/SW Terwilliger Blvd intersection. SimTraffic was used to analyze queues in the vicinity of I-5 interchanges in Segment C (SW Carman Drive/SW Upper Boones Ferry Rd, SW Lower Boones Ferry Rd/ SW Bridgeport Rd).

analysis are divided into the following three segments and provide the basis for comparison among alignment options within each segment:

- Segment A: Inner Portland – SW Lincoln Street to SW Brier Place
- Segment B: Outer Portland – SW Brier Place to SW 68th Parkway
- Segment C: Tigard and Tualatin – SW 68th Parkway to Bridgeport Village

2.3. Affected Environment

The transportation analysis focuses on transportation operations at study area intersections and roadways using the 2010 Highway Capacity Manual (HCM) methodologies for non-signalized intersections and the HCM 2000 methodology for signalized intersections using traffic counts from 2015 to 2017 and 2015 base year travel demand modeling data. The analytical tools used to evaluate traffic operations at study area intersections include Synchro, SimTraffic and Vissim. For each of the three segments in Chapters 3, 4 and 5, the related Existing Conditions section summarizes data collected and analyzed on pedestrian activity, bicycle activity, transit usage, on-street parking usage, freight truck activity and safety data.

2.4. Future Traffic Volumes

The No-Build Alternative horizon year is 2035. At freeway ramp terminals, the No-Build Alternative horizon year is 2045. In addition to future volumes for the No-Build Alternative, future volumes were prepared for the light rail alignment alternatives for comparison purposes. These forecasts take into account future regional land uses and transportation investments including park and ride facilities, where applicable.

2.5. Impact Assessment

Traffic impacts are assessed at both the system-wide level and the intersection-specific level. The future traffic analysis includes both macroscopic (system-wide) and microscopic (intersection and corridor) levels of detail. The macroscopic analysis utilizes the Metro regional travel demand model and is based on the regional macroscopic travel demand model, which forecasts travel on the regional roadway system based on population and employment projections, as well as existing and planned transportation facilities. The microscopic analysis focuses on intersection/corridor performance using Vissim, SimTraffic and the HCM methodologies in Synchro.

The system-wide analysis uses the regional travel demand model to determine whether the proposed light rail project and associated facilities would cause changes in motor vehicle circulation or traffic patterns, including the potential for diversion of traffic. This analysis includes quantification of link volumes from the travel demand model at key screenline locations (e.g., South Portland, mid-Barbur, Tigard), and comparison of link volumes across the No-Build Alternative and the light rail alternatives. Traffic diverted to regional through routes, such as freeways or other limited-access facilities, is quantified using the regional travel demand model as a part of the system-wide traffic impact analysis. The system-wide analysis is supplemented by the detailed motor vehicle traffic analysis, which looks at intersection and corridor operations and performance using stochastic, HCM-based analysis and traffic simulation.

The analysis of intersection-specific traffic impacts includes vehicle delay and queuing. Vehicle delay is generated using both Vissim and Synchro models, which are used to generate V/C ratios for intersections. Delay and queuing analyses were both prepared using Vissim, SimTraffic, and Synchro. Vissim and SimTraffic queuing analysis uses microscopic simulation to determine queues based on the interactions between discrete, individual vehicles. Synchro queuing methodology uses macroscopic analysis to generate a determinate value for each lane, based on HCM methodology.

2.6. Performance Measures and Mitigation

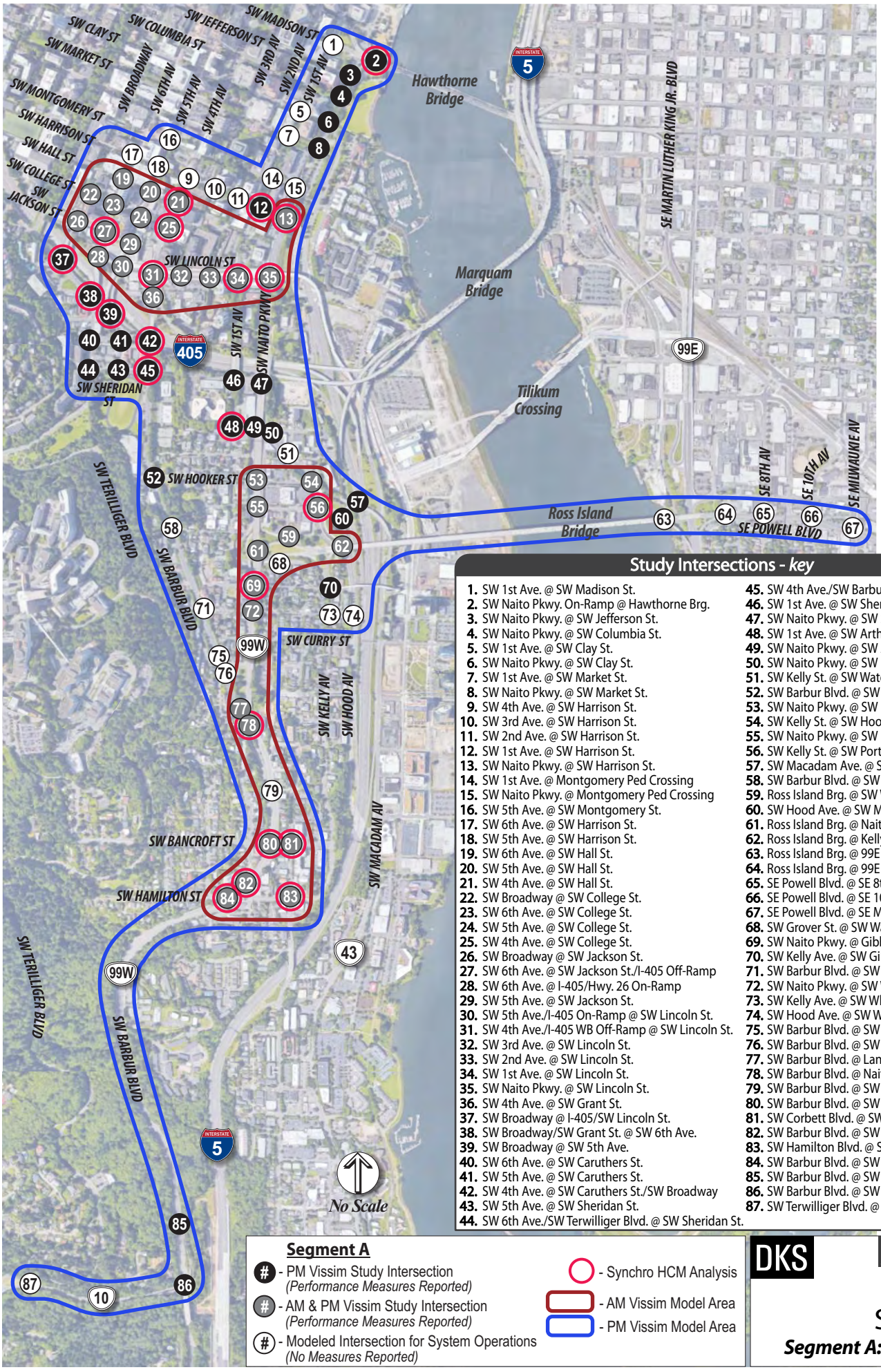
The final step in the transportation analysis process is to compare the study alternatives, including the No-Build Alternative, to determine impacts to the transportation system resulting from the implementation of the proposed project. Potential mitigation measures have been developed at locations that do not meet specific performance standards and/or performance criteria thresholds.

3. SEGMENT A: INNER PORTLAND

This chapter details the transportation operations for both existing and future conditions within Segment A, Inner Portland. The existing operations cover both non-motorized and motorized modes of travel including bicycle, pedestrian, transit and motor vehicle, as well as parking, freight and collision data. The future operations evaluate the potential impacts to motorized and non-motorized modes, potential mitigation strategies for impacts related to light rail alternatives, and possible improvements to be considered by the local jurisdictions, including the City of Portland and Oregon Department of Transportation (ODOT) within the segment.

3.1. Segment A Study Area Description

Segment A is defined as the section from SW Lincoln Street to SW Brier Place. The study area includes 87 intersections, as shown in Figure 3.1-1, all of which currently exist. Sixty-six of the intersections shown on the map were included in the detailed analysis, while the remaining intersections were included in the modeling in order to account for system operations.



Study Intersections - *key*

1. SW 1st Ave. @ SW Madison St.
2. SW Naito Pkwy. On-Ramp @ Hawthorne Brg.
3. SW Naito Pkwy. @ SW Jefferson St.
4. SW Naito Pkwy. @ SW Columbia St.
5. SW 1st Ave. @ SW Clay St.
6. SW Naito Pkwy. @ SW Clay St.
7. SW 1st Ave. @ SW Market St.
8. SW Naito Pkwy. @ SW Market St.
9. SW 4th Ave. @ SW Harrison St.
10. SW 3rd Ave. @ SW Harrison St.
11. SW 2nd Ave. @ SW Harrison St.
12. SW 1st Ave. @ SW Harrison St.
13. SW Naito Pkwy. @ SW Harrison St.
14. SW 1st Ave. @ Montgomery Ped Crossing
15. SW Naito Pkwy. @ Montgomery Ped Crossing
16. SW 5th Ave. @ SW Montgomery St.
17. SW 6th Ave. @ SW Harrison St.
18. SW 5th Ave. @ SW Harrison St.
19. SW 6th Ave. @ SW Hall St.
20. SW 5th Ave. @ SW Hall St.
21. SW 4th Ave. @ SW Hall St.
22. SW Broadway @ SW College St.
23. SW 6th Ave. @ SW College St.
24. SW 5th Ave. @ SW College St.
25. SW 4th Ave. @ SW College St.
26. SW Broadway @ SW Jackson St.
27. SW 6th Ave. @ SW Jackson St./I-405 Off-Ramp
28. SW 6th Ave. @ I-405/Hwy. 26 On-Ramp
29. SW 5th Ave. @ SW Jackson St.
30. SW 5th Ave./I-405 On-Ramp @ SW Lincoln St.
31. SW 4th Ave./I-405 WB Off-Ramp @ SW Lincoln St.
32. SW 3rd Ave. @ SW Lincoln St.
33. SW 2nd Ave. @ SW Lincoln St.
34. SW 1st Ave. @ SW Lincoln St.
35. SW Naito Pkwy. @ SW Lincoln St.
36. SW 4th Ave. @ SW Grant St.
37. SW Broadway @ I-405/SW Lincoln St.
38. SW Broadway/SW Grant St. @ SW 6th Ave.
39. SW Broadway @ SW 5th Ave.
40. SW 6th Ave. @ SW Caruthers St.
41. SW 5th Ave. @ SW Caruthers St.
42. SW 4th Ave. @ SW Caruthers St./SW Broadway
43. SW 5th Ave. @ SW Sheridan St.
44. SW 6th Ave./SW Terwilliger Blvd. @ SW Sheridan St.
45. SW 4th Ave./SW Barbur Blvd. @ SW Sheridan St.
46. SW 1st Ave. @ SW Sheridan St.
47. SW Naito Pkwy. @ SW Sheridan St.
48. SW 1st Ave. @ SW Arthur St.
49. SW Naito Pkwy. @ SW Arthur St.
50. SW Naito Pkwy. @ SW Kelly St.
51. SW Kelly St. @ SW Water St.
52. SW Barbur Blvd. @ SW Hooker St.
53. SW Naito Pkwy. @ SW Hooker St.
54. SW Kelly St. @ SW Hooker St./SW Macadam Ave.
55. SW Naito Pkwy. @ SW Porter St.
56. SW Kelly St. @ SW Porter St./SW Hood Ave.
57. SW Macadam Ave. @ SW Hood Ave.
58. SW Barbur Blvd. @ SW Woods St.
59. Ross Island Brg. @ SW Woods St./SW Water Ave.
60. SW Hood Ave. @ SW Macadam Ave.
61. Ross Island Brg. @ Naito Pkwy.
62. Ross Island Brg. @ Kelly Ramps
63. Ross Island Brg. @ 99E SB
64. Ross Island Brg. @ 99E NB
65. SE Powell Blvd. @ SE 8th Ave.
66. SE Powell Blvd. @ SE 10th Ave.
67. SE Powell Blvd. @ SE Milwaukie Ave.
68. SW Grover St. @ SW Water Ave.
69. SW Naito Pkwy. @ Gibbs/Naito Ramps
70. SW Kelly Ave. @ SW Gibbs St.
71. SW Barbur Blvd. @ SW Whitaker St.
72. SW Naito Pkwy. @ SW Whitaker St.
73. SW Kelly Ave. @ SW Whitaker St.
74. SW Hood Ave. @ SW Whitaker St.
75. SW Barbur Blvd. @ SW Pennoyer St.
76. SW Barbur Blvd. @ SW Condor Ave.
77. SW Barbur Blvd. @ Lane/Ped Crossing
78. SW Barbur Blvd. @ Naito/Ped Crossing
79. SW Barbur Blvd. @ SW Lowell St.
80. SW Barbur Blvd. @ SW Bancroft St.
81. SW Corbett Blvd. @ SW Bancroft St.
82. SW Barbur Blvd. @ SW Hamilton St. *(East)*
83. SW Hamilton Blvd. @ SW Corbett Ave.
84. SW Barbur Blvd. @ SW Hamilton St. *(West)*
85. SW Barbur Blvd. @ SW Capitol Hwy. EB
86. SW Barbur Blvd. @ SW Capitol Hwy. WB
87. SW Terwilliger Blvd. @ SW Capitol Hwy.

Segment A

- # - PM Vissim Study Intersection *(Performance Measures Reported)*
- # - AM & PM Vissim Study Intersection *(Performance Measures Reported)*
- # - Modeled Intersection for System Operations *(No Measures Reported)*
- Synchro HCM Analysis
- AM Vissim Model Area
- PM Vissim Model Area

DKS

figure 3.1-1

Study Area

Segment A: Inner Portland

3.2. Segment A Affected Environment

3.2.1. Segment A Roadway Functional Classification

Table 3.2-1 shows the functional classification for every roadway that is included in the study area of Segment A. Some roadways are part of intersections that were not analyzed but were included in analysis models to ensure accurate system operations.

Functional classifications are listed for the jurisdictional owner. In Segment A, most of the roadways are owned by the City of Portland.

Table 3.2-1. Roadway Functional Classifications in Segment A

Roadway Name(s)	Jurisdiction	Functional Classification
SW 1st Ave.	City of Portland	Local Service Traffic Street
SW 2nd Ave.	City of Portland	Local Service Traffic Street
SW 3rd Ave.	City of Portland	Traffic Access Street
SW 4th Ave.	City of Portland	Traffic Access Street
SW 5th Ave., north of SW Broadway Ave.	City of Portland	Local Service Traffic Street
SW 6th Ave., north of I-405	City of Portland	Local Service Traffic Street
SW Broadway Ave.	City of Portland	Traffic Access Street
Hawthorne Bridge	Multnomah County	Minor Arterial
SW Madison St.	City of Portland	Traffic Access Street
SW Jefferson St.	City of Portland	Local Service Traffic Street
SW Columbia St.	City of Portland	Local Service Traffic Street
SW Clay St.	City of Portland	Traffic Access Street
SW Market St.	City of Portland	Traffic Access Street
SW Montgomery St.	City of Portland	Local Service Traffic Street
SW Harrison St.	City of Portland	Local Service Traffic Street
SW Hall St.	City of Portland	Local Service Traffic Street
SW College St.	City of Portland	Local Service Traffic Street
SW Jackson St.	City of Portland	Local Service Traffic Street
SW Lincoln St.	City of Portland	Local Service Traffic Street
SW Grant St.	City of Portland	Local Service Traffic Street
Interstate 405 (I-405)	Federal Highway Administration	Interstate (NHS[1] Route)
SW Naito Pkwy./ OR 99W, south of Ross Island Br.	Oregon Department of Transportation	Principal Arterial (NHS Route)
SW Naito Pkwy./ OR 99W, I-405 to Ross Island Br.	Oregon Department of Transportation	Minor Arterial
SW Naito Pkwy., north of I-405	City of Portland	Traffic Access Street
SW 6th Ave., south of I-405	City of Portland	Neighborhood Collector
SW Terwilliger Blvd.	City of Portland	Neighborhood Collector
SW 5th Ave., south of SW Broadway Ave.	City of Portland	Major City Traffic Street
SW Caruthers St.	City of Portland	Major City Traffic Street
SW Sheridan St.	City of Portland	Major City Traffic Street
SW Barbur Blvd., north of Naito Pkwy.	City of Portland	Major City Traffic Street
SW Arthur St.	City of Portland	Local Service Traffic Street
SW Kelly Ave.	City of Portland	Major City Traffic Street
SW Water Ave.	City of Portland	Local Service Traffic Street

Table 3.2-1. Roadway Functional Classifications in Segment A

Roadway Name(s)	Jurisdiction	Functional Classification
SW Hooker St.	City of Portland	Local Service Traffic Street
SW Macadam Ave. / OR 43	Oregon Department of Transportation	Principal Arterial (NHS Route)
SW Porter St.	City of Portland	Local Service Traffic Street
SW Hood Ave. / OR 43	Oregon Department of Transportation	Principal Arterial (NHS Route)
SW Woods St.	City of Portland	Local Service Traffic Street
Ross Island Bridge	Oregon Department of Transportation	Principal Arterial (NHS Route)
OR 99E/SE McLoughlin Blvd.	Oregon Department of Transportation	Principal Arterial (NHS Route)
US 26/SE Powell Blvd.	Oregon Department of Transportation	Principal Arterial (NHS Route)
SE 8th Ave., north of SE Powell Blvd.	City of Portland	Major City Traffic Street
SE 8th Ave., south of SE Powell Blvd.	City of Portland	Traffic Access Street
SE 10th Ave.	City of Portland	Local Service Traffic Street
SE Milwaukie Ave., north of SE Powell Blvd.	City of Portland	Major City Traffic Street
SE Milwaukie Ave., south of SE Powell Blvd.	City of Portland	Neighborhood Collector
SW Grover St.	City of Portland	Local Service Traffic Street
SW Gibbs St.	City of Portland	Local Service Traffic Street
SW Whitaker St.	City of Portland	Local Service Traffic Street
SW Pennoyer St.	City of Portland	Local Service Traffic Street
SW Condor Ave.	City of Portland	Local Service Traffic Street
SW Barbur Blvd./ OR 99W, south of Naito Pkwy.	Oregon Department of Transportation	Principal Arterial (NHS Route)
SW Lowell St.	City of Portland	Local Service Traffic Street
SW Bancroft St.	City of Portland	Local Service Traffic Street
SW Corbett Blvd.	City of Portland	Local Service Traffic Street
SW Hamilton St.	City of Portland	Local Service Traffic Street
SW Capitol Hwy.	City of Portland	Major City Traffic Street

Sources:
City of Portland: Comprehensive Plan Maps. https://www.portlandmaps.com/bps/mapapp/

Oregon Department of Transportation: Oregon Transportation Map, Showing Functional Classification of Roads, City of Portland (2016 Edition). http://www.oregon.gov/ODOT/Data/Documents/City_Portland.pdf

[1]NHS = National Highway System

3.2.2. Segment A Active Transportation

Active transportation refers to people traveling by walking or riding a bicycle. For the purposes of this report, walking includes people using wheelchairs, skating, and other human-powered mobility. The affected environment for active transportation includes a description of existing sidewalks, pedestrian crossings, bike lanes, multi-use pathways and similar facilities within the corridor.

In Segment A, north of SW Hamilton Street, SW Barbur Boulevard and SW Naito Parkway include substandard and discontinuous sidewalks. South of SW Hamilton Street, there is a narrow sidewalk on the east side of SW Barbur Boulevard from SW Hamilton Street to the crosswalk at the Rasmussen Village Apartments, and there is no sidewalk on the west side of the street. South of the crosswalk, there are limited and sporadic sections of narrow sidewalk primarily located on the Newbury and Vermont viaducts. SW Barbur Boulevard includes unprotected bike lanes adjacent to relatively high-

speed traffic (there are no bike lanes on the Newbury and Vermont viaducts). SW Naito Parkway has no bike lanes in the study area as shown in Figure 3.2-1.

Several streets in the vicinity lack walking and bicycling facilities, including streets that have relatively high volumes of traffic and curves that limit visibility. Small gaps in the bike lanes along SW Barbur Boulevard require people biking to merge with auto traffic in areas with speed limits of up to 45 miles per hour.

Figures 3.2-1 and 3.2-2 show existing bike lane and sidewalk gaps, respectively, in Segment A. These maps focus on collector and arterial streets, because they reflect the locations of greatest need for sidewalks and bicycle facilities. Local streets typically carry less motor vehicle volume, and can still be safely used for walking and bicycling by many people, even without proper facilities.

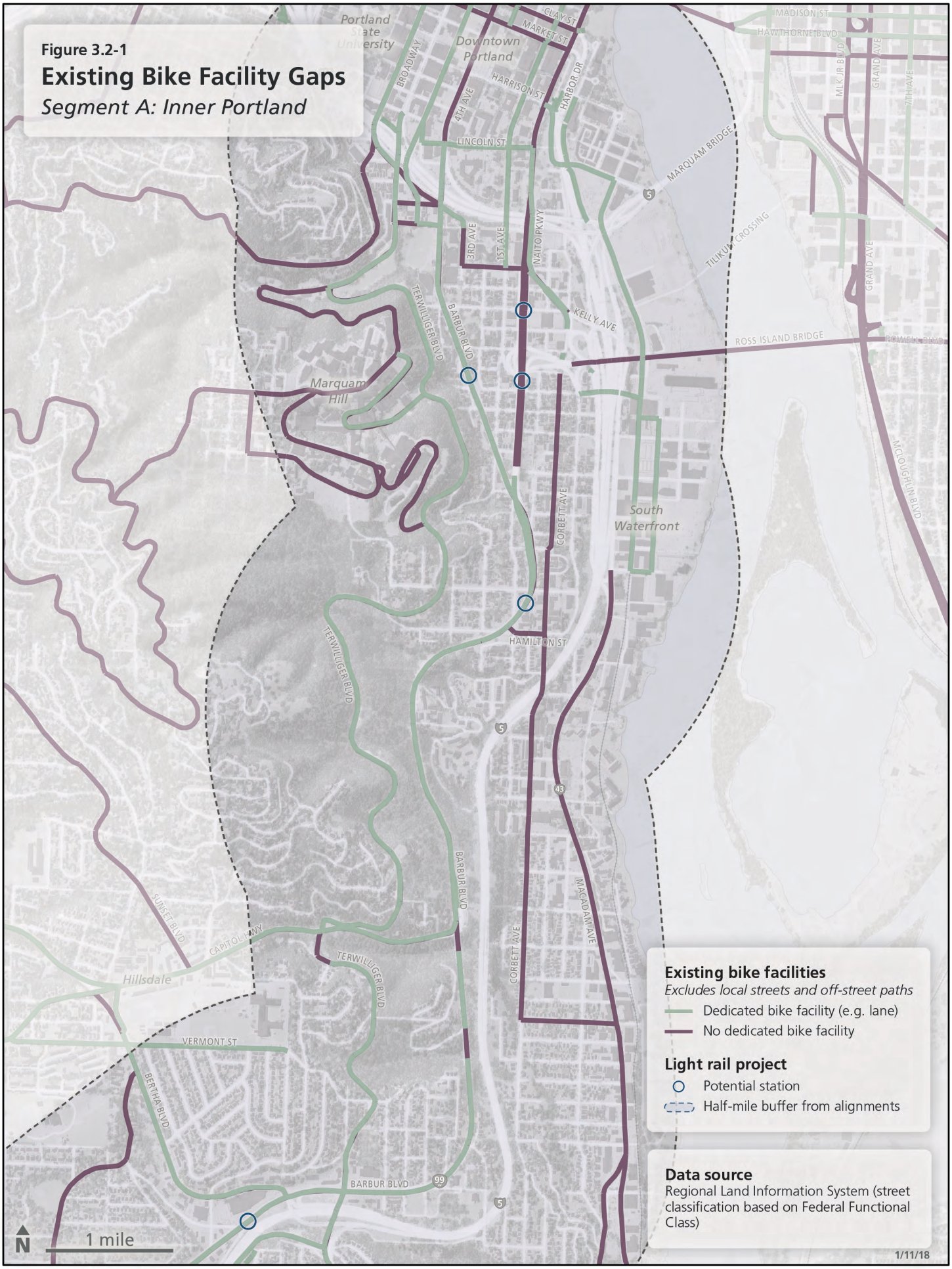


Figure 3.2-1
Existing Bike Facility Gaps
Segment A: Inner Portland
Portland State University
Downtown Portland
Marquam Hill
South Waterfront
Hillsdale
BROADWAY
CLAY ST
MARKET ST
HARRISON ST
HARBOR DR
4TH AVE
LINCOLN ST
MARQUAM BRIDGE
MADISON ST
HAWTHORNE BLVD
MLK JR BLVD
GRAND AVE
7TH AVE
3RD AVE
1ST AVE
NAITO PKWY
TILIKUM CROSSING
KELLY AVE
ROSS ISLAND BRIDGE
POWELL BLVD
MCLOUGHLIN BLVD
TERWILLIGER BLVD
BARBUR BLVD
CORBETT AVE
HAMILTON ST
MACADAM AVE
SUNSET BLVD
CAPITOL HWY
VERMONT ST
BERTHA BLVD
Existing bike facilities
Excludes local streets and off-street paths
Dedicated bike facility (e.g. lane)
No dedicated bike facility
Light rail project
Potential station
Half-mile buffer from alignments
Data source
Regional Land Information System (street classification based on Federal Functional Class)
N
1 mile
1/11/18

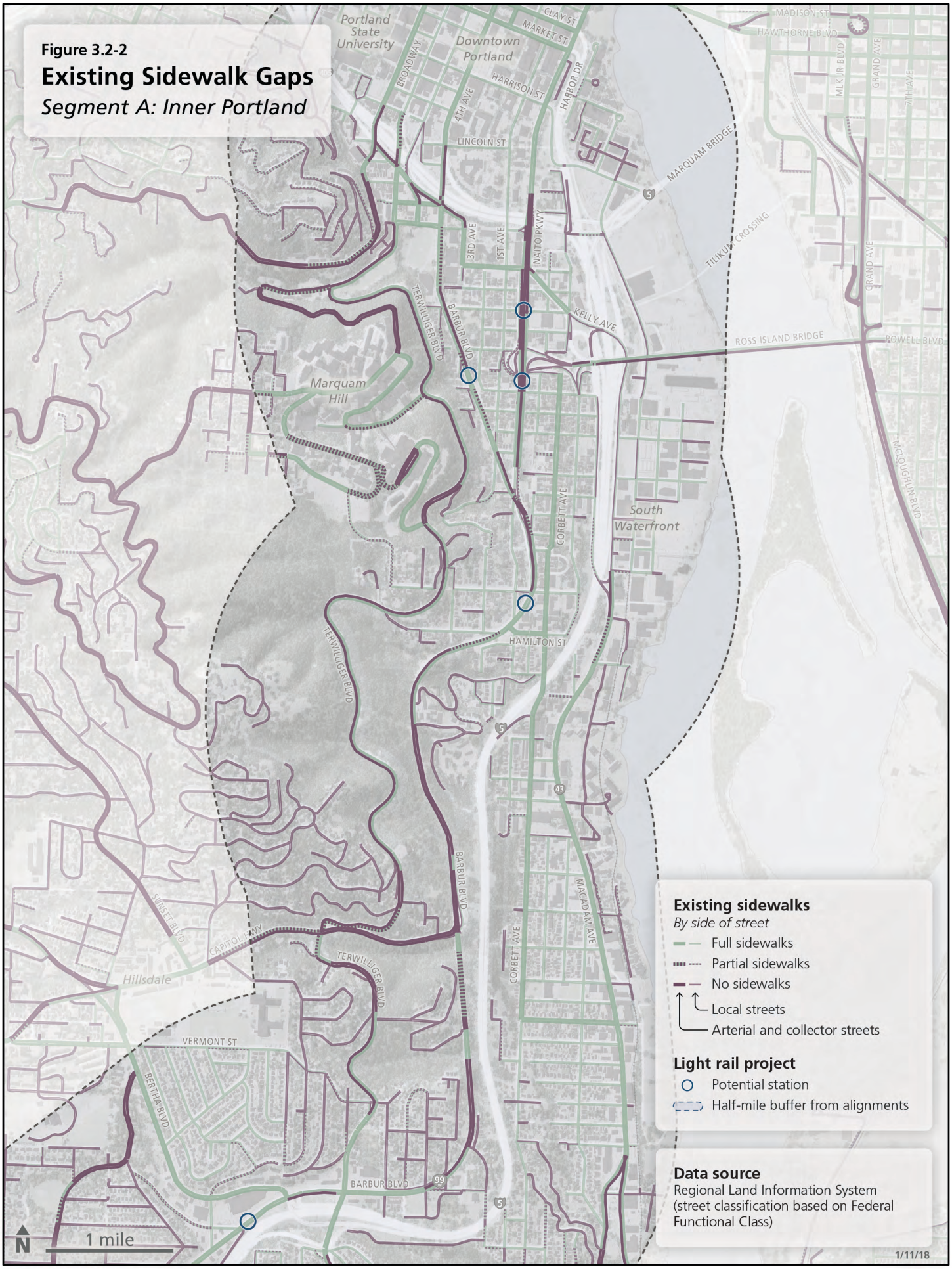


Figure 3.2-2
Existing Sidewalk Gaps
Segment A: Inner Portland
Portland State University
Downtown Portland
South Waterfront
Marquam Hill
Hillsdale
BROADWAY
CLAY ST
MARKET ST
HARRISON ST
HARBOR DR
4TH AVE
LINCOLN ST
MARQUAM BRIDGE
MADISON ST
HAWTHORNE BLVD
MLK JR BLVD
GRAND AVE
7TH AVE
3RD AVE
1ST AVE
NAITO PKWY
TILIKUM CROSSING
KELLY AVE
ROSS ISLAND BRIDGE
ROWELL BLVD
MCLOUGHLIN BLVD
TERWILLIGER BLVD
BARBUR BLVD
CORBETT AVE
HAMILTON ST
MACADAM AVE
SUNSET BLVD
CAPITOL HWY
VERMONT ST
BERTHA BLVD
Existing sidewalks
By side of street
Full sidewalks
Partial sidewalks
No sidewalks
Local streets
Arterial and collector streets
Light rail project
Potential station
Half-mile buffer from alignments
Data source
Regional Land Information System
(street classification based on Federal Functional Class)
N
1 mile
1/11/18

3.2.3. Segment A Motor Vehicle Operations

2017 Existing HCM Operations

To accurately model the existing conditions on the roadway network, turning movement counts were conducted in the AM and PM peak hours for all existing study area intersections. The turning movement count data is shown in Appendix B. The count volumes were balanced according to the ODOT Analysis Procedures Manual to account for differences in data collected on different dates. The balanced network reflects the typical 2017 weekday AM and PM peak-hour traffic conditions. Additional data, including peaking profiles, pedestrian volumes, bicycle volumes, and heavy vehicle percentages, were also input into the Vissim and Synchro models.

Table 3.2-2 shows HCM (Synchro) operations analysis results for the existing AM and PM peak hours. Synchro was used to report LOS, delay, and V/C ratios using HCM methodology. Figure 3.2-3 graphically illustrates the volumes for each study area intersection.

Mobility targets for the appropriate jurisdiction are shown for every intersection. Results for intersections that do not meet mobility targets in a peak hour are shaded gray. The worst-case approach is reported for all two-way stop controlled (TWSC) intersections. The worst lane (WLANE) group is listed under the WLANE columns (AM and PM) for two-way stop-controlled intersections.

Table 3.2-2. HCM (Synchro) Segment A 2017 Existing Conditions Analysis

ID	Intersection	Mobility Target		2017 Existing Conditions								
					AM				PM			
				Control	Delay	LOS	V/C	WLANE	Delay	LOS	V/C	WLANE
A2	SW Naito Pkwy. on-ramp/Hawthorne Br.	PBOT 2nd HR	0.99	TWSC	PM Only				**14.7 [95.9]**	**B [F]**	**1.02**	**NBLn1**
A12	SW 1st Ave./SW Harrison St.	PBOT 2nd HR	0.99	Signal					17.4	B	0.44	-
A13	SW Naito Pkwy./SW Harrison St.	PBOT 2nd HR	0.99	Signal	16.3	B	0.70	-	57.1	E	0.78	-
A21	SW 4th Ave./SW Hall St.	PBOT 2nd HR	0.99	Signal	23.8	C	0.40	-	24.4	C	0.35	-
A25	SW 4th Ave./SW College St.	PBOT 2nd HR	0.99	TWSC	2.5 [33.7]	A [D]	0.17	EBLn1	4.3 [43.5]	A [E]	0.35	EBLn1
A27	SW 6th Ave./SW Jackson St./I-405 northbound off-ramp	ODOT Ramp	0.85	TWSC	[0.8] 14.4	A [B]	0.07	EBLn1	6.3 [32.7]	A [D]	0.40	EBLn1
A31	SW 4th Ave./I-405 northbound off-ramp/ SW Lincoln St.	ODOT Ramp	0.85	Signal	15.5	B	0.55	-	15.3	B	0.52	-
A34	SW 1st Ave./SW Lincoln St.	PBOT 2nd HR	0.99	Signal	44.1	D	0.26	-	24.8	C	0.53	-
A35	SW Naito Pkwy./SW Lincoln St.	PBOT 2nd HR	0.99	Signal	4.4	A	0.53	-	5.4	A	0.58	-
A37	SW Broadway/ I-405 southbound off-ramp/SW Lincoln St.	ODOT Ramp	0.85	Signal	PM Only				18.1	B	0.55	-
A38	SW Broadway/SW Grant St./SW 6th Ave.	PBOT 1st HR	0.99	Signal					17.5	B	0.81	-
A39	SW Broadway Ave./SW 5th Ave.	PBOT 1st HR	0.99	Signal					29.4	C	0.77	-
A42	SW 4th Ave./SW Caruthers St./SW Broadway Ave.	PBOT 1st HR	0.99	Signal					34.8	C	0.79	-

Table 3.2-2. HCM (Synchro) Segment A 2017 Existing Conditions Analysis

ID	Intersection	Mobility Target		2017 Existing Conditions								
					AM				PM			
				Control	Delay	LOS	V/C	WLANE	Delay	LOS	V/C	WLANE
A45	SW 4th Ave./SW Barbur Blvd./SW Sheridan St.	PBOT 1st HR	0.99	Signal					13.9	B	0.60	-
A48	SW 1st Ave./SW Arthur St.	PBOT 1st HR	0.99	Signal					30.6	C	0.90	-
A56	SW Kelly Ave./SW Porter St./SW Hood Ave.	ODOT Ramp	0.85	TWSC	[0.6] 8.6	A [A]	0.14	SBL	1.1 [10.4]	A [B]	0.14	SBLn1
A61	Ross Island Br./SW Naito Pkwy.	ODOT/PBOT 1st HR	0.99	TWSC	**85.8 [191]**	**F [F]**	**1.35**	**SBLn1**	**>300 [>300]**	**F [F]**	**>2.0**	**SBLn1**
A62	Ross Island Br./SW Kelly Ave. ramps	ODOT/PBOT 1st HR	0.99	TWSC	8.2 [55]	A [F]	0.85	NBRn1	**>300 [>300]**	**F [F]**	**>2.0**	**NBRn1**
A69	SW Naito Pkwy./SW Gibbs St./SW Naito Pkwy. ramps	ODOT/PBOT 1st HR	0.99	TWSC	0.0 [13.6]	A [B]	0.01	WBRn1	8.4 [20.4]	A [C]	0.61	WBRn1
A78	SW Barbur Blvd./SW Naito Pkwy./Ped. crossing	ODOT/PBOT 1st HR	0.99	TWSC	0.1 [10.1]	A [B]	0.01	EBLn1	0.2 [22.2]	A[C]	0.09	EBLn1
A80	SW Barbur Blvd./SW Bancroft St.	ODOT/PBOT 1st HR	0.99	TWSC	3.4 [86.5]	A [F]	0.91	WBLn1	0.1 [13.2]	A [B]	0.10	WBLn1
A81	SW Corbett Ave./SW Bancroft St.	PBOT 1st HR	0.99	TWSC	5.2 [26.1]	A [D]	0.21	WBLn1	**30.6 [99.4]**	**C [F]**	**1.03**	**EBLn1**
A82/A84	SW Barbur Blvd./SW Hamilton St.	ODOT/PBOT 1st HR	0.99	Signal	45.2	D	0.94	-	33.9	C	0.94	-
A83	SW Corbett Ave./SW Hamilton St.	PBOT 1st HR	0.99	AWSC	**111**	**F**	**1.30**		**75.7**	**F**	**1.15**	

Notes: ID = Intersection ID #

TWSC = Two-way stop control

AWSC = All-way stop control

Delay = Average vehicle delay (in seconds)

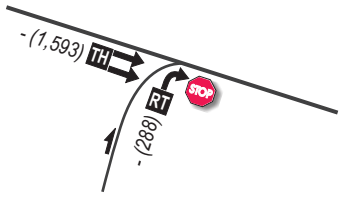
HR = Hour

PBOT = Portland Bureau of Transportation

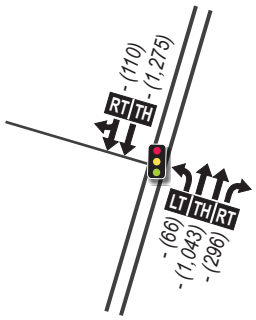
EB = eastbound; NB = northbound; SB = southbound; WB = westbound; Ln = lane

Key: Average Intersection [Worst stop-controlled movement] delay and LOS for TWSC intersections.
V/C represents intersection average for signals and worst movement for stop control intersections.
Delay, LOS, and V/C ratio reported for worst lane for all-way stop control.

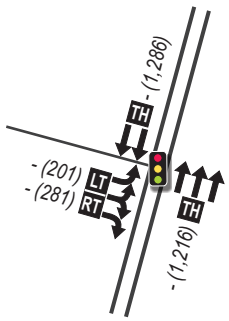
A2. *SW Naito Pkwy. On-Ramp @ Hawthorne Brg.*



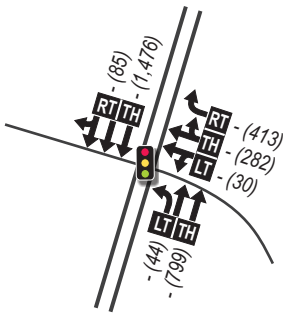
A3. *SW Naito Pkwy. @ SW Jefferson St.*



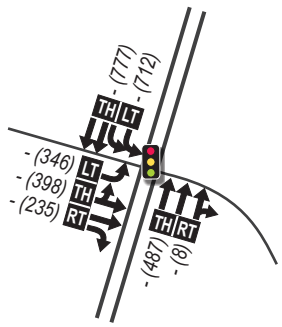
A4. *SW Naito Pkwy. @ SW Columbia St.*



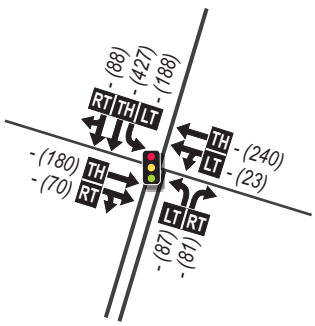
A6. *SW Naito Pkwy. @ SW Clay St.*



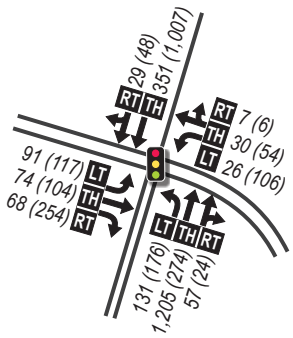
A8. *SW Naito Pkwy. @ SW Market St.*



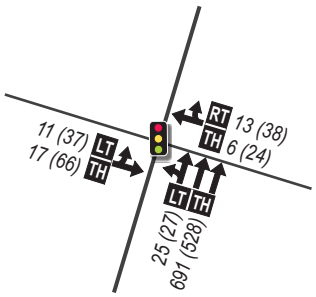
A12. *SW 1st Ave. @ SW Harrison St.*



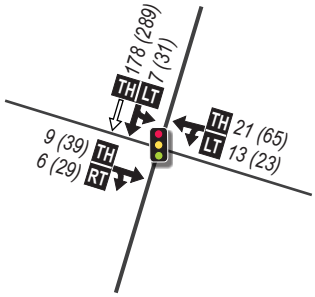
A13. *SW Naito Pkwy. @ SW Harrison St.*



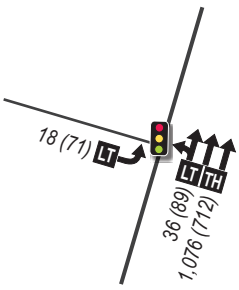
A19. *SW 6th Ave. @ SW Hall St.*



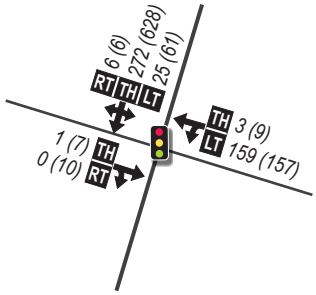
A20. *SW 5th Ave. @ SW Hall St.*



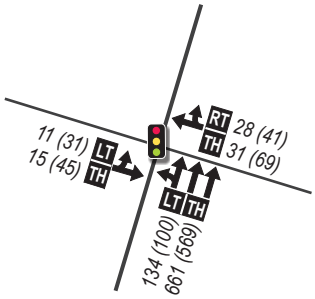
A21. *SW 4th Ave. @ SW Hall St.*



A22. *SW Broadway @ SW College St.*



A23. *SW 6th Ave. @ SW College St.*



LEGEND

00. - Study Intersection No.
STOP - Stop Sign
- Yield Sign
- Traffic Signal
- Lane Configuration
- Bus Only Lane
AM (PM) - Peak Hour Traffic Volumes
LT TH RT - Volume Turn Movement
Left•Thru•Right

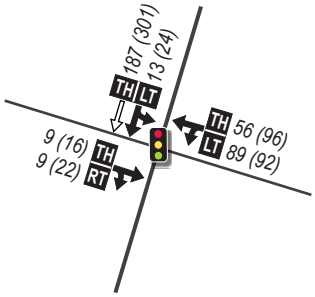
DKS

No Scale

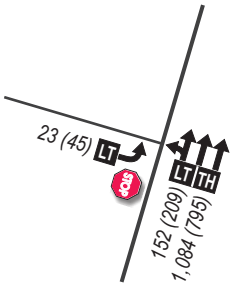
figure **3.2-3a**

2017 Existing Conditions
AM/PM Peak Hour
Segment A: Inner Portland

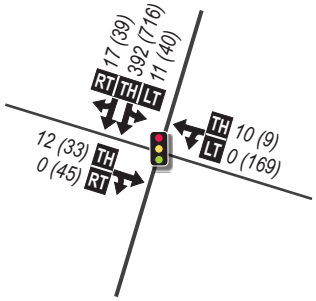
A24. *SW 5th Ave. @ SW College St.*



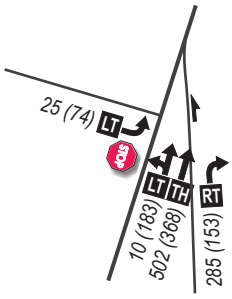
A25. *SW 4th Ave. @ SW College St.*



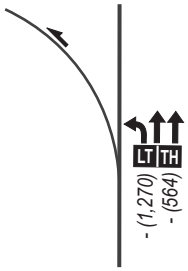
A26. *SW Broadway @ SW Jackson St.*



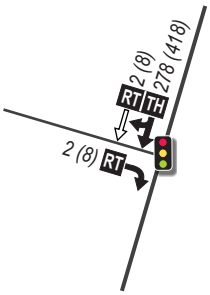
A27. *SW 6th Ave. @ SW Jackson St./ I-405 Off-Ramp*



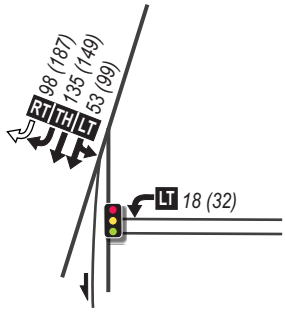
A28. *SW 6th Ave. @ I-405/Hwy. 26 On-Ramp*



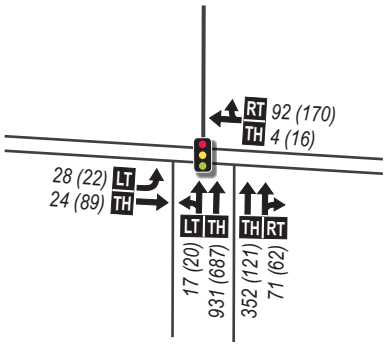
A29. *SW 5th Ave. @ SW Jackson St.*



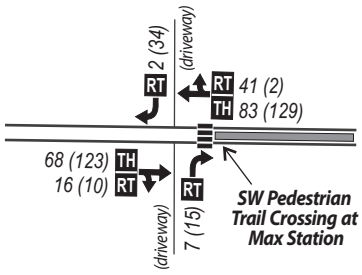
A30. *SW 5th Ave./I-405 On-Ramp @ SW Lincoln St.*



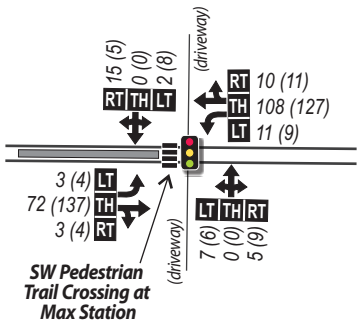
A31. *SW 4th Ave./I-405 WB Off-Ramp @ SW Lincoln St.*



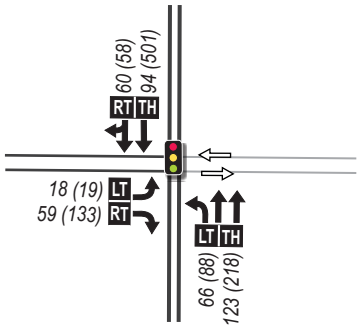
A32. *SW 3rd Ave. @ SW Lincoln St.*



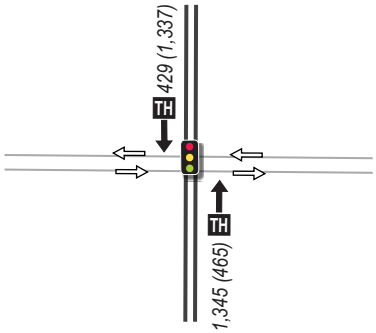
A33. *SW 2nd Ave. @ SW Lincoln St.*



A34. *SW 1st Ave. @ SW Lincoln St.*



A35. *SW Naito Pkwy. @ SW Lincoln St.*



LEGEND

00. - Study Intersection No.
STOP - Stop Sign
- Yield Sign
- Traffic Signal
- Lane Configuration
- Bus Only Lane
AM (PM) - Peak Hour Traffic Volumes
LT TH RT - Volume Turn Movement
Left•Thru•Right

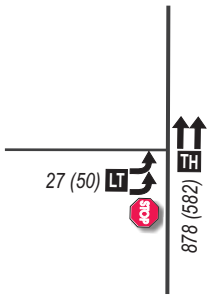
DKS

No Scale

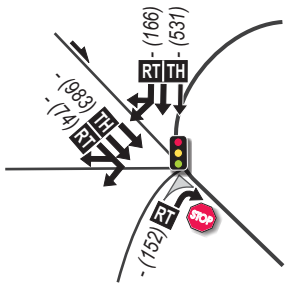
figure **3.2-3b**

2017 Existing Conditions
AM/PM Peak Hour
Segment A: Inner Portland

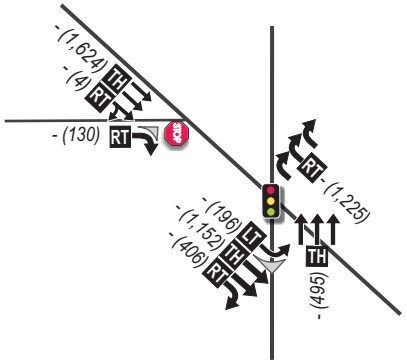
A36. *SW 4th Ave. @ SW Grant St.*



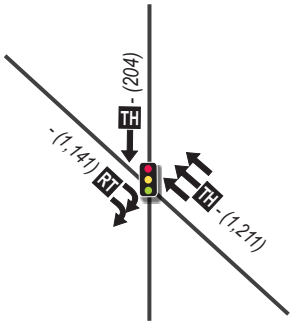
A37. *SW Broadway @ I-405/SW Lincoln St.*



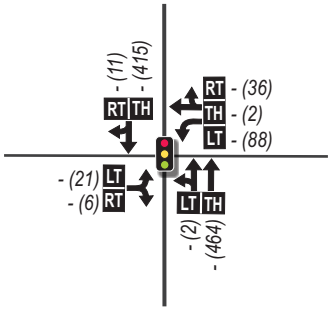
A38. *SW Broadway/SW Grant St. @ SW 6th Ave.*



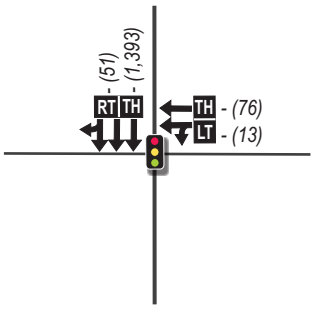
A39. *SW Broadway @ SW 5th Ave.*



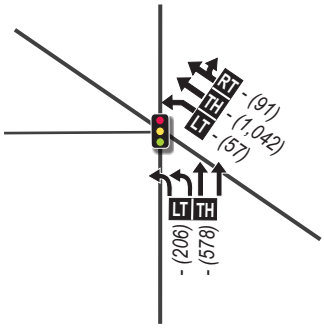
A40. *SW 6th Ave. @ SW Caruthers St.*



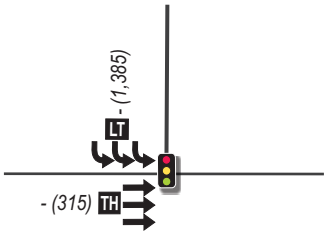
A41. *SW 5th Ave. @ SW Caruthers St.*



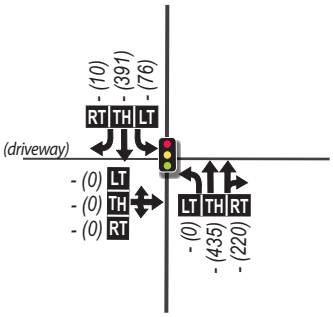
A42. *SW 4th Ave. @ SW Caruthers St./ SW Broadway*



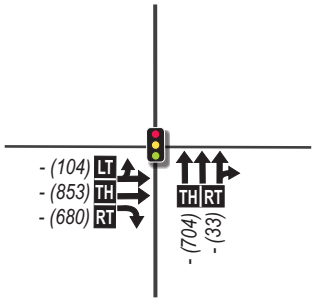
A43. *SW 5th Ave. @ SW Sheridan St.*



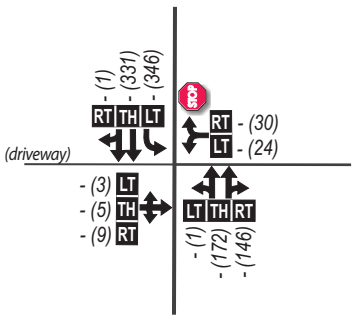
A44. *SW 6th Ave./SW Terwilliger Blvd. @ SW Sheridan St.*



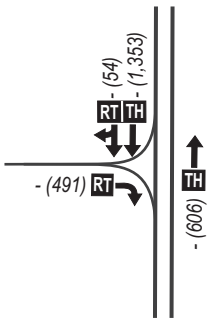
A45. *SW 4th Ave./SW Barbur Blvd. @ SW Sheridan St.*



A46. *SW 1st Ave. @ SW Sheridan St.*



A47. *SW Naito Pkwy. @ SW Sheridan St.*



LEGEND

00. - Study Intersection No.
STOP - Stop Sign
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- Lane Configuration
- Bus Only Lane
AM (PM) - Peak Hour Traffic Volumes
LT TH RT - Volume Turn Movement
Left•Thru•Right

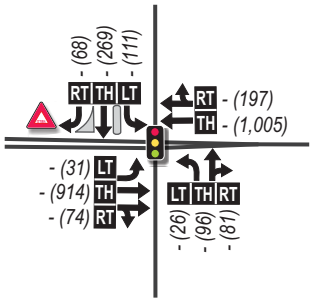
DKS

No Scale

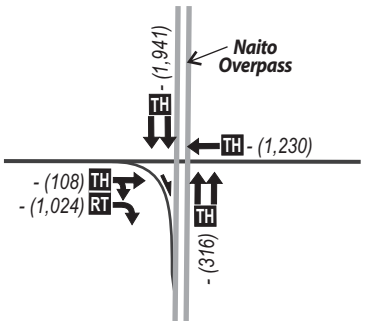
figure **3.2-3c**

2017 Existing Conditions
AM/PM Peak Hour
Segment A: Inner Portland

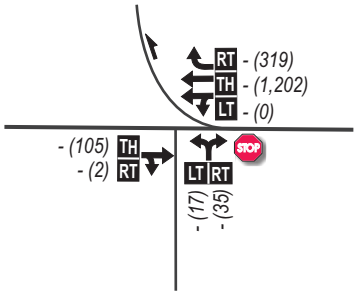
A48. *SW 1st Ave. @ SW Arthur St.*



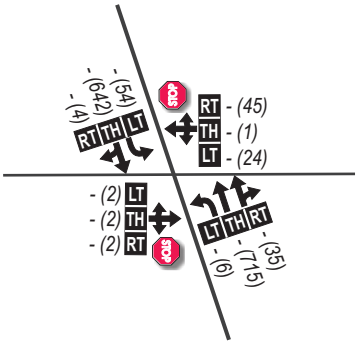
A49. *SW Naito Pkwy. @ SW Arthur St.*



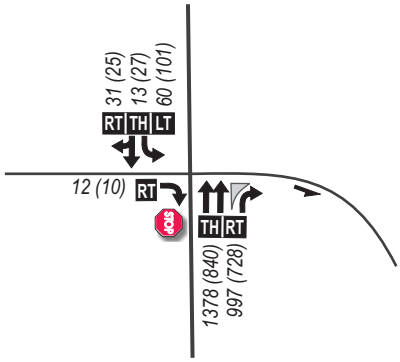
A50. *SW Naito Pkwy. @ SW Kelly St.*



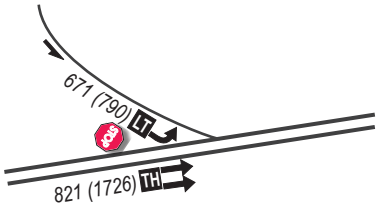
A52. *SW Barbur Blvd. @ SW Hooker St.*



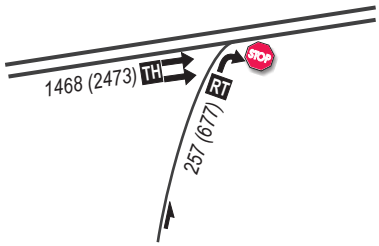
A56. *SW Kelly St. @ SW Porter St./SW Hood Ave.*



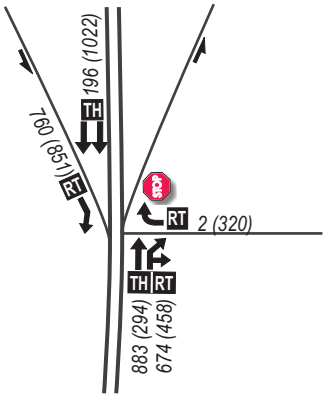
A61. *Ross Island Brg. @ Naito Pkwy.*



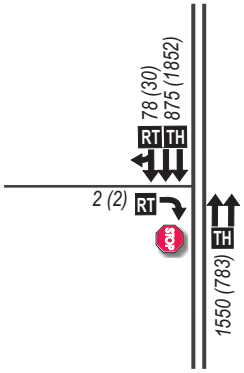
A62. *Ross Island Brg. @ Kelly Ramps*



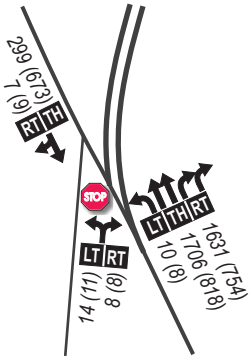
A69. *SW Naito Pkwy. @ Gibbs/Naito Ramps*



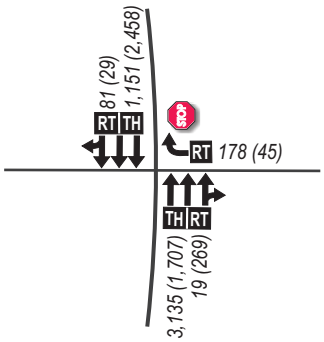
A72. *SW Naito Pkwy. @ SW Whitaker St.*



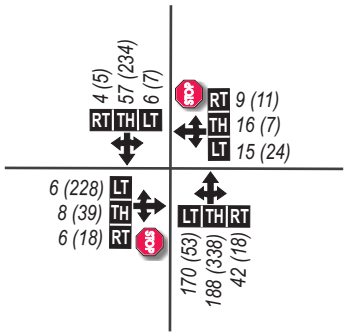
A78. *SW Barbur Blvd. @ SW Naito/ SW Abernathy St.*



A80. *SW Barbur Blvd. @ SW Bancroft St.*



A81. *SW Corbett Blvd. @ SW Bancroft St.*



LEGEND

00. - Study Intersection No.
STOP - Stop Sign
- Yield Sign
- Traffic Signal
← - Lane Configuration
⇦ - Bus Only Lane
AM (PM) - Peak Hour Traffic Volumes
LT TH RT - Volume Turn Movement
Left•Thru•Right

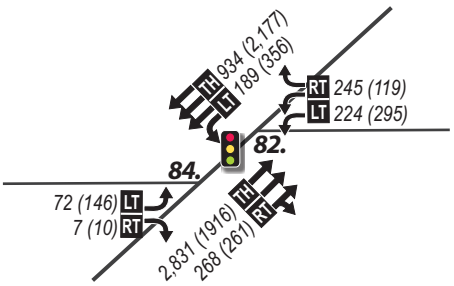
DKS

No Scale

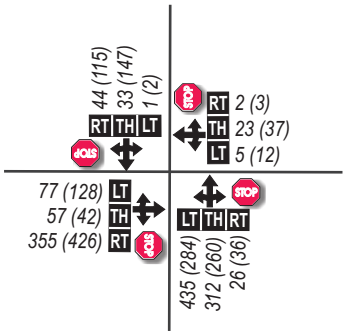
figure **3.2-3d**

2017 Existing Conditions
AM/PM Peak Hour
Segment A: Inner Portland

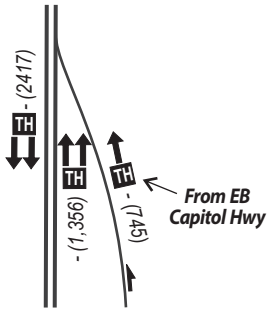
A82. *SW Barbur Blvd. @ SW Hamilton St. (East)*
A84. *SW Barbur Blvd. @ SW Hamilton St. (West)*



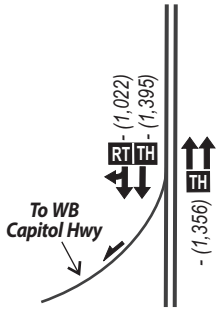
A83. *SW Hamilton Blvd. @ SW Corbett Ave.*



A85. *SW Barbur Blvd. @ SW Capitol Hwy. EB*



A86. *SW Barbur Blvd. @ SW Capitol Hwy. WB*



LEGEND

00. - Study Intersection No.
STOP - Stop Sign
- Yield Sign
- Traffic Signal
- Lane Configuration
- Bus Only Lane
AM (PM) - Peak Hour Traffic Volumes
LT TH RT - Volume Turn Movement
Left•Thru•Right

DKS

No Scale

figure **3.2-3e**

2017 Existing Conditions
AM/PM Peak Hour
Segment A: Inner Portland

As shown in Table 3.2-2, HCM operations analysis indicates the following intersections as failing to meet mobility targets.

AM Peak Hour:

- **SW Naito Parkway northbound ramp to Ross Island Bridge.** This two-way stop controlled intersection operates above capacity according to the HCM analysis. However, driver behavior at this intersection more closely resembles yield than stop controlled conditions, allowing for higher traffic throughput from the SW Naito Parkway approach.

- **SW Corbett Avenue and SW Hamilton Street.** This all-way stop controlled intersection experiences high volume northbound left and eastbound right turns during the AM peak hour. With relatively low conflicting volumes, northbound left-turn and eastbound right-turn vehicles exhibit behavior more typical of yielding movements at a two-way stop controlled intersection, merely slowing before completing the turn movement rather than coming to a complete stop. This driver behavior allows the intersection to service higher volumes than would be expected according to the HCM analysis.

PM Peak Hour:

- **SW Naito Parkway off-ramp and Hawthorne Bridge.** Northbound right-turn volume from SW Naito Parkway onto eastbound Hawthorne Bridge queues significantly during the peak period due to heavy conflicting pedestrian, bicycle and motor vehicle volumes.

- **SW Naito Parkway northbound ramp to Ross Island Bridge.** This two-way stop controlled intersection operates above capacity according to the HCM analysis. However, during the PM peak period, driver behavior at this intersection more closely resembles a zipper merge (where drivers in merging lanes are expected to take alternating turns as two lanes merge into a single lane), which allows for higher volume throughput from the SW Naito Parkway approach.

- **SW Kelly Avenue and Ross Island Bridge.** This two-way stop controlled intersection operates above capacity according to the HCM analysis. Similar to conditions at the SW Naito Parkway and Ross Island Bridge intersection, the PM peak period driver behavior at this location more closely resembles a zipper merge, allowing for higher volume throughput from the SW Kelly Avenue approach.

- **SW Corbett Avenue and SW Bancroft Street.** This two-way stop control intersection performs better than indicated by the HCM analysis because of more aggressive driving behavior from eastbound vehicles on SW Bancroft Street. Field observations did not indicate significant queuing issues at this location.

- **SW Corbett Avenue and SW Hamilton Street.** Like the AM peak-hour conditions, this intersection experiences high volume northbound left turns and eastbound right turns during the PM peak hour. With relatively low conflicting volumes, northbound left-turn and eastbound right-turn vehicles exhibit behavior more typical of yielding movements at a two-way stop controlled intersection, merely slowing before completing the turn movement rather than coming to a complete stop. This driver behavior allows the intersection to service higher volumes than would be expected

according to the HCM analysis. Field observations noted more queuing during PM peak-hour conditions than AM peak-hour conditions.

Additional operational issues observed during the both AM and PM peak hours were either caused by interactions between intersections or bottlenecks outside of the study area, which are operational issues that are not captured in the HCM analysis but will be addressed in the following section.

2017 Existing Conditions Simulation Analysis

Three separate existing conditions simulation models were created for this analysis using the Vissim software. These models target the following three analysis areas and time periods:

- Segment A Downtown AM Peak
- Segment A Hamilton AM Peak
- Segment A PM Peak

The areas analyzed by each of the Vissim models are shown in Figure 3.1-1.

All models were calibrated over a two-hour peak traffic time interval, which was 7 to 9 a.m. for the AM models and 4 to 6 p.m. for the PM model. Model calibration included comparing modeled queues to field-observed queues and queues estimated from Google traffic maps captured during field observations. Other calibration measures included intersection traffic volumes, travel times, speeds, lane utilization, and volume profiles at key system bottlenecks.

The Segment A Downtown AM Peak model focused on intersections within the Segment A study area north of Interstate 405 (I-405). This model was intended to measure the impacts of changes in light rail operations along SW Lincoln Street to motor vehicle operations, mainly on SW Naito Parkway, SW 1st Avenue and the SW 4th Avenue/I-405 northbound off-ramp. To more accurately capture the daily randomness of traffic in and around the study area, the model was run 10 times with unique vehicle arrival patterns, or "random seeds." The results of the 10 simulations were aggregated and averaged to produce performance metrics, such as delay, travel time, and 95th percentile queues. These performance metrics are presented in Appendix E.

System-wide metrics were used to measure the overall performance of each analysis area modeled over the two-hour analysis time periods. These metrics are:

- total vehicles served = number of vehicles exiting the model network during the two-hour analysis period
- latent vehicle demand = vehicle demand unable to enter the network due to queuing. This measure is an indication of greater demand than capacity. As with a v/c ratio greater than 1.00, any demand greater than capacity may result in peak spreading, mode shift alternate routing, etc.
- unserved demand at key gateways = list of key locations generating latent demand
- volume throughput = under future conditions, total volume served at key intersections (p.m. measure only)
- total vehicle hours of delay = total vehicle hours of delay for vehicles that either enter the network or are waiting to enter the network (delay for latent demand)

These system-wide metrics are key measures used mainly to compare the performance of future year conditions in the simulation models.

The system-wide metrics for the Downtown Existing AM Peak model are summarized in Table 3.2-3.

Table 3.2-3. Segment A Downtown Existing AM Simulation System Measures

Measure	Simulation Result (7-9 a.m.)		
Total Vehicles Served	14,000 vehicles		
Latent Vehicle Demand	0 vehicles		
Total Vehicle Hours of Delay	110 vehicle-hours		
Unserved Demand at Key Gateways			
Gateway	**Demand**	**Unserved Demand**	**Percent Unserved Demand**
None	N/A	N/A	N/A

As expected, under existing conditions the system-wide metrics show that the Downtown Existing AM Peak model has the capacity to service existing volumes, which were derived from turn movement counts.

The simulation model was also used to measure delay relative to desired speed as an indicator of queue length. Appendix E includes the queuing for the Downtown AM model on 15-minute increments from 7:00-9:00 a.m. as averaged over 10 simulations for existing conditions. The colors shown in this appendix and all other queuing figures within the appendices indicate the following approximate queue states:

1. Dark Green = free flow, no delay
2. Light Green = slight slowing
3. Yellow = increased slowing, but not yet stop-and-go
4. Orange = furthest extent of stop-and-go queues, rough approximation of 95th percentile queue
5. Red = fluctuates between low speed flow and stopped queue
6. Dark Red = stop-and-go queue during the entire 15-minute peak interval

As shown in Appendix E, the AM queues for the Downtown model are not significant. All the queuing within the modeled downtown grid is simply caused by the standard stop-and-go operations typical to signal operations. Vehicle queuing generally does not extend past the next upstream signalized intersection. This finding is supported by the field observation made during the AM peak hour within this modeled area.

The Segment A Hamilton AM Peak model focused on intersections within the Segment A study area along SW Naito Parkway south of SW Arthur Street, SW Barbur Boulevard south of SW Condor Avenue, and the west Ross Island Bridgehead. This model was intended to measure impacts of changes in the light rail alignment alternatives at the SW Hamilton Street and SW Barbur Boulevard intersection, as well as the impacts of a Ross Island Bridgehead Reconfiguration to AM peak operations. As with the Downtown AM Peak model, the simulation results for the Hamilton model were aggregated and averaged over 10 random seed simulations to produce intersection and performance metrics, such as delay, travel time and 95th percentile queues. These performance metrics are presented in Appendix E.

The system-wide metrics for the Hamilton Existing AM Peak model are summarized in Table 3.2-4.

Table 3.2-4. Segment A Hamilton Existing AM Simulation System Measures

Measure	Simulation Result (7-9 a.m.)		
Total Vehicles Served	20,200 vehicles		
Latent Vehicle Demand	0 vehicles		
Total Vehicle Hours of Delay	460 vehicle-hours		
Unserved Demand at Key Gateways			
Gateway	**Demand**	**Unserved Demand**	**Percent Unserved Demand**
None	N/A	N/A	N/A

As expected, under existing conditions the system-wide metrics show that the Hamilton model has the capacity to service existing volumes, which were derived from turn movement counts.

Like the Downtown model, the Hamilton model was used to measure delay relative to desired speed as an indicator of queue length in the AM peak hour. Appendix E includes the queuing for the Hamilton AM model on 15-minute increments from 7:00-9:00 a.m. as averaged over 10 simulations for existing conditions.

Appendix E highlights the main AM congestion and bottleneck locations noted during field observations and included in the Segment A Hamilton AM Peak model. These key locations are:

- **Northbound SW Kelly Avenue north of SW Porter Street.** High traffic volumes exiting from Interstate 5 (I-5) northbound onto westbound U.S. Highway 26 (US 26) (towards Beaverton) conflicts with traffic entering I-405 northbound from SW 6th Avenue, leading to a rolling queue on the I-405 on-ramp at SW 6th Avenue. This queue spills back along SW Broadway, SW Caruthers Street, SW 3rd Avenue, SW Arthur Street and SW Kelly Avenue. Although the bottleneck location is not included in the Hamilton model, the effects of the queue on SW Kelly Avenue were modeled using a dummy signal.

- **Northbound SW Naito Parkway on-ramp to eastbound Ross Island Bridge.** The stop controlled merge from the SW Naito Parkway ramp onto the eastbound Ross Island Bridge presents drivers with a sight distance issue due to the high skew angle of the intersection. Heavy AM eastbound Ross Island Bridge traffic volumes from SW Arthur Street and SW Naito Parkway also make the northbound ramp movement difficult. Drivers at this location at times exhibit more aggressive behavior than typical of a two-way stop controlled intersection, sometimes failing to come to a complete stop when following a vehicle into an extended gap on the mainline. But overall, as shown in the queue figures (see Appendix E) and observed in the field, queues from the northbound SW Naito Parkway ramp can extend as far south as SW Barbur Boulevard during the height of the AM peak hour.

- **Intersection of SW Hamilton Street and SW Barbur Boulevard.** Northbound traffic on SW Barbur Boulevard queues significantly during the AM peak hour. Partly, this significant queuing is simply a result of the high traffic volumes in the three northbound lanes. Even with a long cycle length, the time required to serve the side street and southbound left-turn movements, along with pedestrian activity, generates significant queues at this location. These queues are increased by frequent in-lane bus activity at the northbound SW Barbur Boulevard transit stop just north of SW Hamilton Street. This bus activity further degrades input in the two outside northbound lanes. As

shown in Appendix E the combined impact of all of these operational issues is northbound queues that occasionally extend to near the SW Capitol Highway merge point during the height of the AM peak hour.

- **Intersection of SW Hamilton Street and SW Corbett Avenue.** As discussed in the Existing HCM Operations section above, the northbound left turn at this all-way stop controlled intersection serves a high traffic volume during the AM peak hour. Some of this traffic comes from vehicles bypassing northbound I-5 coming into downtown Portland, using the I-5 off-ramp to SW Corbett Avenue to bypass freeway congestion. As noted in the Existing HCM Operations section above, vehicles making the northbound left turn do not come to a complete stop unless they must yield to a conflicting movement. This driver behavior was captured in the simulation model, but similar to field conditions, northbound queues are still present.

- **Intersection of SW Capitol Highway and SW Terwilliger Boulevard.** Although not a study area intersection, this location was modeled in Vissim to capture traffic platooning impacts on the northbound SW Capitol Highway and SW Barbur Boulevard merge. Field observations noted that the SW Capitol Highway and SW Terwilliger Boulevard intersection is a bottleneck for eastbound SW Capitol Highway traffic, as indicated by the queues generated from the simulation model and shown in Appendix E.

The Segment A PM Peak simulation model focused on the entire Segment A study area. This model was used to measure and compare the impacts based on multiple modeling iterations of the three DEIS light rail alignment alternatives (A1, A2-BH and A2-LA). This model was also used to test the impacts of two additional (not included in the DEIS) alternatives, one using the Barbur alignment with the Ross Island Bridgehead improvements (A1-BH) and one similar to A2-BH, but with a left turn provided from southbound SW Naito Parkway to eastbound SW Woods Street for access to the Ross Island Bridge eastbound (A2-BH-LT). As with both AM models, the simulation results for the PM model were aggregated and averaged over 10 random seed simulations to produce intersection and performance metrics, such as delay, travel time and 95th percentile queues. These performance metrics are presented in Appendix E.

The system-wide metrics for the Segment A PM Peak model are summarized in Table 3.2-5.

Table 3.2-5. Segment A Existing PM Simulation System Measures

Measure	Simulation Result (4-6 p.m.)		
Total Vehicles Served	46,200 vehicles		
Latent Vehicle Demand	300 vehicles		
Total Vehicle Hours of Delay	3,050 vehicle-hours		
Unserved Demand at Key Gateways			
Gateway	**Demand**	**Unserved Demand**	**Percent Unserved Demand**
None	N/A	N/A	N/A

As expected, under existing conditions, the system-wide metrics show that the PM model can serve most of the counted demand. While some latent demand occurs on minor model gateways, no key gateways (arterials or other high classification streets) have significant latent demand.

Like the AM models, the PM model was used to measure delay relative to desired speed as an indicator of queue length. Appendix E includes the queuing for the Segment A Existing PM model on 15-minute increments from 4:00-6:00 p.m. as averaged over 10 simulations for existing conditions.

Recent field observations during the PM peak hour in the Segment A study area indicate a significant increase in drivers using alternate local routes through the study area, even compared to as recently as two years ago. This phenomenon is likely caused by the increased prevalence of driver routing apps that provide more up-to-date travel time data and increased routing options using local streets. The simulation model attempts to capture a typical "average" weekday condition, but the wide variance in routing that occurs in an area as congested as Segment A means that local and sometimes even regional trip routing could be very different from the modeled conditions on any given day. For this reason, the PM model is focused primarily on bottleneck locations. All local-level traffic impacts caused by different routing choices may not be fully captured in this analysis.

Appendix E highlights the main PM peak congestion and bottleneck locations noted during field observations and included in the PM model. These key locations are summarized as follows:

- **Northbound SW Naito Parkway on-ramp to eastbound Hawthorne Bridge.** As noted in the Existing HCM Operations section above, high volumes of conflicting pedestrian, bicycle, and vehicle hinder vehicles attempting to make a northbound right turn from the SW Naito Parkway ramp onto eastbound Hawthorne Bridge. This condition impedes operations on northbound SW Naito Parkway, especially in the outside lane, and generates queues that occasional spill back through SW Harrison Street and onto adjacent side streets. One of the impacts of this system bottleneck is trip diversion from northbound SW Naito Parkway to northbound SW 1st Avenue via the Boy Scouts of America parking lot located between I-405 and SW Lincoln Street. Nearly 100 peak-hour vehicles used this cut-through based on peak-hour counts. The cut-through allowed vehicles attempting to make a northbound left turn onto westbound SW Harrison Street to bypass the SW Naito Parkway northbound queues. Other impacts from the northbound SW Naito Parkway queue include queue spillback onto SW Columbia Street, SW Market Street and westbound SW Clay Street.

- **Downtown grid encompassed by SW Harrison Street, SW Jackson Street, SW Broadway and SW 4th Avenue.** Queues within this area vary throughout the PM peak period, depending mainly on transit and pedestrian activity related to the Portland State University campus. No intersection generates queues consistently, but city blocks may queue up for several minutes at a time depending on the conditions.

- **I-405 southbound off-ramp to SW Broadway.** Field observations noted that this ramp remained queued during most for the peak period, indicating significant unserved demand. The simulation model focused on matching the volume throughput at this location, based on the traffic counts. Queues on the off-ramp were generated by queue spillback from the Ross Island Bridge, and not directly from the signal operations at SW Broadway.

- **I-405 northbound on-ramp from SW 6th Avenue.** Like the AM traffic conditions, high traffic volumes exiting from I-405 northbound onto westbound US 26 (towards Beaverton) conflict with traffic entering I-405 from SW 6th Avenue, leading to a rolling queue on the I-405 on-ramp at SW 6th Avenue. The speed of this queue was calibrated against the count profile and field video. The impacts of this system bottleneck are more far-reaching under the PM than under AM conditions.

Queue spillback along SW Kelly Avenue leads to queuing along the SW Macadam Avenue northbound ramp and on southbound SW Water Street. The SW Kelly Avenue queues also extend onto the Ross Island Bridge, creating the queue shock waves that ultimately generate much of the westbound queuing on SE Powell Boulevard. The SE Powell Boulevard queuing is outside of the scope of this model. The I-405/6th Avenue on-ramp queue also creates northbound queues on SW Terwilliger Boulevard at SW Broadway. The lane utilization of the slow-moving queue is approximately even east of SW 4th Avenue, with some westbound SW Broadway vehicles waiting to merge into the inside lane until they reach SW 6th Avenue. This aggressive driver behavior was replicated in the simulation model. In addition, southbound traffic from SW Broadway attempting to enter I-405 northbound occasionally queues back through SW Jackson Street.

- **Ross Island Bridgehead eastbound.** The stop controlled approaches to the Ross Island Bridgehead at SW Kelly Avenue and from the northbound SW Naito Parkway ramp contribute to a system bottleneck during the PM peak period. As congestion increases on the Ross Island Bridge due to queue spillback from the SE Powell Boulevard and SE 20th Avenue intersection combined with high traffic and lane changes in the narrow lanes on the Ross Island Bridge, the driver behavior at the bridgehead changes. Both the SW Kelly Avenue and northbound SW Naito Parkway ramp intersections shift from typical two-way stop controlled behavior to zipper merge or "courtesy queuing" operations, with SW Kelly Avenue operating slightly more evenly with one-to-one major to minor street vehicle merge behavior. Once the drivers engage in courtesy queuing behavior, a queue develops back up through the SW 1st Avenue and SW Arthur Street intersection and all the way to the I-405 southbound off-ramp at SW Broadway. The queue from the northbound SW Naito Parkway ramp builds throughout the peak hour, and occasionally extends to SW Hamilton Street. The northbound SW Kelly Avenue to eastbound Ross Island Bridge queue includes vehicles exiting I-5 northbound via SW Macadam Avenue and looping around to SW Kelly Avenue via SW Hood Avenue and SW Whitaker Street. Additional northbound vehicles on SW Corbett Avenue destined for the Ross Island Bridge eschew SW Barbur Boulevard and SW Naito Parkway entirely in favor of the SW Kelly Avenue access. Another popular shortcut is the westbound right turn from SW Gibbs Street directly onto the SW Naito Parkway northbound ramp to the Ross Island Bridge. Drivers on both northbound SW Corbett Avenue and southbound SW 1st Avenue use this route in an attempt to cut short the delay waiting in queue on the mainline routes.

- **Intersection of SW Hamilton Street and SW Corbett Avenue.** The performance of the eastbound leg of this intersection is key to the operations at the much higher volume SW Hamilton Street and SW Barbur Boulevard intersection. Eastbound queue spillback at this all-way stop controlled intersection occasionally extends to SW Barbur Boulevard as a slow-moving (but not stopped) queue.

- **Intersection of SW Hamilton Street and SW Barbur Boulevard.** This intersection has multiple queuing issues during the PM peak hour. Signal timing constraints and occasional northbound queue spillback from the Ross Island Bridge restrict the eastbound leg of the intersection to approximately four to six vehicles per cycle, leading to high vehicle delays and queuing. The southbound left turn also has limited green time available, and queue spillback from the SW Hamilton Street and SW Corbett Avenue intersection occasionally impedes the flow for this movement, leading to queues that can occasional extend up SW Barbur Boulevard to near SW Naito Parkway.

Overall, PM peak hour conditions in Segment A are highly congested and therefore dynamic from day to day. This analysis focused on the best approximation of a "typical" day, and all future scenarios were built off the same set of assumptions.

Preliminary Signal Warrant Analysis

A preliminary signal warrant analysis was completed for study area intersections where new signals or significant changes to existing signals could be included as part of the light rail alternatives. Analysis for both existing year and future year (2035) is presented in Section 3.3.5, Preliminary Signal Warrant Analysis, below. All of the signal warrant analysis presented in this report is based on available turning movement counts and 24-hour counts. The closest available 24-hour count was used to estimate 8-hour and 4-hour volumes where 24-hour counts were not available near all study intersections. A complete warrant analysis will be completed in a later phase of the project following selection of a locally preferred alternative. Appendix D includes details on the analyzed warrants. Intersections (identified below by their alphanumeric IDs) that meet peak-hour, 4-hour volume or 8-hour volume warrants under existing conditions include:

- A51: SW Kelly Avenue/SW Water Avenue
- A61: Ross Island Bridge/SW Naito Parkway
- A62: Ross Island Bridge/SW Kelly Avenue ramps
- A69: SW Naito Parkway/SW Gibbs Street/SW Naito Parkway ramps
- A80: SW Barbur Boulevard/SW Bancroft Street

Intersections that do not meet traffic signal warrants under the existing conditions are analyzed in Section 3.3.5 for year 2035 conditions.

3.2.4. Segment A Freight Operations

Federal, state and local jurisdictions designate freight routes to ensure that those roadways are maintained in a manner that allows for the effective operation of freight-hauling trucks. Freight designations of major facilities within the study corridor include:

- The National Highway System (NHS) is a network of highways serving strategic economic, defense and transportation facilities such as ports, terminals and railway stations. States are encouraged to focus federal highway funding on maintaining the NHS in a state of good repair.
- The Oregon Highway Plan (OHP) freight system has implications for roadway design and mobility standards to accommodate trucks, and may override exceptions granted from other designations.
- Oregon Revised Statute (ORS) 366.215 specifies a series of "Reduction Review" routes, which are designated for the movement of oversized freight trucks. These routes require review during planning, project development review and maintenance to examine whether the modifications to the route would maintain adequate clearances for oversized freight movement (hole in the air capacity) and ensure freight movement is not restricted.
- Regional freight routes are designated by Metro, and are intended to prioritize areas for investment in freight mobility.

- Portland designates city freight routes. Portland's Major Truck Street designation indicates that all truck types should be accommodated on that street, where practicable.

In Segment A, SW Barbur Boulevard south of SW Naito Parkway, SW Naito Parkway and the Ross Island Bridge ramps are all designated as part of the NHS. In addition, the Ross Island Bridge ramps are subject to ORS 366.215 Reduction Review. SW Barbur Boulevard, SW Naito Parkway, and the Ross Island Bridge ramps are designated as Major Truck Streets by the City of Portland.

3.2.5. Segment A On-Street Parking

The supply and utilization of on-street parking within the footprint of the light rail alignment alternatives were determined by measuring the currently available and legal parking within the public right of way, using 22.5 feet[2] to define a parking space. In some locations, there is privately owned land that is used for parking adjacent to the proposed light rail alignments, and these locations were not included in the inventory. The utilization survey was conducted on weekdays in May and August 2017.

In Segment A: Inner Portland, there are two locations with existing on-street parking within the project footprint: on SW Barbur Boulevard south of SW Sheridan Street (Alternative A1) and on SW Naito Parkway between SW Gibbs Street and SW Pennoyer Street (Alternatives A2-LA and A2-BH).

Table 3.2-6 summarizes the results of the inventory and utilization survey in Segment A.

Table 3.2-6. Segment A On-Street Parking Supply and Utilization

Parking Location	Alignment Alternatives	On-Street Parking Supply	AM Utilization	AM Percent Utilization	PM Utilization	PM Percent Utilization	Parking Restrictions
Segment A: Inner Portland							
SW Barbur Blvd. south of SW Sheridan St.	A1	16	5	31%	0	0%	2-hour limit
SW Naito Pkwy. between SW Gibbs St. and SW Pennoyer St.	A2-LA A2-BH	21	4	19%	13	62%	2-hour visitor parking 7a.m.-6 p.m., Mon.-Fri., except by Zone F permit

There are also local streets perpendicular to the light rail transit (LRT) alignment where the project would modify the streetscape for a small portion of the street immediately adjacent to the LRT alignment, often adding curbs, water quality facilities, sidewalks and bike lanes. These streetscape modifications have not been defined in detail and may or may not include on-street parking.

3.2.6. Segment A Safety Analysis

This section analyzes the existing safety performance in Segment A. Collision data forms the basis of this analysis, and was gathered from the last five years (2011 through 2015) from ODOT. This data was

[2] City of Portland Bureau of Development Services, Permanent Administrative Rules, Streets, Alleys, Shared Courts, Common Greens and Pedestrian Connections, July 19, 2010.

supplemented by 2015 Safety Priority Index System (SPIS) data from 2012 to 2014, which is the most recent complete dataset. The crash history maps are included in Appendix BB.

SPIS is a multifactor ranking system developed by ODOT to identify potential safety problems on state highways. SPIS scores are developed based upon crash frequency, severity and rate using a sliding-window approach with overlapping 0.10-mile segments along the state highway over a rolling three-year window (i.e., every year, the score is updated with the most recent three years). A prioritized list of the top 15 percent of statewide SPIS sites is created for each region, and it is encouraged that the top 5 percent of these sites be investigated by the five Region Traffic Manager's offices.

In Segment A, there are two distinct clusters of fatal and serious injury collisions along the project corridor. These two clusters are:

- Ross Island Bridge
- SW Barbur Boulevard/SW Naito Parkway/Ross Island Bridge western access

Ross Island Bridge had the second highest number of fatal and serious injury crashes out of every cluster in the corridor, having 10 total fatal and serious injury collisions. Crash data for these two clusters are tabulated in Table 3.2-7 and Table 3.2-8.

Table 3.2-7. Fatal and Serious Injury Collisions, Segment A (2011–2015)

Location	Fatal	Serious Injury	Total
Project Corridor	**2**	**12**	**14**
Ross Island Bridge	2	8	10
Downtown Portland	0	4	4

Table 3.2-8. Fatal and Serious Injury Collision Type, Segment A (2011–2015)

Location	Pedestrian	Bicycle	Rear-End	Fixed Object	Turning	Other[1]	Total
Project Corridor	**2**	**0**	**6**	**3**	**0**	**3**	**14**
Ross Island Bridge	0	0	5	2	0	3	10
Downtown Portland	2	0	1	1	0	0	4

[1] Other collision types include head-on, sideswipe, and non-collision.

Ross Island Bridge

Across the Ross Island Bridge there were a total of 10 fatal and serious injury collisions (2 fatal and 8 that resulted in serious injuries) between 2011 and 2015. Of the total collisions, five were rear-end, three were sideswipe, and two were fixed-object.

One fatality was a sideswipe-type collision, in which the driver appeared to have a medical attack, forcing the vehicle to leave the center line and first hit the side of the bridge and then a second vehicle. The second fatality was a rear-end collision involving two motorcycles, in which one rider attempted to make an improper U-turn, at which point the second rider collided with the first rider and was stuck by oncoming traffic.

Of the four rear-end collisions that resulted in a serious injury, three were caused by drivers following too closely.

Recommended improvements that could address these collisions include improving lighting along a roadway segment and installing flashing beacons as advance warning for congestion on the bridge.[3]

3.3. Segment A Future Conditions

This section identifies potential impacts to non-motorized and motorized modes of travel associated with the No-Build Alternative and the light rail alternatives within Segment A in 2035 and for freeway ramp terminals in 2045. In addition, potential improvements outside of this project are developed to address the potential deficiencies in the transportation network.

3.3.1. Segment A Alternatives

No-Build Alternative

The No-Build alternative includes projects identified in the Metro 2014 Regional Transportation Plan, Financially Constrained project list. The purpose of this alternative is to provide a point of comparison for future scenarios, rather than comparing the future project with the existing conditions.

Light Rail Alternatives

A full description of the alignment alternatives is included in Chapter 2 of the Draft EIS. A summary description of the alignment alternatives follows.

Segment A Alignment Alternatives

Segment A includes three alignment alternatives: Alternatives A1 (Barbur), A2-BH (Naito with Bridgehead Reconfiguration) and A2-LA (Naito with Limited Access). North of SW Pennoyer Street, Alternative A1 follows the alignment of SW Barbur Boulevard and both Alternatives A2-BH and A2-LA follow SW Naito Parkway.

Alternative A2-BH would reconfigure the Ross Island Bridge connection with SW Naito Parkway. This reconfiguration involves removing the interchange ramps at SW Naito Parkway/Ross Island Bridge, construction of a new ramp from SW Kelly Avenue to the Ross Island Bridge, and connecting the Ross Island Bridge to SW Woods Street at SW Naito Parkway via a signalized intersection. SW Hooker, Gibbs, and Whitaker Streets would gain connections at signalized intersections with SW Naito Parkway under this alternative.

Alternative A2-LA, on the other hand, would reconstruct the existing bridgehead ramps but remove SW Grover Street between SW 1st Avenue and SW Water Avenue. SW Gibbs Street would gain a connection at a signalized intersection with SW Naito Parkway under this alternative.

Additional Analysis Alternatives

In addition to the three DEIS alignment alternatives in Segment A, traffic models were developed for two more alternative concepts. These traffic operations concepts were included in the analysis at request of project partners, but were not included as full alternatives included in the DEIS.

[3] There is no documented crash reduction for this particular application; however, application of such advance warning for congestion at intersections can reduce rear-end collisions by up to 36 percent.

Alternative A1-BH Barbur with Bridgehead includes the same light rail alignment as Alternative A1 and in addition included reconfiguration of traffic operations in the Ross Island Bridgehead area similar to those included in Alternative A2-BH.

Alternative A2-BH-LT includes the same light rail alignment and roadway improvements as Alternative A2-BH, except that it would provide for a left turn for southbound SW Naito Parkway traffic to SW Woods Street providing access to the Ross Island Bridge eastbound.

Marquam Hill Connection Options

In addition to the light rail alternatives, four pedestrian connection options were analyzed between the Oregon Health & Science University (OHSU) Kohler Pavilion and the proposed SW Gibbs Street light rail station at SW Barbur Boulevard (Alternative A1: Barbur) and at SW Naito Parkway (Alternatives A2-BH: Naito with Bridgehead Reconfiguration and A2-LA: Naito with Limited Access). The purpose of this connection is to provide improved pedestrian access between the major medical and employment center at OHSU and the light rail. The four Marquam Hill connection options are:

- Connection 1A: Elevator/Bridge and Path
- Connection 1B: Elevator/Bridge and Recessed Path
- Connection 1C: Elevator/Bridge and Tunnel
- Connection 2: Full Tunnel

The Marquam Hill connection options are described in detail in Chapter 2 of the Draft EIS (see Figures 2.3-6 through 2.3-9).

3.3.2. Segment A System-wide Analysis

The alignment alternatives in Segment A include the consideration of significant changes to the roadway network. All of the Segment A alignment alternatives include revisions to lane configurations to accommodate the light rail transitway. Alternatives A1 and A2-BH include the conversion of ramps to signalized intersections. Alternatives A2-BH and A1-BH (not a Draft EIS alternative) include revisions to traffic flow patterns to and from the Ross Island Bridge. Alternative A2-LA reconstructs roadways without significantly changing traffic patterns.

All of the alignment alternatives would result in a reduction in total north-south motor vehicle volume of between 0.9 percent and 1.4 percent in Segment A. All of the Segment A alignment alternatives would result in a reduction in north-south motor vehicle volume accessing downtown Portland of between 1.7 percent and 4.8 percent. The project would result in improved transit access to/from downtown, converting motor vehicle trips to/from downtown into transit trips. Each alternative is described below detailing the total north-south screenline volume reduction totals as well as segment volume changes due to traffic circulation changes as a result of the build alternative changes.

Alternative A1: Barbur

This alignment alternative would result in limited changes to motor vehicle travel patterns in Segment A, except for select local routes as described below.

Total north-south motor vehicle volume at screenlines would be reduced as follows:

- South Portland (SW Gaines Street) screenline: reduced by 1 percent/1 percent (AM/PM)
- Downtown Portland (SW Hall Street) screenline: reduced by 3 percent/2 percent (AM/PM)

The segment of SW Barbur Boulevard between SW Naito Parkway and SW Broadway would see a volume reduction of 8 percent/1 percent (AM/PM), because one northbound lane would be converted to a transit-only lane. The segment of SW 4th Avenue from SW Broadway to SW Market Street, which is one-way northbound, would see a reduction of 24 percent/11 percent (AM/PM). One block of SW Corbett Avenue between SW Bancroft and SW Hamilton streets would see an increase of 70 percent/69 percent (AM/PM) as a result of relocating the southbound left-turn movement from SW Barbur Boulevard/SW Hamilton Street to SW Barbur Boulevard/SW Bancroft Street, with a corresponding reduction on SW Barbur Boulevard for that block. No other significant impacts were observed.

Alternative A2-BH: Naito with Bridgehead Reconfiguration

This alignment alternative would result in significant changes to motor vehicle travel patterns in Segment A.

Total north-south motor vehicle volume at screenlines would be reduced as follows:

- South Portland (SW Gaines Street) screenline: reduced by 1 percent/1 percent (AM/PM)
- Downtown Portland (SW Hall Street) screenline: reduced by 4 percent/5 percent (AM/PM)

The segment of SW Barbur Boulevard between SW Naito Parkway and SW Broadway sees an increase of 3 percent/9 percent (AM/PM). A significant amount of southbound traffic would shift from SW Naito Parkway to SW 1st Avenue and SW Kelly Avenue, resulting in a reduction of 41 percent/ 59 percent (AM/PM) on SW Naito Parkway, an increase of 83 percent/108 percent (AM/PM) on SW 1st Avenue and an increase of 17 percent/33 percent (AM/PM) on SW Kelly Avenue. One block of SW Corbett Avenue between SW Bancroft and SW Hamilton streets would see an increase of 75 percent/70 percent (AM/PM) as a result of relocating the southbound left turn from SW Barbur Boulevard and SW Hamilton Street to SW Barbur Boulevard and SW Bancroft Street, with a corresponding reduction on SW Barbur Boulevard for that block. SW Corbett Avenue between SW Gibbs and SW Bancroft streets would see a reduction of 33 percent/33 percent (AM/PM). SW Whitaker and SW Curry streets at SW Hood Avenue, which are currently used to access the eastbound Ross Island Bridge, would see a reduction of 55 percent/56 percent (AM/PM), and the adjacent segment of SW Hood Avenue would see a corresponding reduction. SW River Parkway/SW Moody Avenue between SW Harbor Drive and SW Sheridan Street would see an increase of 20 percent/12 percent (AM/PM). No other significant impacts were observed.

Alternative A2-LA: Naito with Limited Access

This alignment alternative would result in limited changes to motor vehicle travel patterns in Segment A.

Total north-south motor vehicle volume at screenlines would be reduced as follows:

- South Portland (SW Gaines Street) screenline: reduced by 1 percent/1 percent (AM/PM)
- Downtown Portland (SW Hall Street) screenline: reduced by 3 percent/2 percent (AM/PM)

The segment of SW Barbur Boulevard between SW Naito Parkway and SW Broadway would see an increase of 1 percent/3 percent (AM/PM). The segment of SW Naito Parkway between SW Market Street and SW Barbur Boulevard would see a reduction of 7 percent/8 percent (AM/PM) because of a slight reduction in capacity associated with a new traffic signal at SW Gibbs Street. The segment of SW 4th Avenue from SW Broadway to SW Market Street, which is one way northbound, would see a reduction of 11 percent/3 percent (AM/PM). No other significant impacts were observed.

Alternative A1-BH: Barbur with Bridgehead

This alignment alternative was not included in the Draft EIS, but it was analyzed in order to understand how the bridgehead reconfiguration would perform without light rail on SW Naito Parkway. The transportation effects of this scenario were considered, and are similar to the effects of Alternative A2-BH.

This alignment alternative results in significant changes to motor vehicle travel patterns in this segment.

Total north-south motor vehicle volume at screenlines would be reduced as follows:

- South Portland (SW Gaines Street) screenline: reduced by 1 percent/1 percent (AM/PM)
- Downtown Portland (SW Hall Street) screenline: reduced by 4 percent/5 percent (AM/PM).

As shown in Table 3.3-1 below, the segment of SW Barbur Boulevard between SW Naito Parkway and SW Broadway would see a reduction in volume of 3 percent (AM), because a northbound lane would be converted to a transit-only lane, which would result in an increase of 6 percent (PM). A significant amount of southbound traffic would shift from SW Naito Parkway to SW 1st Avenue and SW Kelly Avenue, resulting in a reduction of 39 percent/58 percent (AM/PM) on SW Naito Parkway, an increase of 82 percent/108 percent (AM/PM) on SW 1st Avenue and an increase of 18 percent/34 percent (AM/PM) on SW Kelly Avenue. One block of SW Corbett Avenue between SW Bancroft and SW Hamilton streets would see an increase of 70 percent/69 percent (AM/PM) as a result of relocating the southbound left-turn movement from SW Barbur Boulevard and SW Hamilton Street to SW Barbur Boulevard and SW Bancroft Street, with a corresponding reduction on SW Barbur Boulevard for that block. SW Corbett Avenue between SW Gibbs and SW Bancroft streets would see a reduction of 33 percent/33 percent (AM/PM). SW Whitaker and SW Curry streets at SW Hood Avenue, which are currently used to access the eastbound Ross Island Bridge, would see a reduction of 55 percent/56 percent (AM/PM), and the adjacent segment of SW Hood Avenue would see a corresponding reduction. SW River Parkway/SW Moody Avenue between SW Harbor Drive and SW Sheridan Street would see an increase of 19 percent/11 percent (AM/PM). No other significant impacts were observed.

Table 3.3-1. Peak Two-Hour Motor Vehicle Volumes in Segment A

			2035 No-Build		2035 Alternative A1: Barbur		*2035 Alternative A1-BH: Barbur with Bridgehead		2035 Alternative A2-BH: Naito Bridgehead		2035 Alternative A2-LA: Naito Limited Access	
			2-Hour, 2-Way Volume		Change from No-Build		Change from No-Build		Change from No-Build		Change from No-Build	
	From	To	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
A	**Harbor-River-Moody**											
1	Naito	Harbor/River	3,919	4,414	-1.5%	-0.7%	+5.3%	+5.7%	+6.0%	+5.9%	+0.6%	+1.2%
2	Harbor/River	Sheridan	1,517	1,852	-1.3%	-1.1%	+18.9%	+11.3%	+19.5%	+11.8%	-2.0%	-1.7%
3	Sheridan	Whitaker	2,528	2,996	-0.6%	-1.2%	-0.7%	+3.8%	-0.9%	+3.7%	-1.5%	-1.0%
B	**Naito**											
1	Market	Harrison	2,761	3,300	-1.4%	-2.0%	-16.0%	-20.0%	-18.6%	-21.7%	-6.1%	-5.6%
2	Harrison	Lincoln	2,997	3,616	-2.9%	-1.8%	-30.1%	-39.7%	-33.0%	-41.4%	-6.7%	-5.0%
3	Lincoln	Sheridan	2,997	3,616	-2.9%	-1.8%	-30.1%	-39.7%	-33.0%	-41.4%	-6.7%	-5.0%
4	Sheridan	Ross Is Bridge	3,914	5,461	-0.7%	-0.9%	-39.2%	-58.1%	-41.2%	-59.1%	-6.6%	-7.5%
5	Ross Is Bridge	Barbur	5,602	6,235	+0.1%	-0.9%	-0.7%	-6.5%	-2.9%	-7.3%	-6.7%	-6.0%
C	**1st**											
1	Market	Harrison	435	613	+0.5%	-2.6%	+14.0%	-3.3%	+14.7%	-3.3%	0.0%	-5.1%
2	Harrison	Lincoln	634	723	+6.2%	-5.3%	+79.3%	+87.4%	+81.7%	+86.4%	+2.2%	-8.6%
3	Lincoln	Sheridan	1,039	1,424	+1.0%	-5.1%	+47.0%	+42.3%	+48.7%	+42.3%	-5.1%	-5.1%
4	Sheridan	Arthur	711	984	+2.4%	-2.1%	+81.6%	+107.9%	+83.3%	+107.6%	-11.3%	-8.4%
5	Arthur	Woods	1,011	1,081	-0.3%	-0.5%	-29.0%	-23.3%	-30.1%	-23.1%	-7.0%	-23.7%
D	**Barbur-4th**											
1	Market	Harrison	1,010	655	-8.5%	-5.6%	-1.0%	-6.4%	+6.4%	-4.1%	-3.3%	-3.4%
2	Harrison	Lincoln	636	646	-23.9%	-10.8%	-22.5%	-14.4%	-11.0%	-5.4%	-11.2%	-2.5%
3	Lincoln	Broadway	1,186	937	-13.4%	-6.4%	-10.8%	-7.9%	-4.5%	-1.7%	-4.2%	-1.0%
4	Broadway	Naito	3,017	3,062	-7.7%	-1.4%	-3.3%	+5.6%	+3.0%	+9.3%	+1.0%	+2.8%
5	Naito	Bancroft	8,547	9,187	-3.1%	-0.6%	-1.7%	-1.6%	-0.9%	-1.3%	-4.0%	-2.8%
6	Bancroft	Hamilton	8,055	8,620	-11.7%	-13.1%	-13.4%	-14.8%	-13.2%	-14.7%	-3.6%	-2.6%
7	Hamilton	Rasmussen	8,039	8,391	-2.5%	-2.3%	-4.1%	-4.4%	-4.0%	-4.4%	-3.1%	-2.4%
E	**5th**											
2	Harrison	Jackson	298	1,135	-12.8%	0.0%	-27.9%	-1.0%	-26.2%	+1.4%	-8.4%	+1.2%
3	Jackson	Broadway	298	1,135	-12.8%	0.0%	-27.9%	-1.0%	-26.2%	+1.4%	-8.4%	+1.2%
F	**6th**											
2	Harrison	Jackson	921	1,167	-1.1%	-0.7%	-2.9%	-0.9%	-2.8%	-1.5%	-2.1%	-0.6%
3	Jackson	Broadway	423	667	-0.2%	-1.5%	-4.5%	-1.6%	-5.7%	-3.0%	-3.8%	-1.5%
G	**Broadway-Arthur-Kelly**											
1	Market	Harrison	945	1,550	-0.3%	-0.4%	-4.7%	+0.3%	-5.5%	+0.5%	-0.1%	0.0%
2	Harrison	Jackson	2,004	3,198	-2.0%	-1.4%	-1.2%	-1.6%	-0.7%	-1.5%	-1.0%	-1.3%
3	Jackson	I-405	1,396	1,920	-1.9%	-0.8%	-0.9%	-1.2%	-0.2%	-1.1%	-0.8%	-0.7%
4	I-405	4th	7,994	8,670	-1.2%	-0.1%	+1.7%	+0.7%	+2.3%	+1.1%	+0.2%	+0.1%
5	4th	1st	4,530	4,980	+2.2%	+1.5%	+8.3%	+1.2%	+7.2%	+0.7%	-0.1%	+0.1%
6	1st	Naito	5,117	5,641	+1.4%	+0.7%	+11.2%	+7.1%	+10.5%	+6.7%	-0.8%	-4.3%
7	Naito	Corbett	4,569	4,249	+0.1%	-0.6%	+18.3%	+33.7%	+17.4%	+33.2%	+0.5%	-0.5%
H	**Macadam**											
1	Gibbs	Gaines	4,118	4,031	+0.2%	+2.1%	+4.7%	+7.3%	+4.3%	+6.6%	-0.6%	+0.4%
2	Gaines	Bancroft	3,154	3,608	-0.3%	+0.6%	+1.9%	+0.8%	+1.4%	+0.4%	-0.7%	+0.1%
J	**Hood**											
1	Grover	Whitaker	3,300	3,422	-0.9%	+0.0%	-29.8%	-34.6%	-29.7%	-34.5%	-0.3%	+0.5%
2	Whitaker	Curry	2,435	2,346	-0.6%	+0.3%	-8.7%	-10.8%	-8.9%	-10.7%	-0.4%	+0.2%
3	Curry	Gaines	5,846	5,148	-1.0%	-0.0%	-2.2%	-1.7%	-2.4%	-1.8%	-0.2%	-0.7%
4	Gaines	Bancroft	2,764	3,649	-1.5%	+0.0%	-0.3%	-2.0%	-0.4%	-2.2%	+0.6%	-0.0%
K	**Whitaker-Curry**											
1	Gibbs	Macadam	1,303	1,460	-4.0%	-0.6%	-54.6%	-55.8%	-54.6%	-56.3%	+0.2%	-0.8%
L	**Corbett**											
1	Gibbs	Bancroft	750	928	+1.9%	-26.3%	-32.9%	-32.9%	-32.7%	-33.0%	+5.7%	-2.2%
2	Bancroft	Hamilton	962	1,164	+70.1%	+69.2%	+69.8%	+69.0%	+74.6%	+70.3%	-3.6%	-6.2%
M	**Terwilliger**											
1	Sam Jackson	Campus Dr.	2,119	2,404	-0.6%	-0.2%	-0.9%	0.0%	-0.2%	+0.2%	-0.2%	+0.1%
2	Campus Dr.	Hamilton	2,058	2,113	-1.2%	-1.4%	-0.8%	-1.2%	-0.8%	-1.6%	-0.7%	-1.5%
N	**Ross Island Bridge**											
1	Willamette R	Kelly	11,500	12,005	-0.2%	-0.2%	+4.4%	+2.9%	+4.4%	+2.8%	-0.3%	-0.2%
2	Kelly	Naito	5,600	6,729	-0.3%	-0.4%	-14.8%	-31.4%	-14.9%	-31.5%	-1.0%	-0.8%
P	**Water-Baker-Sheridan**											
1	Kelly	Moody	1,141	1,291	-0.3%	-1.2%	+6.9%	+7.0%	+6.0%	+7.2%	-0.9%	-2.6%

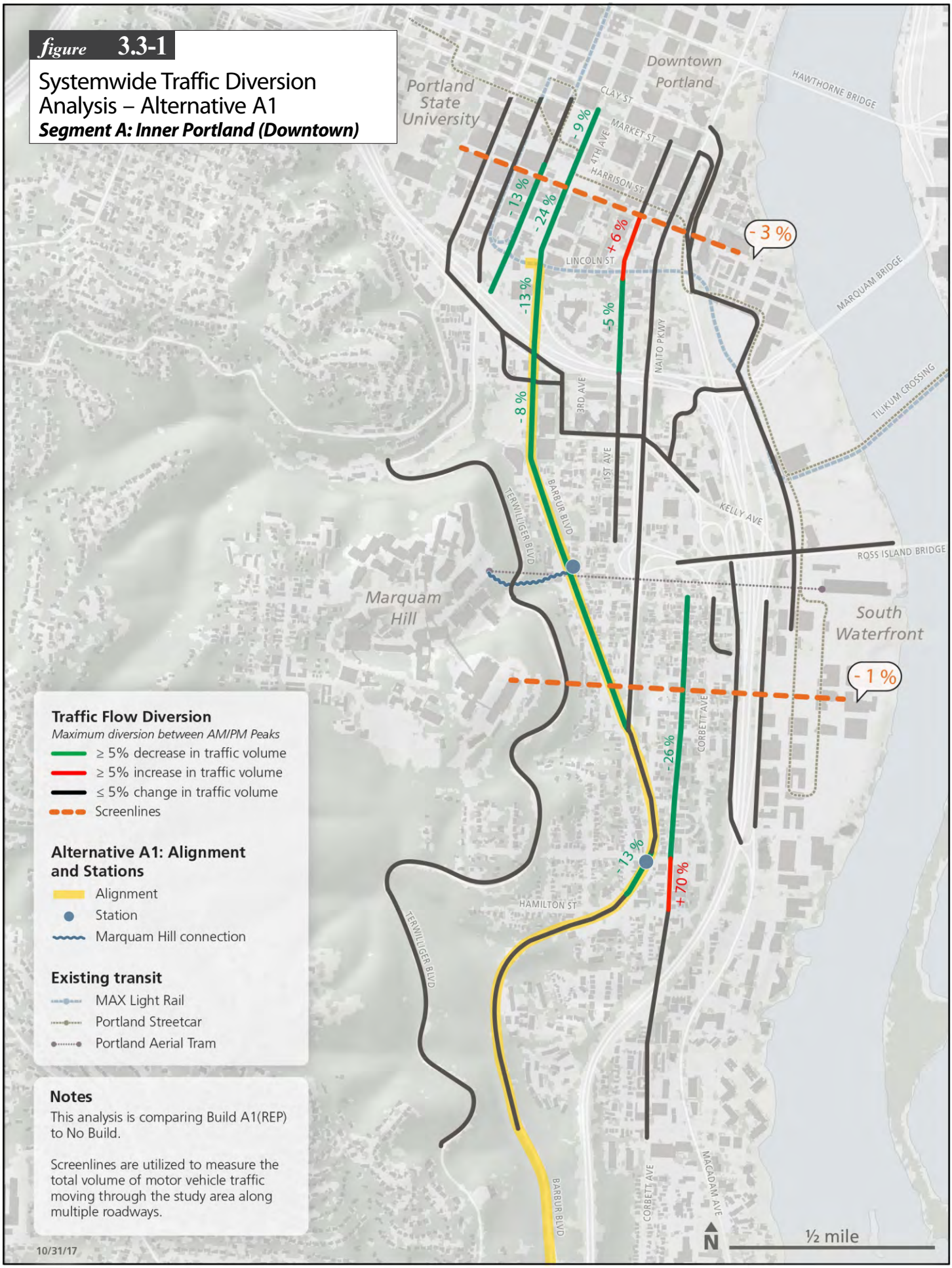
From	To	2035 No-Build 2-Hour, 2-Way Volume AM	2035 No-Build 2-Hour, 2-Way Volume PM	2035 Alternative A1: Barbur Change from No-Build AM	2035 Alternative A1: Barbur Change from No-Build PM	*2035 Alternative A1-BH: Barbur with Bridgehead Change from No-Build AM	*2035 Alternative A1-BH: Barbur with Bridgehead Change from No-Build PM	2035 Alternative A2-BH: Naito Bridgehead Change from No-Build AM	2035 Alternative A2-BH: Naito Bridgehead Change from No-Build PM	2035 Alternative A2-LA: Naito Limited Access Change from No-Build AM	2035 Alternative A2-LA: Naito Limited Access Change from No-Build PM
Q I-5											
1	at Gaines	20,247	21,828	-0.7%	-0.5%	-0.6%	-1.1%	-0.6%	-1.1%	-0.5%	-0.4%
Screenlines											
Harbor, Naito, 1st, 4th, 5th, 6th, Broadway, measured at Hall		11,409	14,899	-3.0%	-1.7%	-4.1%	-4.8%	-3.7%	-4.7%	-2.6%	-1.6%
Terwilliger, Barbur, Naito, Corbett, Hood, I-5, Macadam, measured at Gaines		41,638	43,345	-1.0%	-0.9%	-1.1%	-1.4%	-1.0%	-1.3%	-1.1%	-1.0%

* Not a Draft EIS alternative.

figure **3.3-1**

Systemwide Traffic Diversion Analysis – Alternative A1

Segment A: Inner Portland (Downtown)



Traffic Flow Diversion

Maximum diversion between AM/PM Peaks

- ≥ 5% decrease in traffic volume
- ≥ 5% increase in traffic volume
- ≤ 5% change in traffic volume
- Screenlines

Alternative A1: Alignment and Stations

- Alignment
- Station
- Marquam Hill connection

Existing transit

- MAX Light Rail
- Portland Streetcar
- Portland Aerial Tram

Notes

This analysis is comparing Build A1(REP) to No Build.

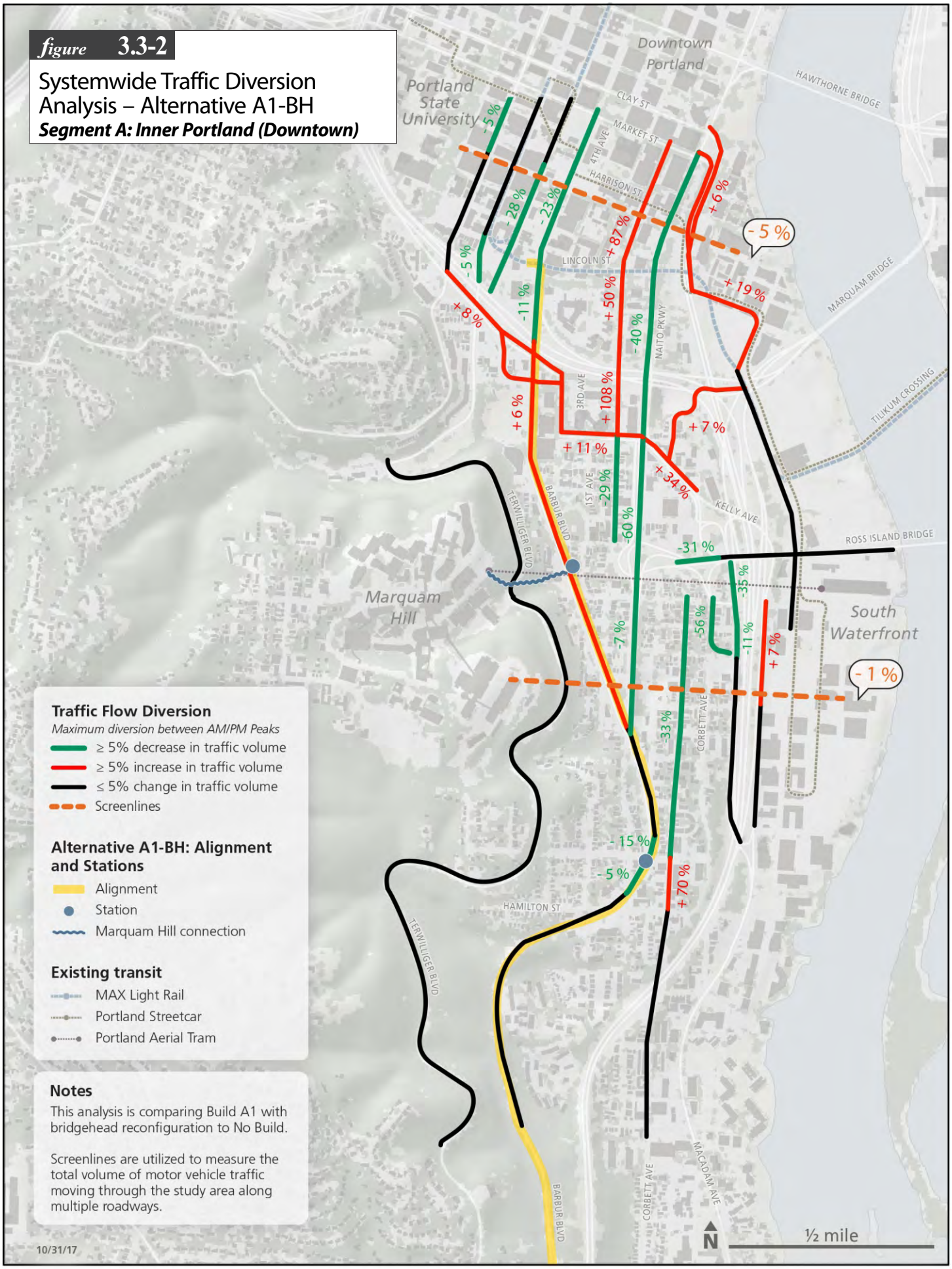
Screenlines are utilized to measure the total volume of motor vehicle traffic moving through the study area along multiple roadways.

10/31/17

figure **3.3-2**

Systemwide Traffic Diversion Analysis – Alternative A1-BH

Segment A: Inner Portland (Downtown)



Traffic Flow Diversion

Maximum diversion between AM/PM Peaks

- ≥ 5% decrease in traffic volume
- ≥ 5% increase in traffic volume
- ≤ 5% change in traffic volume
- Screenlines

Alternative A1-BH: Alignment and Stations

- Alignment
- Station
- Marquam Hill connection

Existing transit

- MAX Light Rail
- Portland Streetcar
- Portland Aerial Tram

Notes

This analysis is comparing Build A1 with bridgehead reconfiguration to No Build.

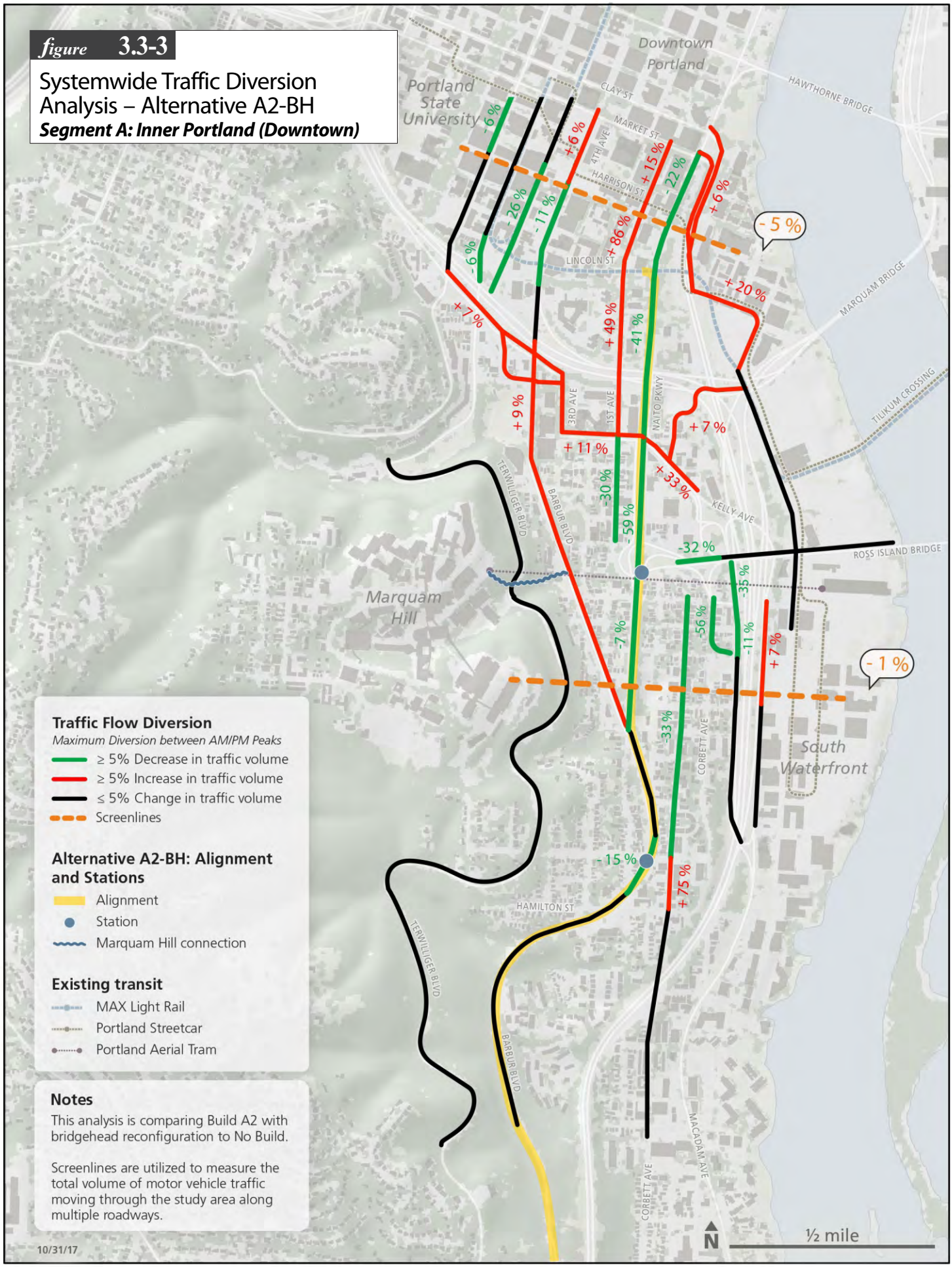
Screenlines are utilized to measure the total volume of motor vehicle traffic moving through the study area along multiple roadways.

10/31/17

figure **3.3-3**

Systemwide Traffic Diversion Analysis – Alternative A2-BH

Segment A: Inner Portland (Downtown)



Traffic Flow Diversion

Maximum Diversion between AM/PM Peaks

- ≥ 5% Decrease in traffic volume
- ≥ 5% Increase in traffic volume
- ≤ 5% Change in traffic volume
- Screenlines

Alternative A2-BH: Alignment and Stations

- Alignment
- Station
- Marquam Hill connection

Existing transit

- MAX Light Rail
- Portland Streetcar
- Portland Aerial Tram

Notes

This analysis is comparing Build A2 with bridgehead reconfiguration to No Build.

Screenlines are utilized to measure the total volume of motor vehicle traffic moving through the study area along multiple roadways.

10/31/17

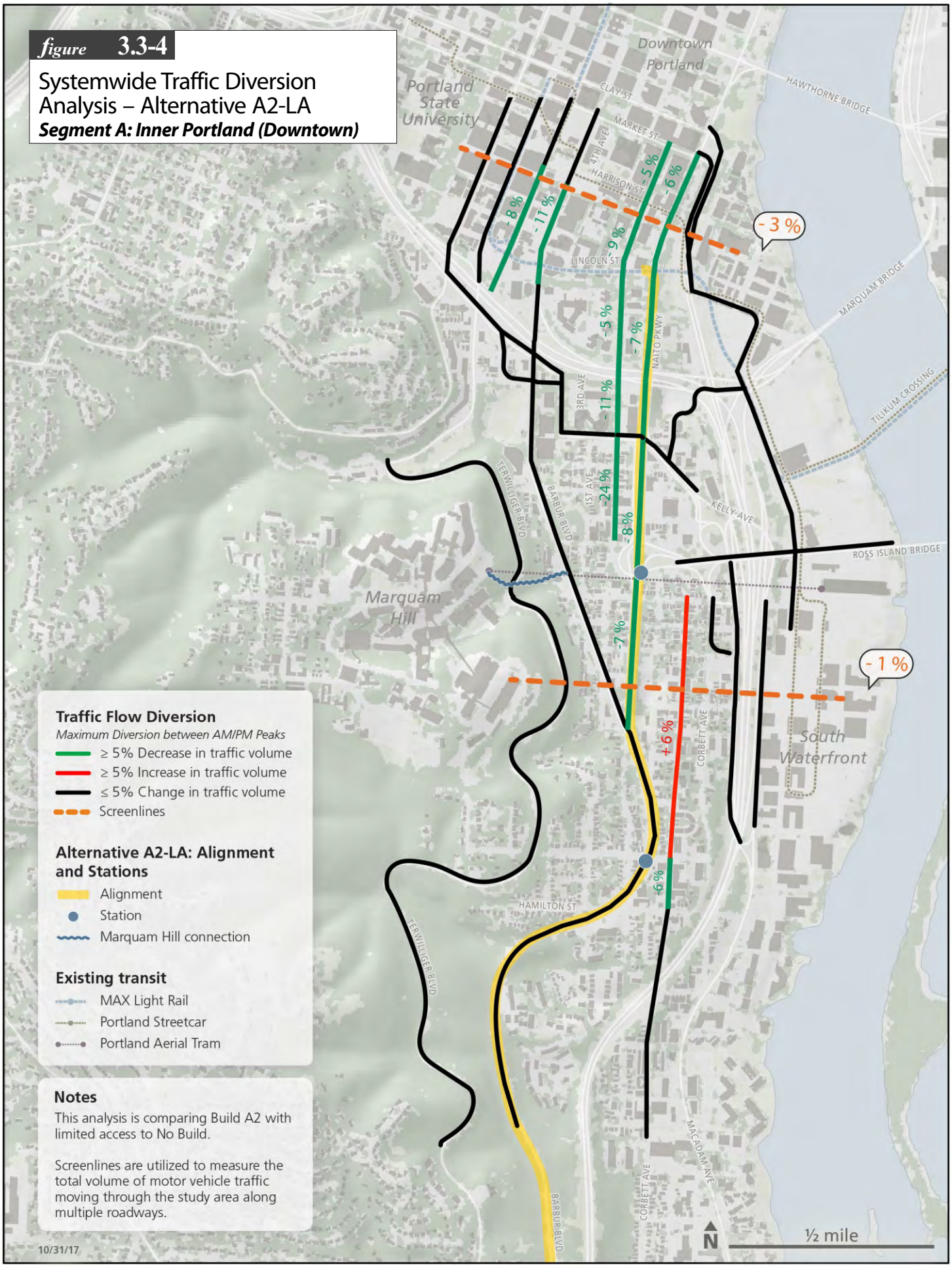


figure 3.3-4
Systemwide Traffic Diversion Analysis – Alternative A2-LA
Segment A: Inner Portland (Downtown)
Downtown Portland
Portland State University
Marquam Hill
South Waterfront
CLAY ST
MARKET ST
HARRISON ST
LINCOLN ST
HAMILTON ST
4TH AVE
3RD AVE
1ST AVE
NAITO PKWY
BARBUR BLVD
TERWILLIGER BLVD
CORBETT AVE
KELLY AVE
MACADAM AVE
HAWTHORNE BRIDGE
MARQUAM BRIDGE
TILIKUM CROSSING
ROSS ISLAND BRIDGE
- 8 %
- 11 %
- 9 %
- 5 %
- 6 %
- 3 %
- 5 %
- 7 %
- 11 %
- 24 %
- 8 %
- 7 %
+ 6 %
- 6 %
- 1 %
Traffic Flow Diversion
Maximum Diversion between AM/PM Peaks
≥ 5% Decrease in traffic volume
≥ 5% Increase in traffic volume
≤ 5% Change in traffic volume
Screenlines
Alternative A2-LA: Alignment and Stations
Alignment
Station
Marquam Hill connection
Existing transit
MAX Light Rail
Portland Streetcar
Portland Aerial Tram
Notes
This analysis is comparing Build A2 with limited access to No Build.
Screenlines are utilized to measure the total volume of motor vehicle traffic moving through the study area along multiple roadways.
10/31/17
N
½ mile

Willamette River Bridges

The nine bridges over the Willamette River near central Portland serve as a useful screenline to identify changes in regional travel patterns. While none of the alignment options directly modify any bridges, the configurations with modifications to the Ross Island bridgehead (Alternative A2-BH and A1-BH Barbur plus bridgehead alternative) do affect connections to the Ross Island Bridge.

All of the light rail alignments alternatives result in a difference of total motor vehicle river crossings of 0.1 percent or less, a negligible difference.

As shown in Table 3.3-2 below, the light rail alignment alternatives without modifications to the Ross Island bridgehead (Alternatives A1 and A2-LA) result in negligible changes to travel patterns among the bridges. The alignment alternatives with modifications to the Ross Island bridgehead (Alternatives A2-BH and A1-BH) would increase trips on the Ross Island Bridge by 2.9 percent to 4.4 percent, with a corresponding reduction in trips over the Hawthorne, Morrison, Burnside, and Steel bridges.

Table 3.3-2. Peak Two-Hour Motor Vehicle Volumes on Willamette River Bridges

		2035 No-Build		2035 Alternative A1: Barbur		*2035 Segment A Alternative: Barbur plus Bridgehead		2035 Alternative A2-BH: Naito Bridgehead		2035 Alternative A2-LA: Naito Limited Access	
		2-Hour, 2-Way Volume		Change from No-Build		Change from No-Build		Change from No-Build		Change from No-Build	
	Bridge	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
1	Fremont	22,204	22,277	+0.1%	-0.0%	-0.1%	-0.6%	-0.0%	-0.1%	+0.1%	+0.0%
2	Broadway	5,747	6,082	-0.1%	+0.0%	-0.2%	-0.1%	-0.1%	0.0%	+0.0%	-0.1%
3	Steel	2,263	3,015	-0.7%	-0.3%	-1.1%	-1.5%	-1.0%	-1.3%	-0.2%	-0.3%
4	Burnside	6,297	6,717	-0.0%	-0.1%	-0.9%	-0.5%	-0.8%	-0.4%	-0.1%	-0.1%
5	Morrison	6,940	7,434	+0.4%	-0.1%	-0.4%	-0.9%	-0.3%	-0.9%	+0.4%	-0.2%
6	Hawthorne	5,310	6,130	-0.5%	-0.1%	-2.7%	-1.0%	-2.8%	-1.0%	-0.7%	-0.1%
7	Marquam	23,534	24,446	-0.2%	-0.1%	-0.5%	-0.2%	-0.5%	-0.1%	-0.1%	-0.1%
8	Ross Island	11,500	12,005	-0.2%	-0.2%	+4.4%	+2.9%	+4.4%	+2.8%	-0.3%	-0.2%
9	Sellwood	6,912	7,087	0.0%	+0.1%	-0.4%	-0.1%	-0.5%	-0.2%	-0.2%	+0.0%
Screenline: Total River Crossings		90,707	95,193	-0.1%	-0.1%	+0.1%	-0.1%	+0.1%	+0.1%	-0.1%	-0.1%

* Not a Draft EIS alternative.

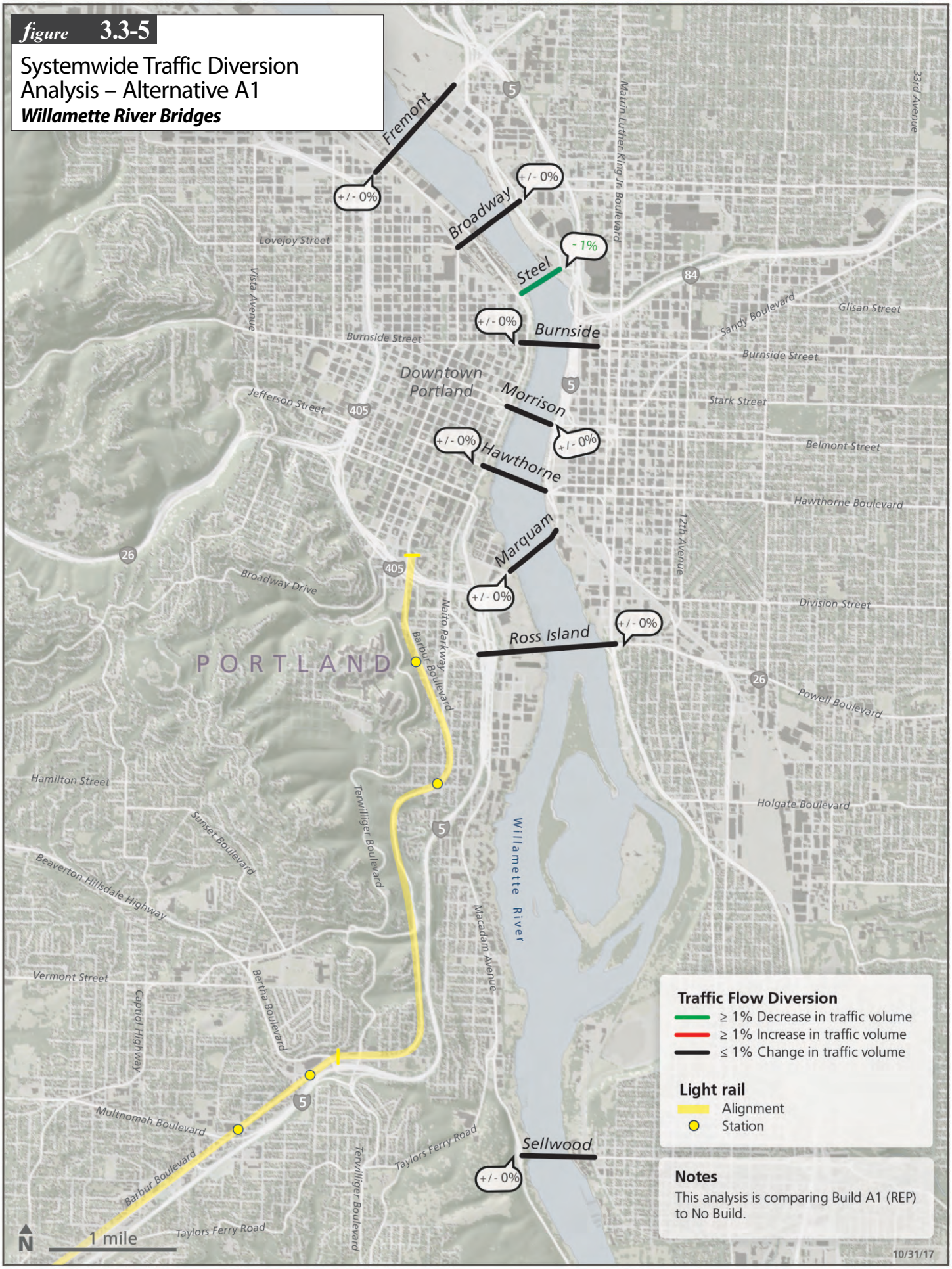


figure 3.3-5
Systemwide Traffic Diversion Analysis – Alternative A1
Willamette River Bridges
Fremont
+/- 0%
Broadway
+/- 0%
Steel
- 1%
Burnside
+/- 0%
Morrison
+/- 0%
Hawthorne
+/- 0%
Marquam
+/- 0%
Ross Island
+/- 0%
Sellwood
+/- 0%
Downtown Portland
PORTLAND
Willamette River
Lovejoy Street
Vista Avenue
Burnside Street
Jefferson Street
Broadway Drive
Naito Parkway
Barbur Boulevard
Terwilliger Boulevard
Hamilton Street
Sunset Boulevard
Beaverton Hillsdale Highway
Vermont Street
Capitol Highway
Bertha Boulevard
Multnomah Boulevard
Taylors Ferry Road
Macadam Avenue
Martin Luther King Jr Boulevard
33rd Avenue
Sandy Boulevard
Glisan Street
Stark Street
Belmont Street
Hawthorne Boulevard
12th Avenue
Division Street
Powell Boulevard
Holgate Boulevard
5
84
405
26
Traffic Flow Diversion
≥ 1% Decrease in traffic volume
≥ 1% Increase in traffic volume
≤ 1% Change in traffic volume
Light rail
Alignment
Station
Notes
This analysis is comparing Build A1 (REP) to No Build.
N
1 mile
10/31/17

figure **3.3-6**

Systemwide Traffic Diversion Analysis – Alternative A1-BH

Willamette River Bridges

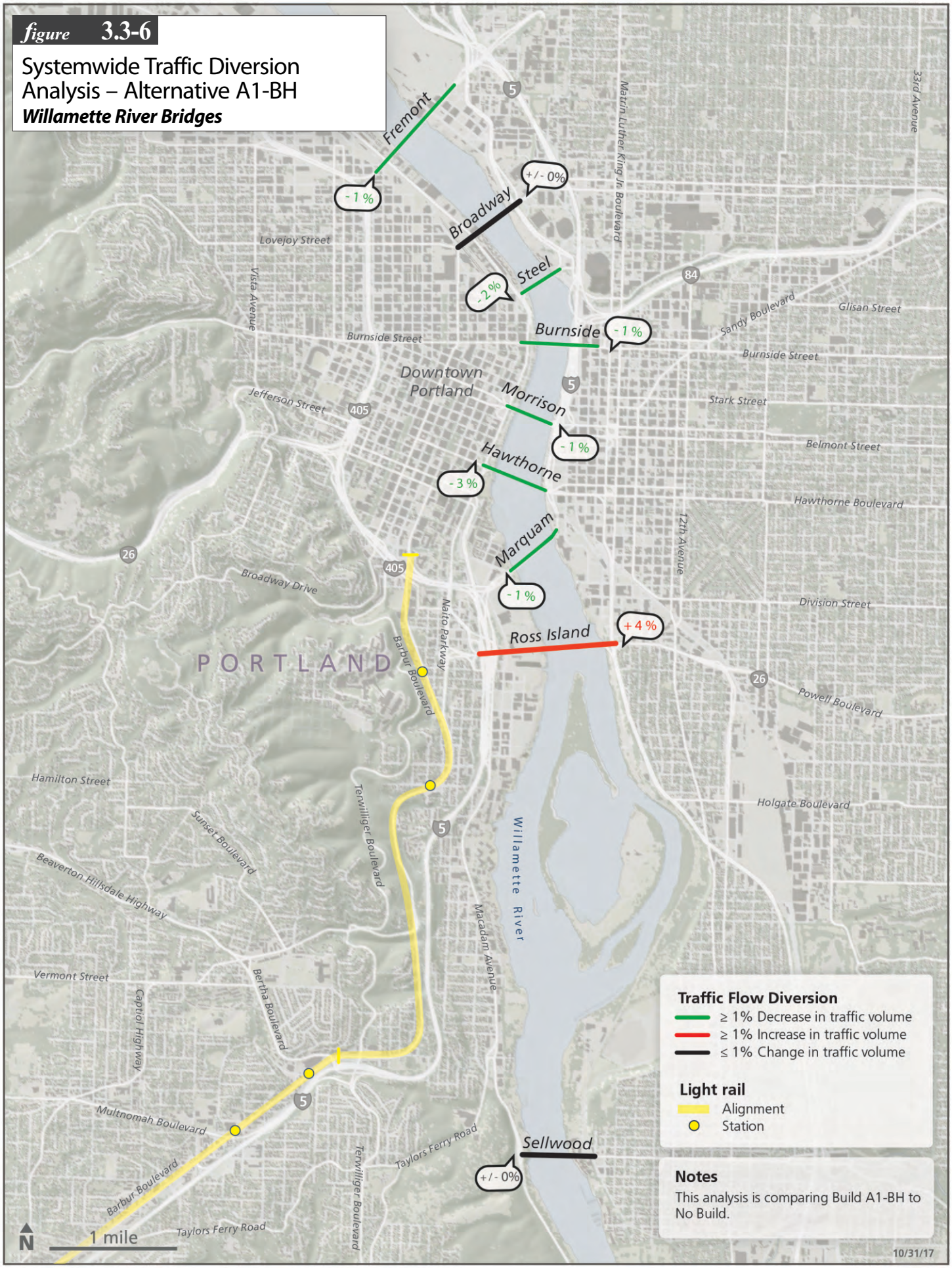
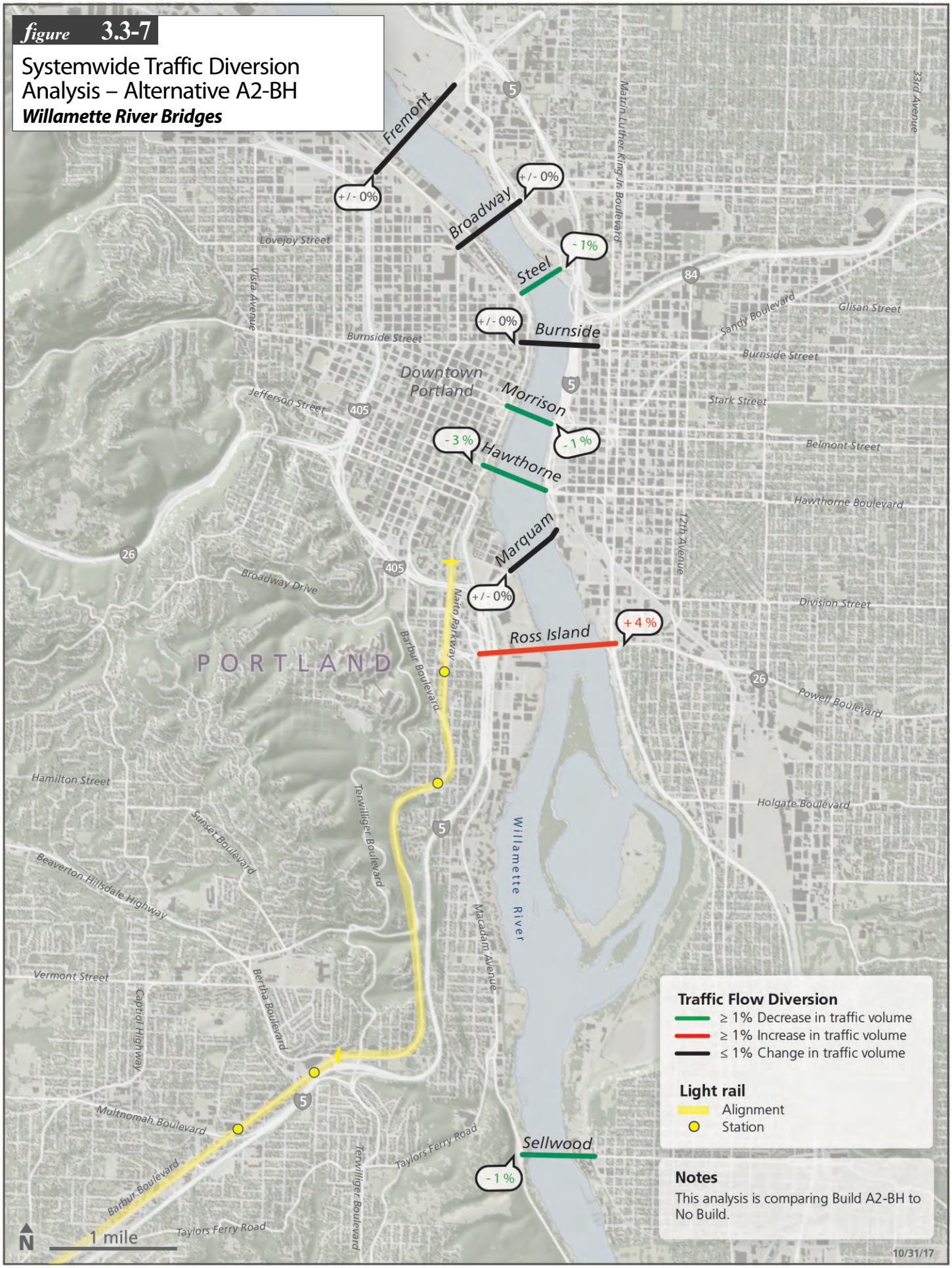


figure **3.3-7**

Systemwide Traffic Diversion Analysis – Alternative A2-BH

Willamette River Bridges



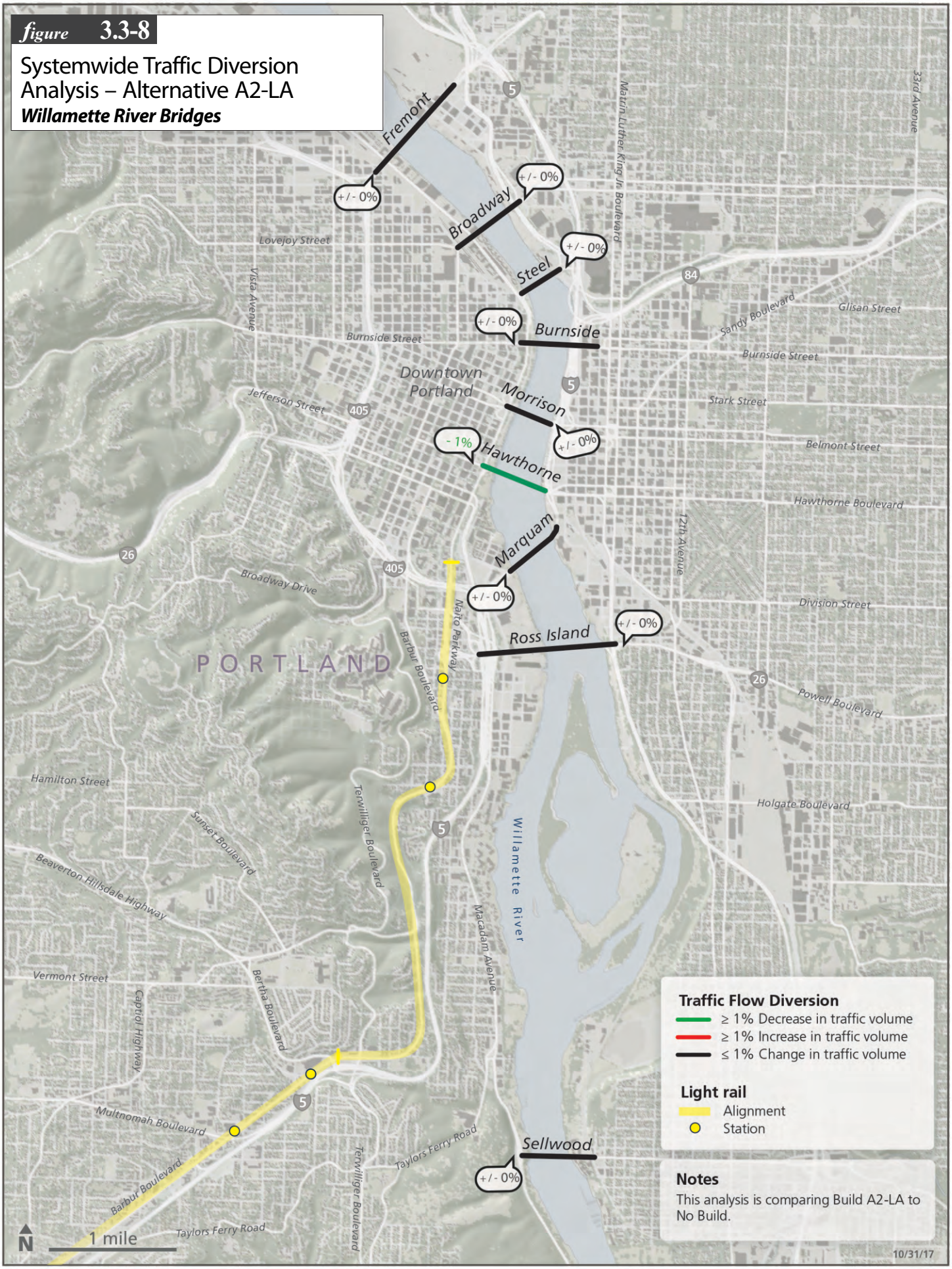


figure 3.3-8
Systemwide Traffic Diversion Analysis – Alternative A2-LA
Willamette River Bridges
Fremont
+/- 0%
Broadway
+/- 0%
Steel
+/- 0%
Burnside
+/- 0%
Morrison
+/- 0%
Hawthorne
- 1%
Marquam
+/- 0%
Ross Island
+/- 0%
Sellwood
+/- 0%
Downtown Portland
PORTLAND
Willamette River
Lovejoy Street
Vista Avenue
Burnside Street
Jefferson Street
Broadway Drive
Naito Parkway
Barbur Boulevard
Terwilliger Boulevard
Macadam Avenue
Hamilton Street
Sunset Boulevard
Beaverton Hillsdale Highway
Vermont Street
Bertha Boulevard
Capitol Highway
Multnomah Boulevard
Taylors Ferry Road
Martin Luther King Jr Boulevard
12th Avenue
33rd Avenue
Sandy Boulevard
Glisan Street
Stark Street
Belmont Street
Hawthorne Boulevard
Division Street
Powell Boulevard
Holgate Boulevard
5
84
405
26
Traffic Flow Diversion
≥ 1% Decrease in traffic volume
≥ 1% Increase in traffic volume
≤ 1% Change in traffic volume
Light rail
Alignment
Station
Notes
This analysis is comparing Build A2-LA to No Build.
N
1 mile
10/31/17

3.3.3. Segment A Active Transportation

With the No-Build Alternative, pedestrian and bicycle activity would remain similar to existing activity, but with some increased activity because of the forecasted residential and employment growth in the corridor and planned improvements to bicycle and pedestrian facilities. Previous planning in the corridor identified a series of station access improvements that would improve and facilitate bicycle and pedestrian access to the proposed light rail stations. These improvements are not included as integral project elements, but the potential impacts of these planned improvements are referenced in the discussion of active transportation impacts.

The impacts of the project on walking and bicycling were evaluated using several available methodologies. The analysis considered the impact of the project on the:

- presence of walking and bicycling facilities, focusing on sidewalks and bike lanes
- quality of the walking and bicycling environment, based on the HCM's multimodal level of service (MMLOS) methodologies
- spacing of marked pedestrian crossings on arterial roadways in relation to the City of Portland's draft standards.

Presence of Walking and Bicycling Facilities

In Segment A, small gaps in the bike lanes on SW Barbur Boulevard and SW Naito Parkway require people biking to merge with auto traffic in areas with speed limits of up to 45 miles per hour. The project would include sidewalks and full bike lanes on both roadways, and would improve the convenience and safety of walking and bicycling both to and along the light rail line.

The alignment alternatives would add or reconstruct bicycle and pedestrian facilities on the streets with light rail, such as SW Naito Parkway and SW Barbur Boulevard. The station access improvements would supplement the walking and bicycling improvements included in the alignment alternatives with sidewalks and bikeways on streets that connect to the light rail stations.

Multimodal Level of Service

The HCM documents methodologies for the evaluation of the comfort of the walking and bicycling environment along roadways based on their design and traffic characteristics. The methodologies allow the assignment of a letter grade between A and F to the quality of the environment along each roadway segment for each mode of travel. MMLOS methodologies were used to calculate segment-level pedestrian level of service (PLOS) and bicycle level of service (BLOS) along SW Naito Parkway and SW Barbur Boulevard with and without the project. The roadway segments were selected based on their challenging walking and bicycling environments and large degree of potential change with the project.

Pedestrian Level of Service

For each roadway, segment-level PLOS was calculated for each side of the street. Segment-level LOS is a planning-level approach that captures the influence of both the roadway cross-section, including pedestrian environment and motor vehicle traffic characteristics, but does not consider intersection

quality or crossing frequency. The worse PLOS of the two sides of the roadway is reported for each segment in the Tables 3.3-3 and 3.3-4 below.

Table 3.3-3. Segment-level Pedestrian Level of Service along SW Barbur Boulevard and SW Naito Parkway in South Portland

To/From (Segment A)	2035 No-Build		2035 A1: Barbur		2035 A2-BH: Naito Bridgehead		2035 A2-LA: Naito Limited Access	
	Barbur	Naito	Barbur	Naito	Barbur	Naito	Barbur	Naito
SW Sheridan St. – Ross Is. Bridge	D	F	C	F	D	D	D	D
Ross Is. Bridge – SW Barbur Blvd./SW Naito Pkwy.		F		F		D		D

Table 3.3-4. Segment-level Pedestrian Level of Service along SW Barbur Boulevard South of SW Naito Parkway

To/From (Segment A)	2035 No-Build	2035 Light Rail
SW Lowell St. – SW Capitol Hwy.	F	E
SW Capitol Hwy. – SW 3rd Ave.	E	C

Bicycle Level of Service

For each segment, segment-level BLOS was calculated for each side of the street. Segment-level BLOS is a planning-level approach that captures the influence of the roadway cross-section, including the bicycling environment and the motor vehicle traffic characteristics, but does not consider intersection quality or crossing frequency. The worse BLOS of the two sides is reported for each segment in Tables 3.3-5 and 3.3-6 below.

Table 3.3-5. Segment-level Bicycle Level of Service along SW Barbur Boulevard and SW Naito Parkway in South Portland

To/From (Segment A)	2035 No-Build		2035 A1: Barbur		2035 A2-BH: Naito Bridgehead		2035 A2-LA: Naito Limited Access	
	Barbur	Naito	Barbur	Naito	Barbur	Naito	Barbur	Naito
SW Sheridan St. – Ross Is. Bridge	B	E	A	E	B	A	B	A
Ross Is. Bridge – SW Barbur Blvd./SW Naito Pkwy.		D		D		A		A

Table 3.3-6: Segment-level Bicycle Level of Service along Barbur Boulevard south of Naito Parkway

To/From (Segment A)	2035 No-Build	2035 Light Rail
SW Lowell St. – SW Capitol Hwy.	B	B
SW Capitol Hwy. – SW 3rd Ave.	C	A

Pedestrian Crossing Spacing

The ability to safely cross the street at regular intervals is an essential part of creating an attractive walking and bicycling environment, but it is not measured in the evaluation of presence of facilities or the MMLOS analysis. To evaluate the effect of the project on this aspect of the transportation network, a

review of pedestrian crossing spacing in the corridor was performed for the project in the areas where the project significantly alters the crossing patterns in Segments A and B.

The City of Portland has proposed a spacing standard for marked crossings that would apply to SW Naito Parkway and SW Barbur Boulevard. The proposed standard is 530 feet maximum spacing within pedestrian districts and designated main streets, and 795 feet maximum spacing along city walkways and at every transit stop. SW Naito Parkway and SW Barbur Boulevard would be designated as city walkways (795-foot standard) except in the following areas, in which the main street designation (530-foot standard) would apply:

- SW Naito Parkway: I-405 to SW Grover Street
- SW Barbur Boulevard: I-405 to SW Hooker Street, SW Bancroft Street to SW Hamilton Street, SW 5th Avenue to SW13th Avenue, SW Evans Street to SW Spring Garden Street, SW 24th Avenue to SW Primrose Street, SW Plum Street to SW Huber Street

SW Naito Parkway and SW Barbur Boulevard were evaluated for compliance with the spacing requirements between SW Sheridan Street and SW Brier Place, excluding "The Woods," area between the Rasmussen Village apartments and SW Brier Place where there are no pedestrian attractors or generators. Where the spacing exceeded the maximum, the degree of excess was documented and the length of street within 150 percent of the standard was documented in order to quantify the degree to which crossing spacing exceeds the proposed standard. The percentages of the length of roadways meeting the standard, failing to meet the standard but close, and failing to meet the standard and not close are summarized in the following Table 3.3-7 and shown in Figure 3.3-9.

Table 3.3-7: Percent of SW Naito Parkway/SW Barbur Boulevard Meeting Proposed City Standard for Crossings, from Lincoln Street to Rasmussen Village Crosswalk

Location	Meets standard?	No-Build	A1	A2-BH	A2-LA
Overall: Naito/Barbur within Segment A	Yes, meets standard	1%	14%	16%	5%
	No; close to standard (≤150%)	13%	7%	25%	16%
	No; not close to standard (>150%)	85%	79%	59%	79%
Naito Parkway within Segment A	Yes, meets standard	0%	0%	29%	0%
	No; close to standard (≤150%)	0%	0%	21%	0%
	No; not close to standard (>150%)	100%	100%	50%	100%
Barbur Boulevard within Segment A	Yes, meets standard	2%	24%	8%	8%
	No; close to standard (≤150%)	23%	21%	24%	25%
	No; not close to standard (>150%)	74%	54%	68%	67%
Naito Parkway Civic Main Street within Segment A	Yes, meets standard	0%	0%	33%	0%
	No; close to standard (≤150%)	0%	0%	0%	0%
	No; not close to standard (>150%)	100%	100%	67%	100%
Barbur Boulevard Civic Main Street within Segment A	Yes, meets standard	10%	27%	27%	27%
	No; close to standard (≤150%)	39%	32%	32%	32%
	No; not close to standard (>150%)	51%	42%	42%	42%

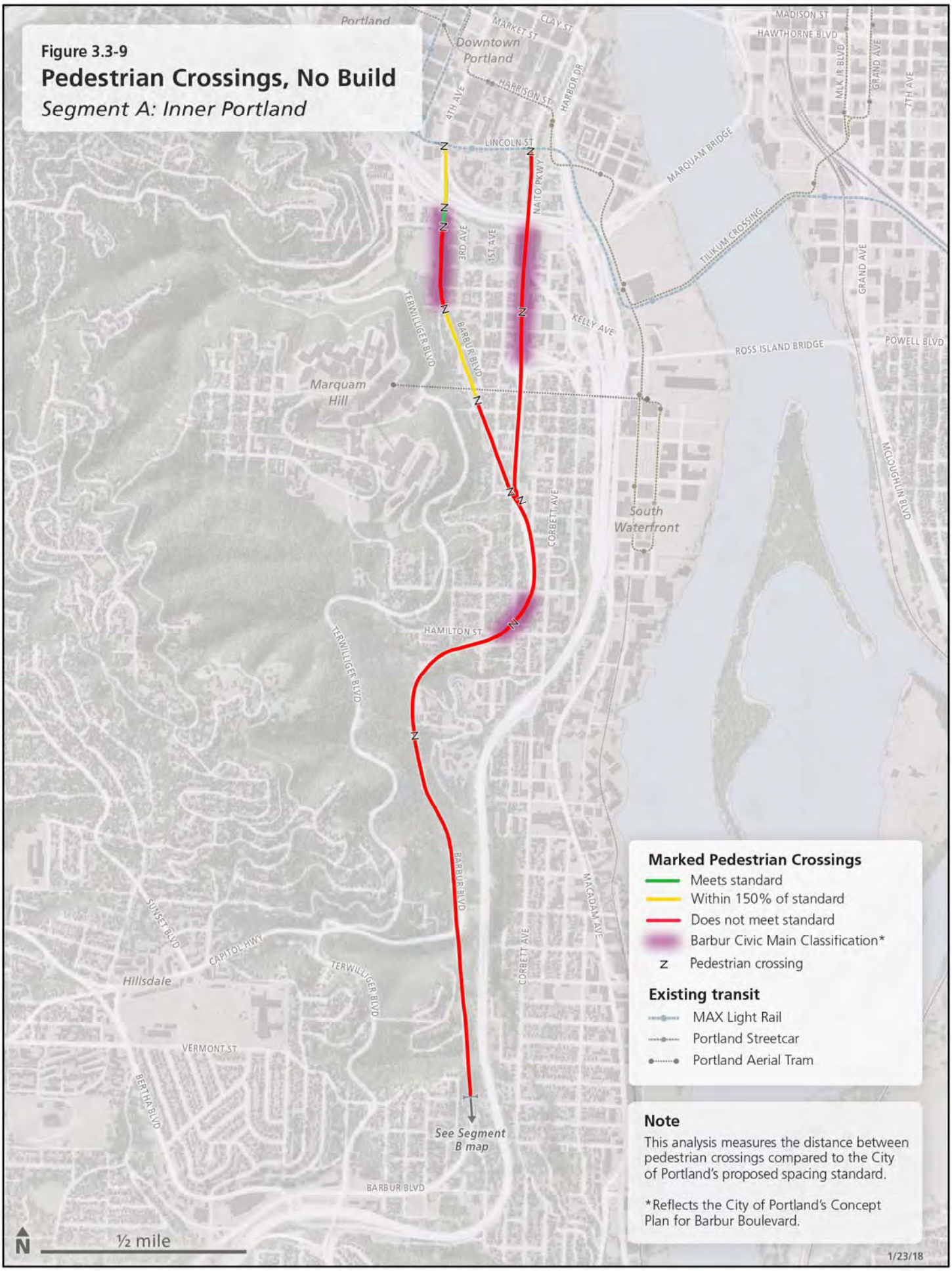


Figure 3.3-9
Pedestrian Crossings, No Build
Segment A: Inner Portland
Portland
Downtown Portland
MARKET ST
CLAY ST
HARRISON ST
4TH AVE
HARBOR DR
LINCOLN ST
NAITO PKWY
MADISON ST
HAWTHORNE BLVD
MLK JR BLVD
GRAND AVE
7TH AVE
MARQUAM BRIDGE
TILIKUM CROSSING
3RD AVE
1ST AVE
TERWILLIGER BLVD
BARBUR BLVD
KELLY AVE
ROSS ISLAND BRIDGE
POWELL BLVD
Marquam Hill
CORBETT AVE
South Waterfront
MCLOUGHLIN BLVD
HAMILTON ST
SUNSET BLVD
CAPITOL HWY
Hillsdale
VERMONT ST
BERTHA BLVD
MACADAM AVE
See Segment B map
BARBUR BLVD
Marked Pedestrian Crossings
Meets standard
Within 150% of standard
Does not meet standard
Barbur Civic Main Classification*
Pedestrian crossing
Existing transit
MAX Light Rail
Portland Streetcar
Portland Aerial Tram
Note
This analysis measures the distance between pedestrian crossings compared to the City of Portland's proposed spacing standard.
*Reflects the City of Portland's Concept Plan for Barbur Boulevard.
N
½ mile
1/23/18

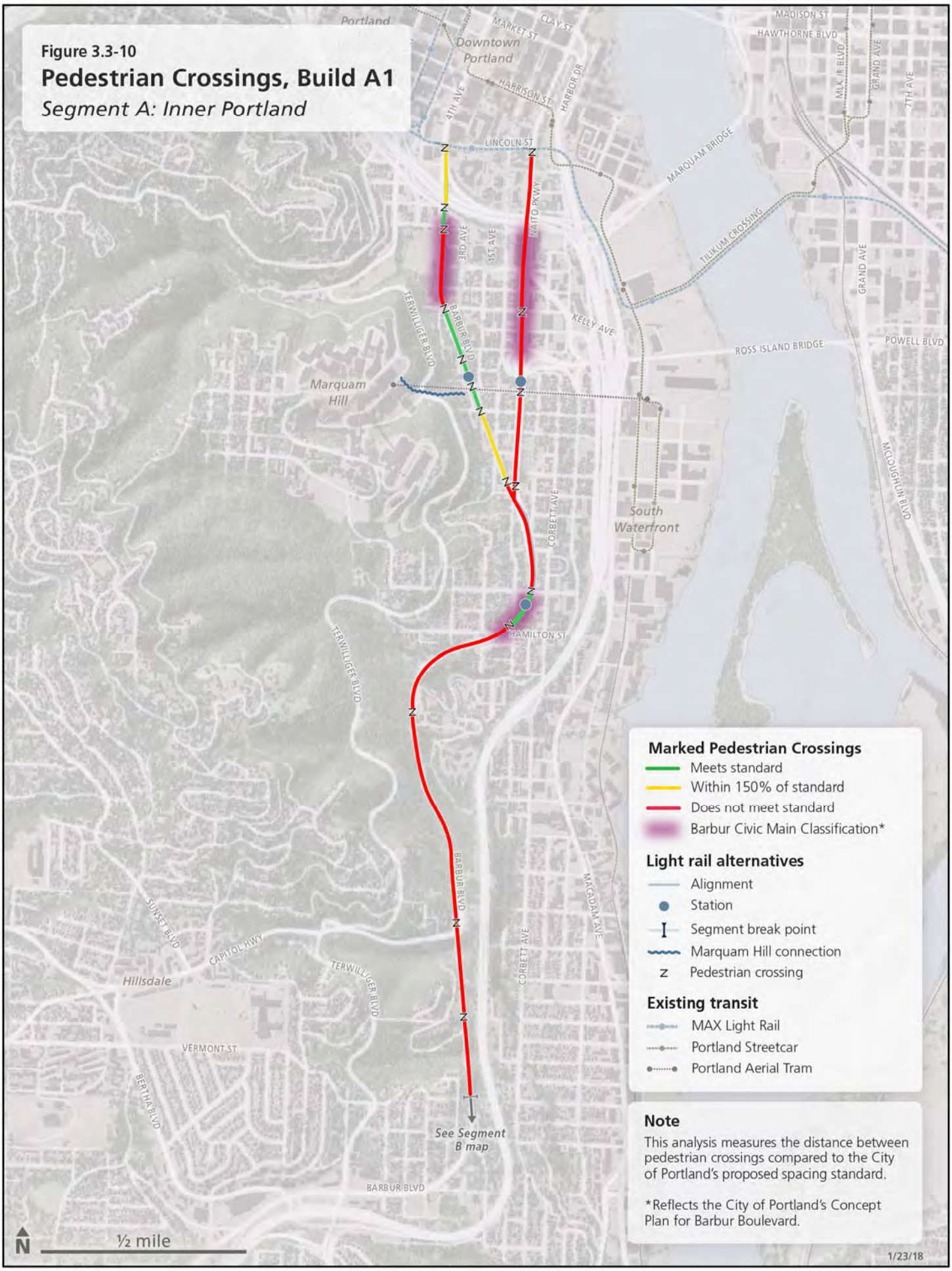


Figure 3.3-10
Pedestrian Crossings, Build A1
Segment A: Inner Portland
Portland
Downtown Portland
MARKET ST
CLAY ST
HARRISON ST
HARBOR DR
4TH AVE
LINCOLN ST
MADISON ST
HAWTHORNE BLVD
MLK JR BLVD
GRAND AVE
7TH AVE
MARQUAM BRIDGE
TILIKUM CROSSING
NAITO PKWY
3RD AVE
1ST AVE
TERWILLIGER BLVD
BARBUR BLVD
KELLY AVE
ROSS ISLAND BRIDGE
POWELL BLVD
Marquam Hill
South Waterfront
CORBETT AVE
MCLOUGHLIN BLVD
HAMILTON ST
MACADAM AVE
SUNSET BLVD
CAPITOL HWY
Hillsdale
VERMONT ST
BERTHA BLVD
See Segment B map
Marked Pedestrian Crossings
Meets standard
Within 150% of standard
Does not meet standard
Barbur Civic Main Classification*
Light rail alternatives
Alignment
Station
Segment break point
Marquam Hill connection
Pedestrian crossing
Existing transit
MAX Light Rail
Portland Streetcar
Portland Aerial Tram
Note
This analysis measures the distance between pedestrian crossings compared to the City of Portland's proposed spacing standard.
*Reflects the City of Portland's Concept Plan for Barbur Boulevard.
N
½ mile
1/23/18

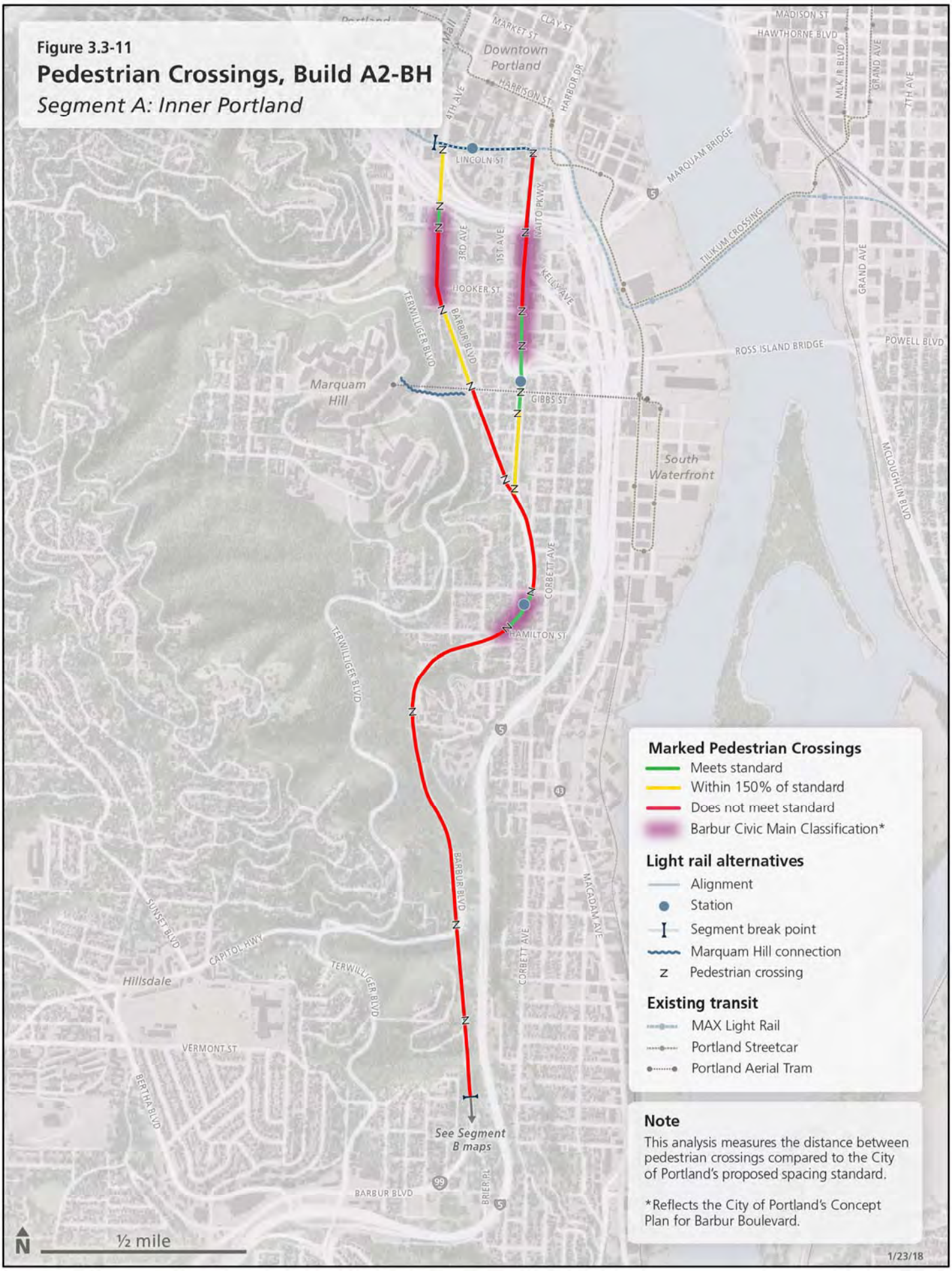


Figure 3.3-11
Pedestrian Crossings, Build A2-BH
Segment A: Inner Portland
Downtown Portland
Marquam Hill
South Waterfront
Hillsdale
MARKET ST
CLAY ST
HARRISON ST
HARBOR DR
4TH AVE
LINCOLN ST
MADISON ST
HAWTHORNE BLVD
MLK JR BLVD
GRAND AVE
7TH AVE
MARQUAM BRIDGE
TILIKUM CROSSING
NAITO PKWY
3RD AVE
1ST AVE
KELLY AVE
HOOKER ST
TERWILLIGER BLVD
BARBUR BLVD
GIBBS ST
ROSS ISLAND BRIDGE
POWELL BLVD
MCLOUGHLIN BLVD
CORBETT AVE
HAMILTON ST
MACADAM AVE
SUNSET BLVD
CAPITOL HWY
VERMONT ST
BERTHA BLVD
BRIER PL
See Segment B maps
Marked Pedestrian Crossings
Meets standard
Within 150% of standard
Does not meet standard
Barbur Civic Main Classification*
Light rail alternatives
Alignment
Station
Segment break point
Marquam Hill connection
Pedestrian crossing
Existing transit
MAX Light Rail
Portland Streetcar
Portland Aerial Tram
Note
This analysis measures the distance between pedestrian crossings compared to the City of Portland's proposed spacing standard.
*Reflects the City of Portland's Concept Plan for Barbur Boulevard.
N
½ mile
1/23/18

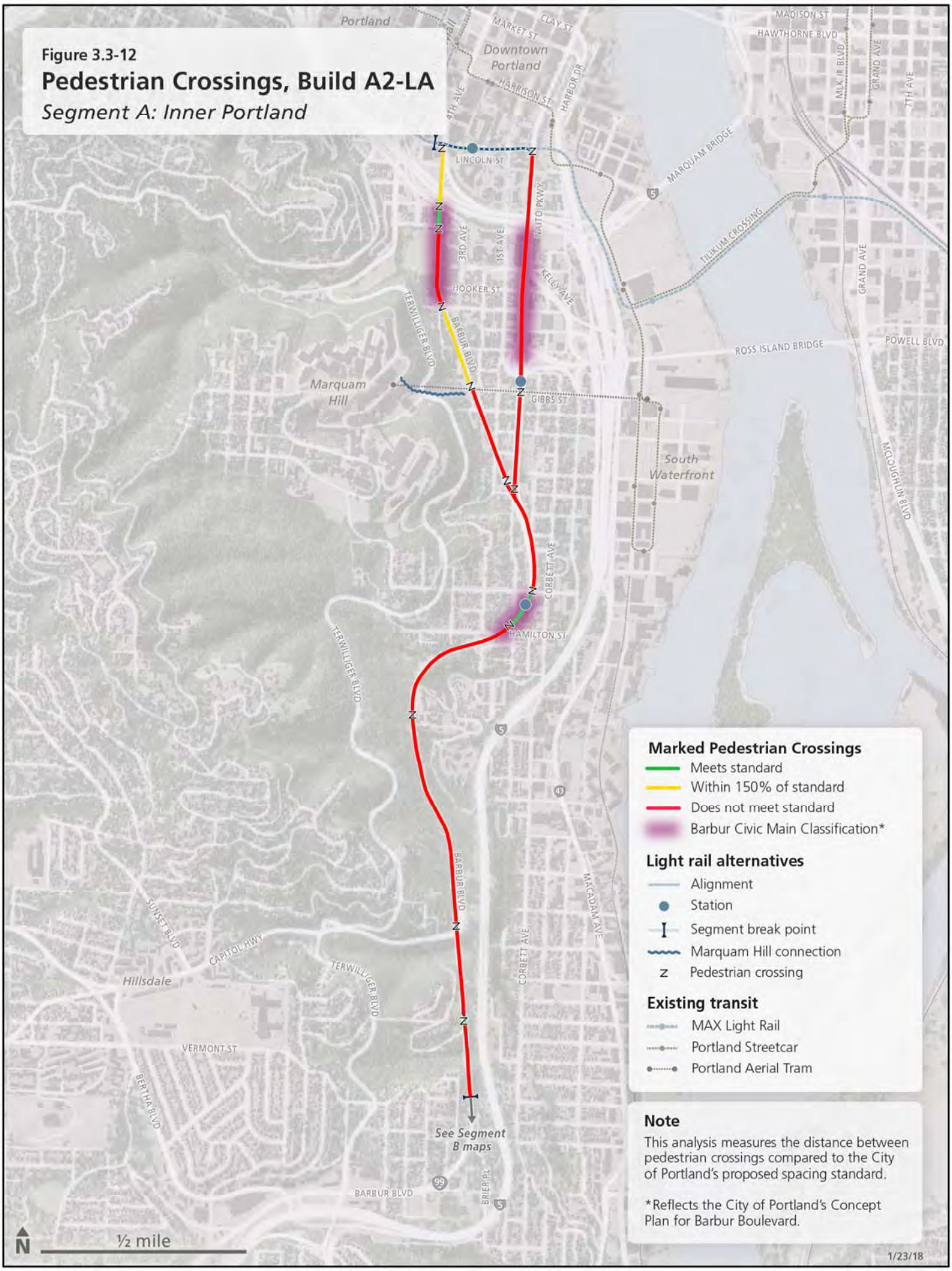


Figure 3.3-12
Pedestrian Crossings, Build A2-LA
Segment A: Inner Portland
Portland
Downtown Portland
MARKET ST
CLAY ST
HARRISON ST
HARBOR DR
4TH AVE
MADISON ST
HAWTHORNE BLVD
MLK JR BLVD
GRAND AVE
7TH AVE
LINCOLN ST
MARQUAM BRIDGE
TILIKUM CROSSING
NAITO PKWY
3RD AVE
1ST AVE
KELLY AVE
HOOKER ST
TERWILLIGER BLVD
BARBUR BLVD
Marquam Hill
GIBBS ST
ROSS ISLAND BRIDGE
POWELL BLVD
South Waterfront
MCLOUGHLIN BLVD
CORBETT AVE
HAMILTON ST
MACADAM AVE
SUNSET BLVD
CAPITOL HWY
Hillsdale
VERMONT ST
BERTHA BLVD
See Segment B maps
BARBUR BLVD
BRIER PL
Marked Pedestrian Crossings
Meets standard
Within 150% of standard
Does not meet standard
Barbur Civic Main Classification*
Light rail alternatives
Alignment
Station
Segment break point
Marquam Hill connection
Pedestrian crossing
Existing transit
MAX Light Rail
Portland Streetcar
Portland Aerial Tram
Note
This analysis measures the distance between pedestrian crossings compared to the City of Portland's proposed spacing standard.
*Reflects the City of Portland's Concept Plan for Barbur Boulevard.
N
½ mile
1/23/18

Station Access Improvements

In addition to the walking and bicycle facility improvements included along SW Barbur Boulevard and SW Naito Parkway as part of the alignment alternatives, the project includes three station access improvement options in Segment A (see Figure 2.3-10 of the Draft EIS). The station access improvements include a mix of bike lanes, sidewalks and sharrows (arrows painted on low-volume streets to indicate a shared-use bicycle route). Table 3.3-8 summarizes these improvements in Segment A.

Table 3.3-8. Segment A Station Access Improvements

Segment A: Inner Portland	Major Design Elements	Potential Impacts	Notes
Station Access Improvement			
SA01: 1st Bikeway	Sharrows, 6-foot bike lane (southbound only)	On-street parking removal	
SA02: Grover Bikeway	Sharrows	None	
SA03: Hamilton Sidewalks and Bikeway	Sharrows, bike lane, sidewalk	On-street parking removal, possible property impacts	Uphill may require parking removal; sidewalk on only one side avoids park impacts

Impacts from implementing these station access improvements could include parking removal, acquisition of right of way and construction-related impacts (e.g., traffic, noise). Mitigation for station access improvement impacts could include neighborhood parking management measures, construction traffic management and time-of-day construction limitations.

Marquam Hill Connection Options

Marquam Hill Connections 1A, 1B and 1C all include two elevators; an open-air, moderate grade path; and stairs with ADA ramps and bridge structures. Connection 1A includes an at-grade crossing of SW Terwilliger Boulevard, and Connections 1B and 1C include a below-grade crossing of SW Terwilliger Boulevard. Connection 2 includes a tunnel with a moderate grade and a single 294-foot elevator at the west end to connect to OHSU. All of the connection options would improve pedestrian accessibility between the OHSU campus, SW Barbur Boulevard, SW Naito Parkway and the surrounding neighborhoods. With tunnels and elevators, the connection would need to be actively managed and monitored to maintain a safe and attractive pedestrian environment.

Impacts associated with the Marquam Hill connection options could include construction-related impacts (noise, traffic, vibration, etc.). Mitigation for construction noise and vibration could be important because of the nature of medical facilities at OHSU.

3.3.4. Segment A Motor Vehicle Operations

2035 No-Build Alternative HCM Operations

The No-Build Alternative assumes that the project is not constructed. The No-Build Alternative provides a basis for comparison between future scenarios with and without the project. The only future project included within Segment A for the No-Build Alternative is a new traffic signal at the SW 4th Avenue and SW College Street intersection to accommodate the pedestrians and cyclists added by the Green Loop multi-use path along SW 4th Avenue, and the Division transit bus line.

The Synchro analysis for the No-Build Alternative is shown in Table 3.3-9. Intersections that do not meet the mobility target are shaded gray for each failing peak hour. The volumes are shown graphically in Figure 3.3-13.

Table 3.3-9. HCM (Synchro) Segment A 2035 No-Build Alternative Analysis

					2035 No-Build								
						AM				PM			
ID	Intersection	Note	Mobility Target		Control	Delay	LOS	V/C	WLANE	Delay	LOS	V/C	WLANE
A2	SW Naito Pkwy. on-ramp/Hawthorne Br.	1	PBOT 2nd HR	0.99	TWSC	PM Only				10.8 [72.6]	B [F]	0.93	NBLn1
A12	SW 1st Ave./SW Harrison St.	1	PBOT 2nd HR	0.99	Signal					17.7	B	0.46	-
A13	SW Naito Pkwy./SW Harrison St.	1	PBOT 2nd HR	0.99	Signal	23.3	C	0.74	-	50.3	D	0.91	-
A21	SW 4th Ave./SW Hall St.	1	PBOT 2nd HR	0.99	Signal	28.2	C	0.37	-	27.4	C	0.36	-
A25	SW 4th Ave./SW College St.	1	PBOT 2nd HR	0.99	Signal	9.7	A	0.40	-	8.8	A	0.39	-
A27	SW 6th Ave./SW Jackson St./I-405 northbound off-ramp	1	ODOT Ramp	0.85	TWSC	0.9 [14]	A [B]	0.06	EBLn1	5.9 [27.9]	A [D]	0.34	EBLn1
A31	SW 4th Ave./I-405 northbound off-ramp/SW Lincoln St.	1	ODOT Ramp	0.85	Signal	11.7	B	0.56	-	14.5	B	0.49	-
A34	SW 1st Ave./SW Lincoln St.	1	PBOT 2nd HR	0.99	Signal	27.7	C	0.27	-	27.6	C	0.55	-
A35	SW Naito Pkwy./ SW Lincoln St.	1	PBOT 2nd HR	0.99	Signal	4.2	A	0.55	-	4.5	A	0.59	-
A37	SW Broadway Ave./ I-405 southbound off-ramp/SW Lincoln St.	1	ODOT Ramp	0.85	Signal	PM Only				18.4	B	0.60	-
A38	SW Broadway Ave./SW Grant St./SW 6th Ave.	1	PBOT 1st HR	0.99	Signal					18.6	B	0.82	-
A39	SW Broadway Ave./SW 5th Ave.	1	PBOT 1st HR	0.99	Signal					21.8	C	0.73	-
A42	SW 4th Ave./SW Caruthers St./SW Broadway Ave.	1	PBOT 1st HR	0.99	Signal					35.1	D	0.70	-
A45	SW 4th Ave./SW Barbur Blvd./SW Sheridan St.	1	PBOT 1st HR	0.99	Signal					13.8	B	0.60	-
A48	SW 1st Ave./SW Arthur St.	1	PBOT 1st HR	0.99	Signal					28.6	C	0.87	-
A56	SW Kelly Ave./SW Porter St./SW Hood Ave.	1	ODOT Ramp	0.85	TWSC	1.3 [14.9]	A [B]	0.27	SBL	1.1 [10.8]	A [B]	0.15	SBL
A61	Ross Island Br./SW Naito Pkwy.	1	ODOT/PBOT 1st HR	0.99	TWSC	**135.5 [280.9]**	**F [F]**	**1.56**	**SBLn1**	**258 [>300]**	**F [F]**	**>2.0**	**SBLn1**
A62	Ross Island Br./SW Kelly Ave. ramps	1	ODOT/PBOT 1st HR	0.99	TWSC	**25.5 [147.8]**	**C [F]**	**1.18**	**NBRn1**	**>300 [>300]**	**F [F]**	**>2.0**	**NBRn1**
A69	SW Naito Pkwy./ SW Gibbs St./SW Naito Pkwy. ramps	1	ODOT/PBOT 1st HR	0.99	TWSC	0.3 [15.3]	A [C]	0.04	WBRn1	7.1 [18.3]	A [C]	0.54	WBRn1
A78	SW Barbur Blvd./SW Naito Pkwy./Ped. crossing	1	ODOT/PBOT 1st HR	0.99	TWSC	0.1 [10.5]	A [B]	0.05	EBLn1	0.3 [22.4]	A [C]	0.11	EBLn1

Table 3.3-9. HCM (Synchro) Segment A 2035 No-Build Alternative Analysis

ID	Intersection	Note	Mobility Target		2035 No-Build							
						AM				PM			
					Control	Delay	LOS	V/C	WLANE	Delay	LOS	V/C	WLANE
A80	SW Barbur Blvd./ SW Bancroft St.	1	ODOT/PBOT 1st HR	0.99	TWSC	**4.4 [108.1]**	**A [F]**	**1.00**	**WBLn1**	0.2 [14.5]	A [B]	0.18	WBLn1
A81	SW Corbett Ave./ SW Bancroft St.	1	PBOT 1st HR	0.99	TWSC	5.7 [33.8]	A [D]	0.29	WBLn1	**63.2 [216.3]**	**F [F]**	**1.34**	**EBLn1**
A82/A84	SW Barbur Blvd./ SW Hamilton St.	1	ODOT/PBOT 1st HR	0.99	Signal	48.5	D	0.99	-	44.1	D	0.99	-
A83	SW Corbett Ave./ SW Hamilton St.	1	PBOT 1st HR	0.99	AWSC	**164.2**	**F**	**1.52**	**-**	**123.6**	**F**	**1.39**	**-**

Key: Average Intersection [Worst stop-controlled movement] delay and LOS for TWSC intersections.
V/C represents intersection average for signals and worst movement for stop control intersections.
HR = hour; Ln = lane; PBOT = Portland Bureau of Transportation; EB = eastbound; NB = northbound; SB = southbound; WB = westbound.
[1]Intersection analysis completed as part of 2016 SWC study with review by ODOT, PBOT and Metro.

As shown in Table 3.3-9, HCM analysis indicated the following intersections as failing to meet mobility targets:

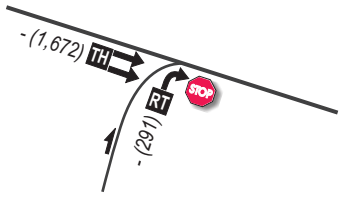
AM Peak Hour:

- **SW Naito Parkway northbound ramp to Ross Island Bridge.** This intersection continues to operate above the mobility target.
- **SW Kelly Avenue and Ross Island Bridge.** This intersection fails to meet mobility targets under future No-Build Alternative conditions because of increased volumes on SW Kelly Avenue.
- **SW Barbur Boulevard and SW Bancroft Street.** Drivers using the east leg of this intersection face increased conflicting northbound volume on SW Barbur Boulevard in the future, leading to operations that fail to meet the mobility target.
- **SW Corbett Avenue and SW Hamilton Street**. This all-way stop controlled intersection failed to meet mobility targets under existing conditions and experiences higher future traffic volumes than under existing conditions, further degrading intersection performance.

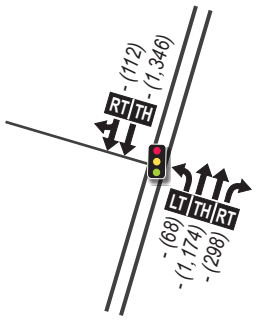
PM Peak Hour:

- **SW Naito Parkway and Ross Island Bridge.** This intersection continues to operate above the mobility target.
- **SW Kelly Avenue and Ross Island Bridge.** This intersection continues to operate above the mobility target.
- **SW Corbett Avenue and SW Bancroft Street**. Increased demand on the stop controlled approaches and northbound left turns from a shared lane result in the intersection failing to meet mobility targets.
- **SW Corbett Avenue and SW Hamilton Street.** This intersection is already exceeding mobility targets under existing conditions; therefore, with no capacity improvements, the intersection of SW Corbett Avenue and SW Hamilton Street fails to meet mobility targets under year 2035 conditions.

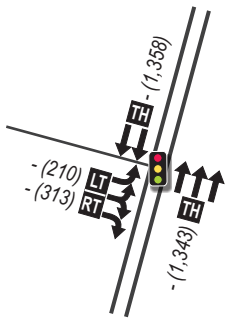
A2. *SW Naito Pkwy. On-Ramp @ Hawthorne Brg.*



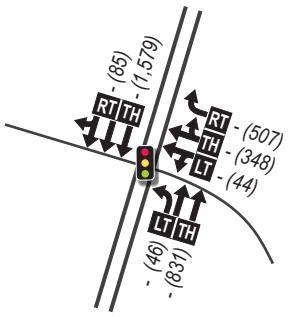
A3. *SW Naito Pkwy. @ SW Jefferson St.*



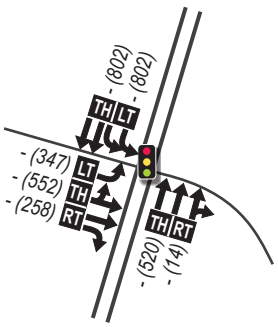
A4. *SW Naito Pkwy. @ SW Columbia St.*



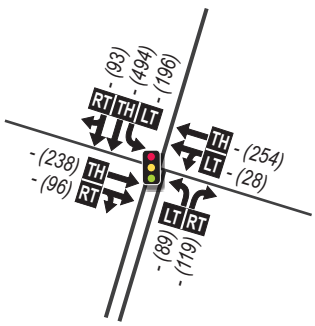
A6. *SW Naito Pkwy. @ SW Clay St.*



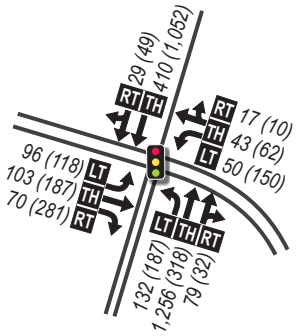
A8. *SW Naito Pkwy. @ SW Market St.*



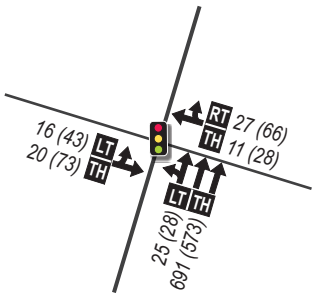
A12. *SW 1st Ave. @ SW Harrison St.*



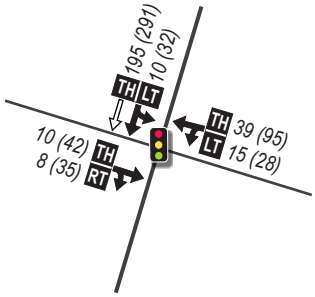
A13. *SW Naito Pkwy. @ SW Harrison St.*



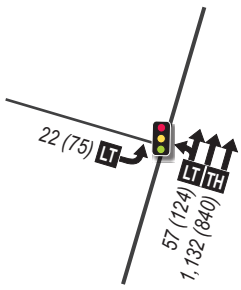
A19. *SW 6th Ave. @ SW Hall St.*



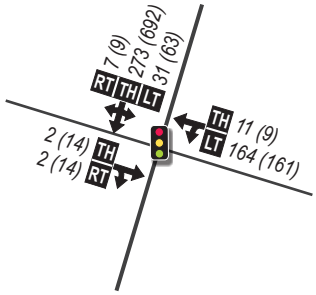
A20. *SW 5th Ave. @ SW Hall St.*



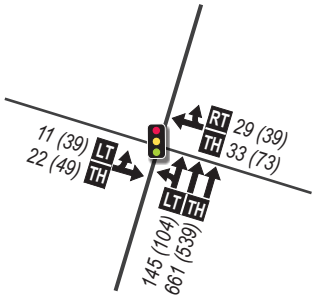
A21. *SW 4th Ave. @ SW Hall St.*



A22. *SW Broadway @ SW College St.*



A23. *SW 6th Ave. @ SW College St.*



LEGEND

00. - Study Intersection No.
STOP - Stop Sign
- Yield Sign
- Traffic Signal
- Lane Configuration
- Bus Only Lane
AM (PM) - Peak Hour Traffic Volumes
LT TH RT - Volume Turn Movement
Left•Thru•Right

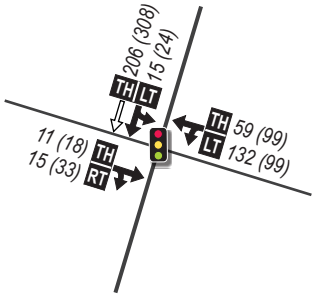
DKS

No Scale

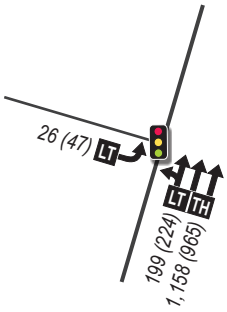
figure **3.3-13a**

2035 No Build Alternative
AM/PM Peak Hour
Segment A: Inner Portland

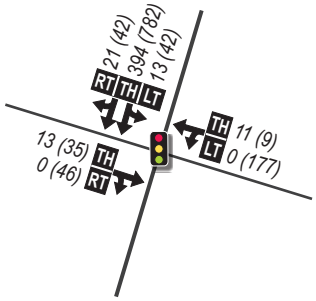
A24. *SW 5th Ave. @ SW College St.*



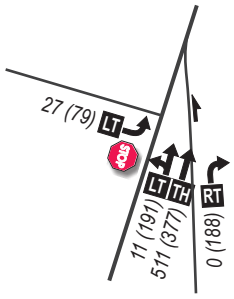
A25. *SW 4th Ave. @ SW College St.*



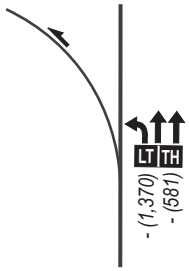
A26. *SW Broadway @ SW Jackson St.*



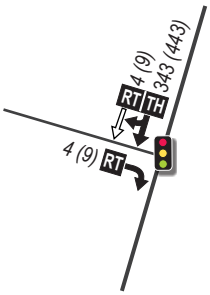
A27. *SW 6th Ave. @ SW Jackson St./ I-405 Off-Ramp*



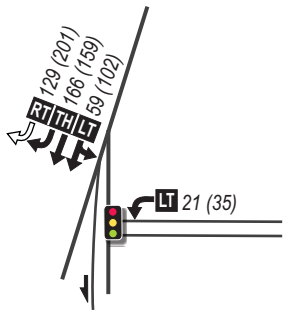
A28. *SW 6th Ave. @ I-405/Hwy. 26 On-Ramp*



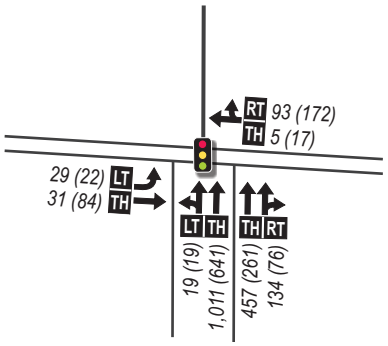
A29. *SW 5th Ave. @ SW Jackson St.*



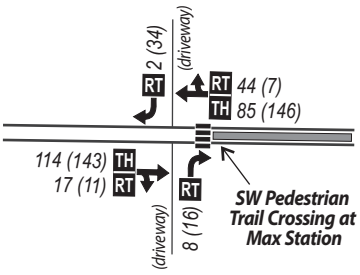
A30. *SW 5th Ave./I-405 On-Ramp @ SW Lincoln St.*



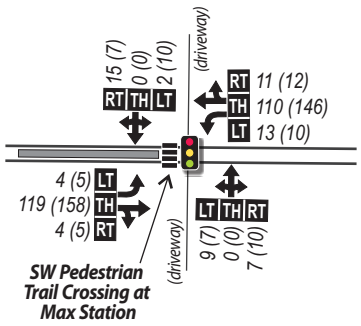
A31. *SW 4th Ave./I-405 WB Off-Ramp @ SW Lincoln St.*



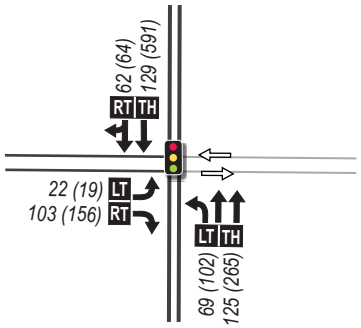
A32. *SW 3rd Ave. @ SW Lincoln St.*



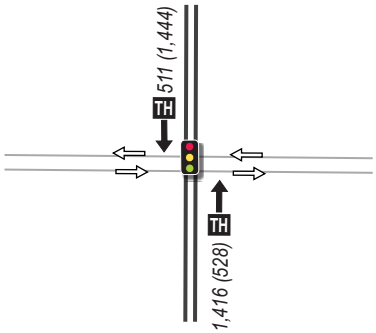
A33. *SW 2nd Ave. @ SW Lincoln St.*



A34. *SW 1st Ave. @ SW Lincoln St.*



A35. *SW Naito Pkwy. @ SW Lincoln St.*



LEGEND

00. - Study Intersection No.
STOP - Stop Sign
- Yield Sign
- Traffic Signal
- Lane Configuration
- Bus Only Lane
AM (PM) - Peak Hour Traffic Volumes
LT TH RT - Volume Turn Movement
Left•Thru•Right

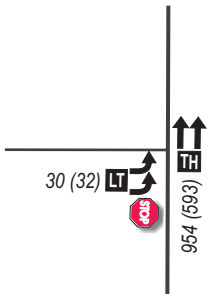
DKS

No Scale

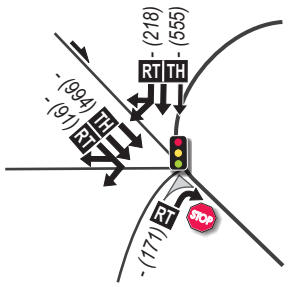
figure **3.3-13b**

2035 No Build Alternative
AM/PM Peak Hour
Segment A: Inner Portland

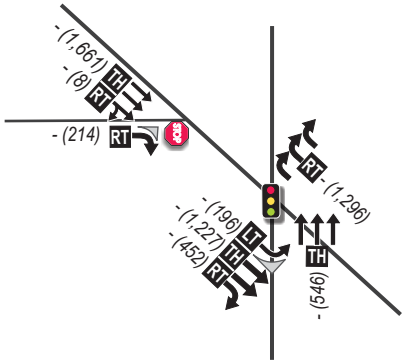
A36. *SW 4th Ave. @ SW Grant St.*



A37. *SW Broadway @ I-405/SW Lincoln St.*

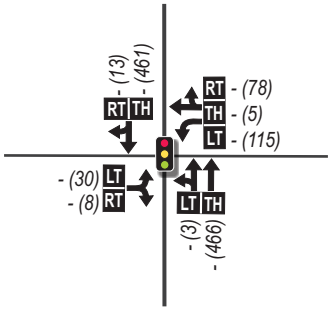


A38. *SW Broadway/SW Grant St. @ SW 6th Ave.*

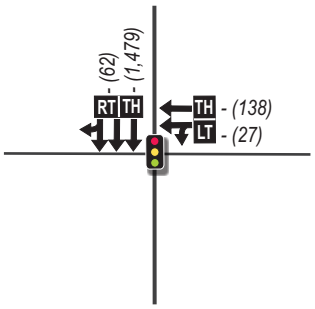


A39. *SW Broadway @ SW 5th Ave.*

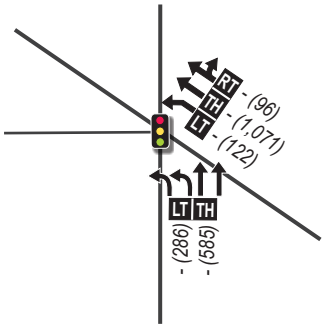
A40. *SW 6th Ave. @ SW Caruthers St.*



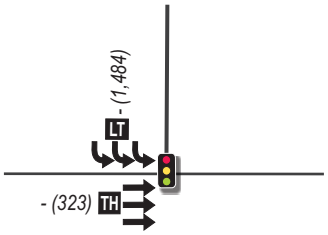
A41. *SW 5th Ave. @ SW Caruthers St.*



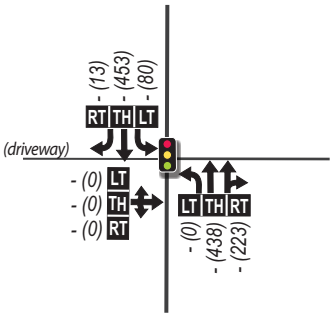
A42. *SW 4th Ave. @ SW Caruthers St./ SW Broadway*



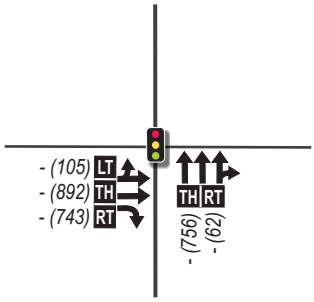
A43. *SW 5th Ave. @ SW Sheridan St.*



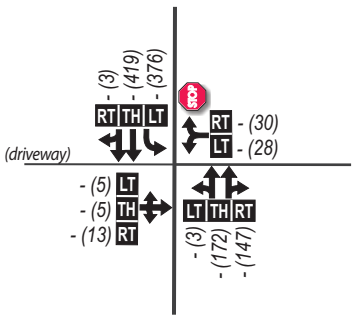
A44. *SW 6th Ave./SW Terwilliger Blvd. @ SW Sheridan St.*



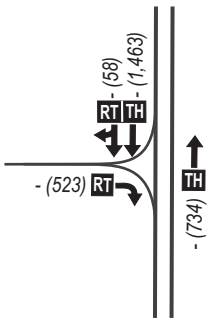
A45. *SW 4th Ave./SW Barbur Blvd. @ SW Sheridan St.*



A46. *SW 1st Ave. @ SW Sheridan St.*



A47. *SW Naito Pkwy. @ SW Sheridan St.*



LEGEND

00. - Study Intersection No.
STOP - Stop Sign
- Yield Sign
- Traffic Signal
- Lane Configuration
- Bus Only Lane
AM (PM) - Peak Hour Traffic Volumes
LT TH RT - Volume Turn Movement
Left•Thru•Right

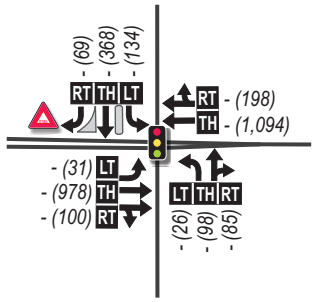
DKS

No Scale

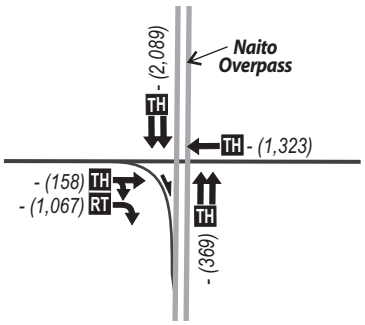
figure **3.3-13c**

2035 No Build Alternative
AM/PM Peak Hour
Segment A: Inner Portland

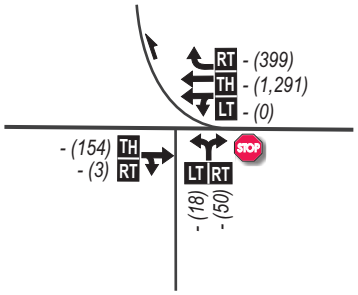
A48. *SW 1st Ave. @ SW Arthur St.*



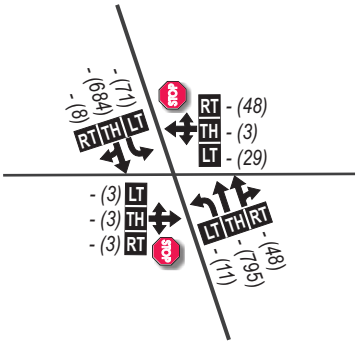
A49. *SW Naito Pkwy. @ SW Arthur St.*



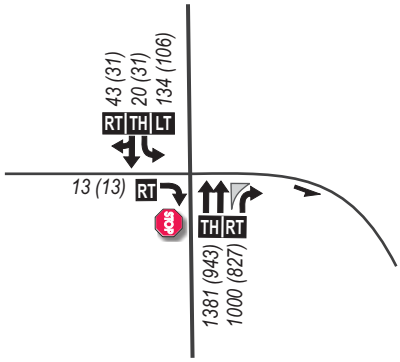
A50. *SW Naito Pkwy. @ SW Kelly St.*



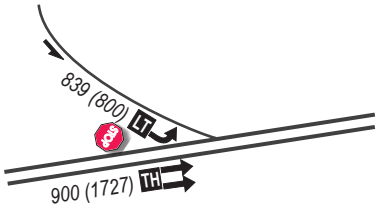
A52. *SW Barbur Blvd. @ SW Hooker St.*



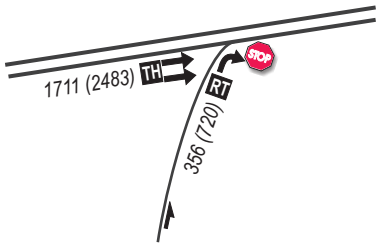
A56. *SW Kelly St. @ SW Porter St./SW Hood Ave.*



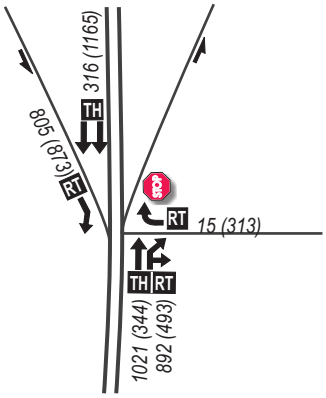
A61. *Ross Island Brg. @ Naito Pkwy.*



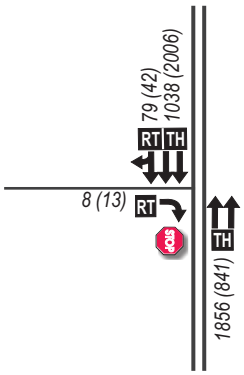
A62. *Ross Island Brg. @ Kelly Ramps*



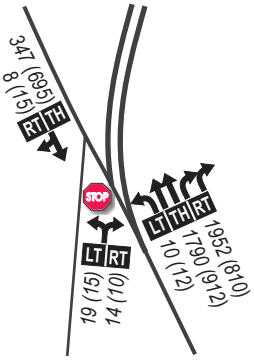
A69. *SW Naito Pkwy. @ Gibbs/Naito Ramps*



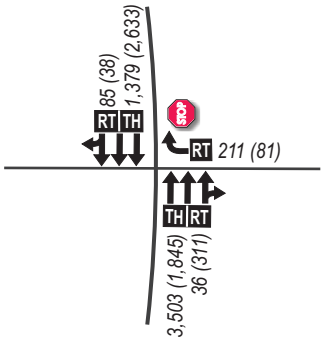
A72. *SW Naito Pkwy. @ SW Whitaker St.*



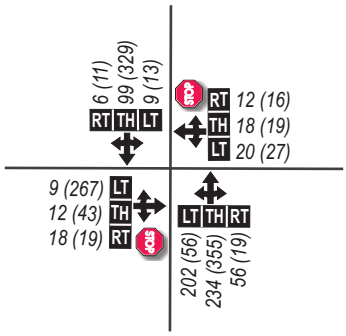
A78. *SW Barbur Blvd. @ SW Naito/ SW Abernathy St.*



A80. *SW Barbur Blvd. @ SW Bancroft St.*



A81. *SW Corbett Blvd. @ SW Bancroft St.*



LEGEND

00. - Study Intersection No.
STOP - Stop Sign
- Yield Sign
- Traffic Signal
- Lane Configuration
- Bus Only Lane
AM (PM) - Peak Hour Traffic Volumes
LT TH RT - Volume Turn Movement
Left•Thru•Right

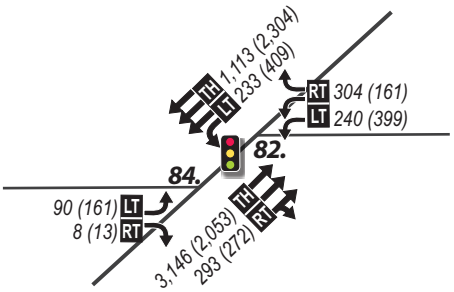
DKS

No Scale

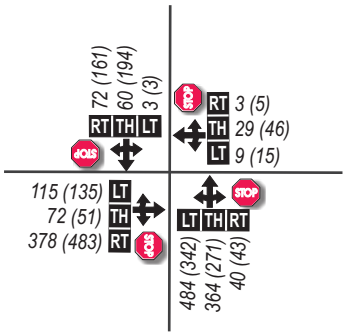
figure **3.3-13d**

2035 No Build Alternative
AM/PM Peak Hour
Segment A: Inner Portland

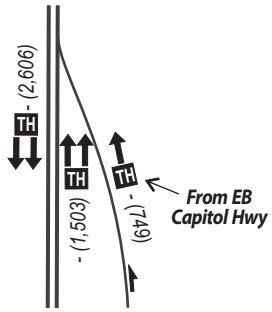
A82. *SW Barbur Blvd. @ SW Hamilton St. (East)*
A84. *SW Barbur Blvd. @ SW Hamilton St. (West)*



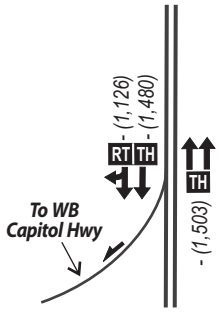
A83. *SW Hamilton Blvd. @ SW Corbett Ave.*



A85. *SW Barbur Blvd. @ SW Capitol Hwy. EB*



A86. *SW Barbur Blvd. @ SW Capitol Hwy. WB*



LEGEND

00. - Study Intersection No.
STOP - Stop Sign
- Yield Sign
- Traffic Signal
- Lane Configuration
- Bus Only Lane
AM (PM) - Peak Hour Traffic Volumes
LT TH RT - Volume Turn Movement
Left•Thru•Right

DKS

No Scale

figure **3.3-13e**

2035 No Build Alternative
AM/PM Peak Hour
Segment A: Inner Portland

Similar to existing conditions, there are several other intersections that have operational issues not captured in the HCM analysis due to operations at adjacent intersections or queue spillback from bottlenecks elsewhere in the area. These operational issues will be discussed further in the Queuing Analysis section that follows.

2035 No-Build Alternative Simulation Queuing and Operations Analysis

Simulation models for the future conditions with the No-Build Alternative were developed from all three of the calibrated existing conditions models (Downtown AM, Hamilton AM, and Segment A PM). No changes were made to the modeling driver behavior assumptions, but volumes and vehicle routing patterns were updated based on the 2035 Metro Travel Demand model. There are not Metro RTP projects within model area, however a PBOT project was added with the no-build analysis to signalize the northbound Naito ramp to eastbound Hawthorne Bridge. For this project, the northbound ramp is signalized only with the right eastbound lane. The left lane is free and barrier separated.

As with the existing models, performance metrics such as delay, travel times, and 95th percentile queues were pulled from each of the future simulation models. These metrics are included in Appendix K. The four system-wide metrics used for the existing models (vehicles served, latent vehicle demand, unserved demand at key gateways, and total vehicle hours of delay) were also pulled from the simulation model. Peak 15-minute queue figures for the No-Build Alternative were also created for each model using the same methodology as used for the existing models.

The system-wide metrics for the Downtown AM model for the No-Build Alternative are summarized in Table 3.3-10.

Table 3.3-10. Segment A Downtown No-Build AM Simulation System Measures

Measure	Simulation Result (7-9 a.m.)		
Total Vehicles Served	15,200 vehicles		
Latent Vehicle Demand	0 vehicles		
Total Vehicle Hours of Delay	130 vehicle-hours		
Unserved Demand at Key Gateways			
Gateway	**Demand**	**Unserved Demand**	**Percent Unserved Demand**
None	N/A	N/A	N/A

As shown by the system-wide metrics, under the No-Build Alternative, the Downtown AM model has the capacity to service the forecasted demand. Note that this does not guarantee that the demand is able to reach the downtown area, because regional bottlenecks occur outside the model, especially on SW Barbur Boulevard/SW Naito Parkway (due to issues discussed in the next section) and the freeways. Appendix K includes the queuing for the Downtown AM model on 15-minute increments from 7:00-9:00 a.m. as averaged over 10 simulations for the No-Build Alternative.

The Downtown AM No-Build queuing plots in Appendix K highlight the main forecasted bottleneck locations for the No-Build Alternative in 2035, as simulated in the model. Traffic volumes for the Downtown AM model analysis area are not forecasted to increase significantly under No-Build Alternative conditions. As shown in Appendix K, the only noticeable increases in peak queuing occur on northbound SW Naito Parkway. However, the queues are not long enough to have major impacts on any upstream intersections. While not reflected in this model, regional traffic bottlenecks that occur outside the Downtown AM model area could significantly alter AM travel patterns in the future.

The system-wide metrics for the Hamilton AM model for the No-Build Alternative are summarized in Table 3.3-11.

Table 3.3-11. Segment A Hamilton No-Build AM Simulation System Measures

Measure	Simulation Result (7-9 a.m.)		
Total Vehicles Served	21,200 vehicles		
Latent Vehicle Demand	1,120 vehicles		
Total Vehicle Hours of Delay	1,600 vehicle-hours		
Unserved Demand at Key Gateways			
Gateway	**Demand (veh)**	**Unserved Demand (veh)**	**Percent Unserved Demand**
Northbound Corbett Ave (south of Hamilton St)	**1,540**	**180**	**12%**
Northbound Macadam Ave (I-5 northbound off-ramp)	2,670	70	3%
Eastbound SW Capitol Hwy (east of Terwilliger Blvd)	**2,740**	**600**	**22%**
Northbound SW Barbur Blvd (south of SW Capitol Hwy)	**4,100**	**200**	**5%**

Bold = Demand exceeds volume served by 5% or more

The system-wide metrics show that under No-Build Alternative AM conditions in 2035, the Hamilton AM model does not have the capacity to fully serve the forecasted demand. The causes of the unserved demand at key gateways are discussed in conjunction with the discussion of the performance at key bottleneck locations later in this section. Appendix K includes the queuing for the Hamilton AM model on 15-minute increments from 7:00-9:00 a.m. as averaged over 10 simulations for the No-Build Alternative.

The Hamilton AM No-Build queuing plots in Appendix K highlight the main forecasted bottleneck locations for the No-Build Alternative in 2035, as simulated in the model. These key locations are:

- Northbound SW Kelly Avenue north of SW Porter Street. Same issues as noted under existing conditions.
- Ramp from northbound SW Naito Parkway to eastbound Ross Island Bridge. Same issue as noted under existing conditions. However, under future conditions, the queue from this bottleneck location would spill back onto SW Barbur Boulevard and affect operations for northbound traffic at SW Hamilton Street and SW Barbur Boulevard.
- Intersection of SW Hamilton Street and SW Barbur Boulevard. Queues increase significantly over existing conditions because of forecasted volume increases, which would spill back south along SW Barbur Boulevard and west on eastbound SW Capitol Highway, reaching SW Terwilliger Boulevard.
- Intersection of SW Hamilton Street and SW Corbett Avenue. Traffic operations at this intersection would further degrade over existing conditions because of forecasted increases in northbound traffic.
- Intersection of SW Capitol Highway and SW Terwilliger Boulevard. Operations at this intersection would be impacted by the queue spillback from northbound SW Barbur Boulevard.

Overall, the Hamilton AM model peak-hour traffic conditions for the No-Build Alternative indicate high levels of congestion and large unserved demand. In reality, driving behaviors would likely shift

regionally with further route diversion, mode shift and peak spreading to avoid the large delays incurred by the unserved demand attempting to enter the study area during the peak two hours.

The system-wide metrics for the Segment A PM model for the No-Build Alternative are summarized in Table 3.3-12. These metrics include unserved demand at key locations impacted either by No-Build or Build conditions.

Table 3.3-12. Segment A No-Build PM Simulation System Measures

Measure		Simulation Result (4-6 p.m.)		
Total Vehicles Served		47,200 vehicles		
Latent Vehicle Demand		4,090 vehicles		
Total Vehicle Hours of Delay		7,520 vehicle-hours		
Unserved Demand at Key Gateways (4-6 p.m.)				
Gateway		**Demand (veh)**	**Unserved Demand (veh)**	**% Unserved Demand**
North	Eastbound SW Market St (East of SW 1st Ave)	**2,500**	**230**	**9%**
	Southbound SW Broadway (north of SW College St)	1,690	60	4%
	Southbound SW Naito Pkwy (north of Hawthorne St)	3,010	<10	N/A
	Southbound SW 5th Ave (north of SW Harrison St)	590	<10	N/A
South	Northbound SW Macadam Ave (I-5 northbound off-ramp)	2,320	60	2%
	Northbound Corbett Ave (south of Hamilton St)	**1,280**	**70**	**6%**
	Northbound SW Terwilliger Blvd (south of Broadway)	1,350	<10	N/A
	Eastbound SW Capitol Hwy (east of SW Terwilliger Blvd)	1,720	<10	N/A
	Northbound SW Terwilliger Blvd (south of Capitol Hwy)	350	<10	N/A
	Northbound SW Barbur Blvd (south of SW Capitol Hwy)	2,850	<10	N/A
East	Westbound SE Powell Blvd (east of SE Milwaukie Ave)	**3,290**	**1,460**	**44%**
	Northbound SE Milwaukie Ave (south of SE Powell Blvd)	**1,060**	**340**	**32%**
	Southbound SE Milwaukie Ave (north of SE Powell Blvd)	**1,620**	**180**	**11%**
	Southbound SE 8th Ave (99E northbound off-ramp)	**1,830**	**1,050**	**57%**
West	I-405 Southbound Off-Ramp at SW Broadway	2,050	10	1%
	Northbound SW Broadway Dr (south of SW Grant St)	**730**	**120**	**16%**
	Eastbound SW Hamilton St (west of SW Barbur Blvd)	**330**	**220**	**67%**
Throughput at System Bottlenecks (4-6 p.m.)				
Location		**Demand**	**Throughput**	**% Demand Served**
Ross Island Bridge Westbound at I-5		**5,030**	**2,140**	**43%**
Ross Island Bridge Eastbound at I-5		**6,120**	**5,590**	**91%**
SW Barbur Blvd Northbound at SW Hamilton St		**4,280**	**3,950**	**92%**
SW Barbur Blvd Southbound at SW Hamilton St		**5,040**	**4,160**	**82%**

Bold = Demand exceeds volume served by 5% or more

The system-wide metrics show that under No-Build Alternative PM conditions in 2035, the Segment A PM model does not have the capacity to fully serve the forecasted demand. The causes of the unserved demand at key gateways are discussed in conjunction with the discussion of performance of key bottleneck locations later in this section. Appendix K includes the queuing for the Segment A PM model on 15-minute increments from 4:00-6:00 p.m. as averaged over 10 simulations for the No-Build Alternative.

The No-Build queuing plots in Appendix K highlight the main forecasted bottleneck locations for the No-Build Alternative in 2035, as simulated in the model. These key locations cause the unserved demand issues included in Table 3.3-12, and are summarized as follows:

- **Downtown grid encompassed by SW Harrison Street, SW Jackson Street, SW Broadway and SW 4th Avenue.** Performance of the downtown grid would degrade mainly along SW College Street. Increased demand on SW Broadway would lead to more queue spillback from the SW Broadway and I-405 southbound off-ramp intersection, ultimately affecting westbound traffic on SW College Street.

- **I-405 southbound off-ramp to SW Broadway.** For the same reasons as discussed in the existing conditions section, the I-405 southbound off-ramp would develop queues throughout the peak period. However, increased volume on SW Broadway would lead to longer southbound queues at this intersection and ultimately cause some latent southbound demand on SW Broadway.

- **I-405 northbound on-ramp from SW 6th Avenue.** The Metro regional travel demand model projects essentially no increase in total demand on the I-405 northbound on-ramp in the year 2035. However, upstream bottleneck issues would prevent the entire demand from reaching the intersection under the No-Build Alternative 2035 conditions, so the overall intersection performance and queuing appear to improve due to the lower traffic volumes reaching the I-405 northbound on-ramp. All of the operational assumptions and calibration adjustments that were applied in this area in the existing conditions model were carried into the No-Build Alternative future conditions model.

- **Ross Island Bridgehead eastbound.** The driver behavior at the eastbound Ross Island Bridgehead area would continue as it does under existing conditions. The northbound SW Naito Parkway to eastbound Ross Island Bridge queue would behave very similar to existing conditions. The Metro regional travel demand model showed that there would be significant growth in the South Waterfront area by the year 2035. This growth will add significant volume to SW Macadam Avenue and SW Hood Avenue. These volume increases impact the weave between the I-5 northbound to Ross Island Bridge eastbound and Ross Island Bridge westbound to I-5 southbound movements. The combined impact of increased weaving and the queue spillback from the SW Kelly Avenue to eastbound Ross Island Bridge ramp creates a bottleneck at the westbound end of the Ross Island Bridge from the ramp merging with SW Macadam Avenue traffic, resulting in latent demand on westbound SE Powell Boulevard, SE Milwaukie Avenue and SE 8th Avenue (from OR 99E). The bottleneck also would prevent the full No-Build Alternative demand from reaching the SW 1st Avenue and SW Arthur Street intersection, and would result in latent demand on SW Macadam Avenue as well. In addition, traffic operations for all approaches in the I-405 ramps, SW Broadway, SW 4th, SW 5th, SW 6th, SW Caruthers, and SW Sheridan would improve due to the decreased westbound volumes reaching this area.

- **Intersection of SW Hamilton Street and SW Corbett Avenue.** Increased volume on northbound I-5 would lead to more traffic using SW Corbett Avenue and SW Kelly Avenue as a bypass to reach the Ross Island Bridge. This traffic would increase northbound queues on SW Corbett Avenue and SW Kelly Avenue, leading to latent demand at both these locations.

- **Intersection of SW Hamilton Street and SW Barbur Boulevard.** Queuing issues at this intersection would remain relatively similar to existing conditions, with the exception of northbound SW Barbur Boulevard, which would experience queues that extend at times nearly to the SW Capitol Highway merge due to increased volumes.

Overall, the PM peak-hour conditions for the No-Build Alternative in Segment A indicate high levels of congestion and large unserved demand. In reality, driving behaviors would likely shift regionally with further route diversion, mode shift and peak spreading to avoid the large delays incurred by the unserved demand attempting to enter the study area during the peak two hours.

Light Rail Alternatives 2035 HCM Operations

Alternative A1: Barbur

The Alternative A1 is described in Section 3.3.1. Both the AM Synchro analysis and the PM Synchro analysis for Alternative A1 are shown in Table 3.3-13. Intersections that do not meet the mobility target are shaded gray for each failing peak hour. The peak-hour forecasted volumes Alternative A1 are shown graphically in Figure 3.3-14.

Table 3.3-13. Alternative A1: Barbur, 2035 HCM (Synchro) Analysis

					2035 Alternative A1: Barbur								
						AM				PM			
ID	Intersection	Note	Mobility Target		Control	Delay	LOS	V/C	WLANE	Delay	LOS	V/C	WLANE
A2	SW Naito Pkwy. on-ramp/ Hawthorne Br.	1	PBOT 2nd HR	0.99	TWSC	PM Only				7.9 [50.7]	A [F]	0.83	NBLn1
A12	SW 1st Ave./SW Harrison St.	1	PBOT 2nd HR	0.99	Signal					17.5	B	0.46	-
A13	SW Naito Pkwy./ SW Harrison St.	1	PBOT 2nd HR	0.99	Signal	23.6	C	0.79	-	47.7	D	0.87	-
A21	SW 4th Ave./SW Hall St.	1	PBOT 2nd HR	0.99	Signal	25.0	C	0.35	-	27.1	C	0.35	-
A25	SW 4th Ave./SW College St.	1	PBOT 2nd HR	0.99	Signal	15.3	B	0.40	-	8.6	A	0.38	-
A27	SW 6th Ave./SW Jackson St./I-405 northbound off-ramp	1	ODOT Ramp	0.85	TWSC	0.9 [14]	A [B]	0.07	EBLn1	6.1 [27.7]	A [D]	0.35	EBLn1
A31	SW 4th Ave./I-405 northbound off-ramp/SW Lincoln St.	1	ODOT Ramp	0.85	Signal	10.3	B	0.63	-	11.4	B	0.46	-
A34	SW 1st Ave./SW Lincoln St.	1	PBOT 2nd HR	0.99	Signal	42.5	D	0.28	-	22.8	C	0.47	-
A35	SW Naito Pkwy./ SW Lincoln St.	1	PBOT 2nd HR	0.99	Signal	5.0	A	0.70	-	4.6	A	0.58	-
A37	SW Broadway Ave./I-405 southbound off-ramp/SW Lincoln St.	1	ODOT Ramp	0.85	Signal	PM Only				18.4	B	0.59	-
A38	SW Broadway Ave./SW Grant St./SW 6th Ave.	1	PBOT 1st HR	0.99	Signal					17.1	B	0.81	-

ID	Intersection	Note	Mobility Target		2035 Alternative A1: Barbur								
						AM				PM			
					Control	Delay	LOS	V/C	WLANE	Delay	LOS	V/C	WLANE
A39	SW Broadway Ave./SW 5th Ave.	1	PBOT 1st HR	0.99	Signal					17.6	B	0.74	-
A42	SW 4th Ave./SW Caruthers St./SW Broadway Ave.	1	PBOT 1st HR	0.99	Signal					17.7	B	0.70	-
A45	SW 4th Ave./SW Barbur Blvd./SW Sheridan St.	1	PBOT 1st HR	0.99	Signal					16.1	B	0.64	-
A48	SW 1st Ave./SW Arthur St.	1	PBOT 1st HR	0.99	Signal					29.1	C	0.87	-
A56	SW Kelly Ave./SW Porter St./SW Hood Ave.	1	ODOT Ramp	0.85	Signal					1.1 [10.7]	A [B]	0.15	SBL
A61	Ross Island Br./SW Naito Pkwy.	N/A	ODOT/PBOT 1st HR	0.99	TWSC					**252.2 [>300]**	**F [F]**	**>2.0**	**SBLn1**
A62	Ross Island Br./SW Kelly Ave. ramps	1	ODOT/PBOT 1st HR	0.99	TWSC					**>300 [>300]**	**F [F]**	**>2.0**	**NBRn1**
A69	SW Naito Pkwy./SW Gibbs St./SW Naito Pkwy. ramps	1	ODOT/PBOT 1st HR	0.99	Signal					7.1 [18.1]	A [C]	0.65	WBRn1
A78	SW Barbur Blvd./SW Naito Pkwy./Ped. crossing	1	ODOT/PBOT 1st HR	0.99	Signal					35.8	D	0.96	-
A80	SW Barbur Blvd./ SW Bancroft St.	1	ODOT/PBOT 1st HR	0.99	Signal					25.9	C	0.90	-
A81	SW Corbett Blvd./ SW Bancroft St.	1	PBOT 1st HR	0.99	Signal					38.3	D	0.69	-
A82/A84	SW Barbur Blvd. / SW Hamilton St	1	ODOT/PBOT 1st HR	0.99	Signal					30.5	C	0.95	-
A83	SW Corbett St./ SW Hamilton St.	1	PBOT 1st HR	0.99	Signal					36.7	C	0.75	-

Key: Worst Major [Worst stop-controlled delay] for TWSC intersections.
V/C represents intersection average for signals and worst movement for stop control intersections.
HR = hour; Ln = lane; PBOT = Portland Bureau of Transportation; EB = eastbound; NB = northbound; R = right; SB = southbound; WB = westbound.
1. Intersection analysis completed as part of 2016 SWC study with review by ODOT, PBOT and Metro.

As shown in Table 3.3-13, all AM study area intersections analyzed met mobility targets for Alternative A1, however two intersections were identified for Alternative A2-BH that do not meet the mobility target under AM peak-hour conditions, and would be expected to also not meet the mobility target for Alternative A1.

AM Peak Hour (see Alternative A2-BH):

- **SW Barbur Boulevard at SW Bancroft Street.** This new signal would fail to meet mobility targets under future volume conditions, primarily because of the conflict between increased northbound though volumes and the heavy southbound left-turn movement shifted to this intersection from SW Barbur Boulevard and SW Hamilton Street.

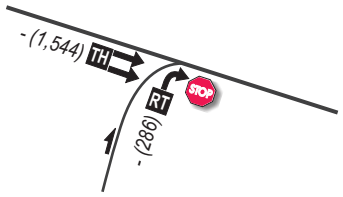
- **SW Barbur Boulevard at SW Hamilton Street.** This intersection would fail to meet mobility targets because of higher northbound through volumes and a capacity reduction from three to two northbound lanes.

The HCM analysis indicated the following intersections as failing to meet mobility targets under PM peak-hour conditions:

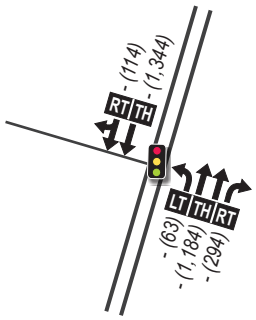
- **SW Naito Parkway northbound ramp to Ross Island Bridge.** This intersection would continue to operate above the mobility target.
- **SW Kelly Avenue Ramps and Ross Island Bridge.** This intersection would continue to operate above the mobility target.

As indicated in previous sections, these operations results do not account for queue spillback at some of the key study area bottlenecks, such as the Ross Island Bridgehead and I-405 northbound on-ramp. The impacts of these bottlenecks will be discussed further in the Build Alternatives Simulation Queuing and Operations sections.

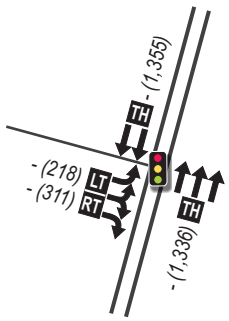
A2. *SW Naito Pkwy. On-Ramp @ Hawthorne Brg.*



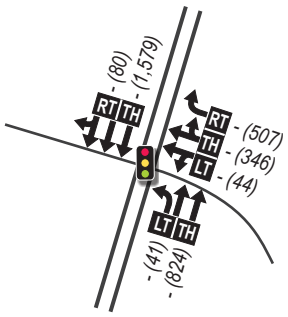
A3. *SW Naito Pkwy. @ SW Jefferson St.*



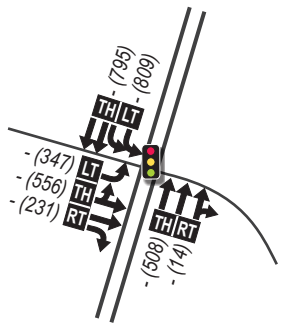
A4. *SW Naito Pkwy. @ SW Columbia St.*



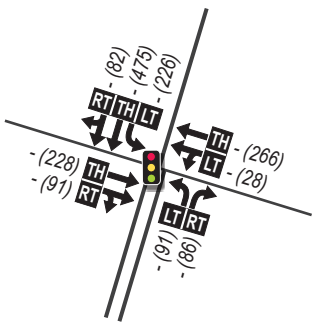
A6. *SW Naito Pkwy. @ SW Clay St.*



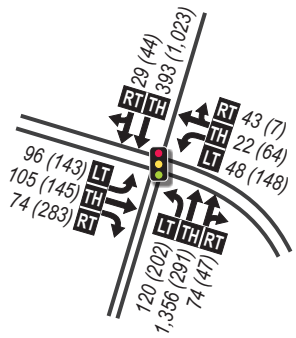
A8. *SW Naito Pkwy. @ SW Market St.*



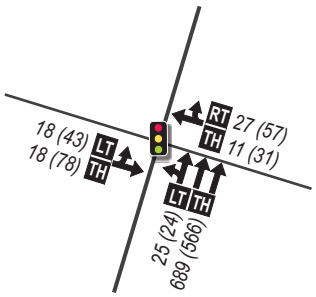
A12. *SW 1st Ave. @ SW Harrison St.*



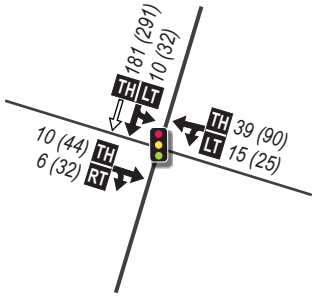
A13. *SW Naito Pkwy. @ SW Harrison St.*



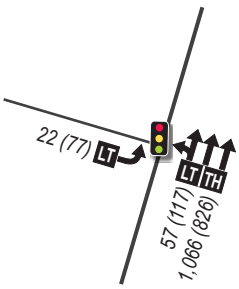
A19. *SW 6th Ave. @ SW Hall St.*



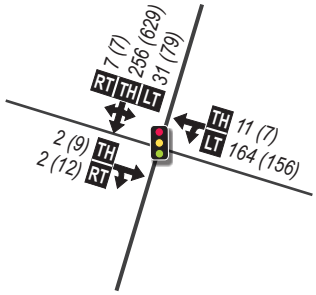
A20. *SW 5th Ave. @ SW Hall St.*



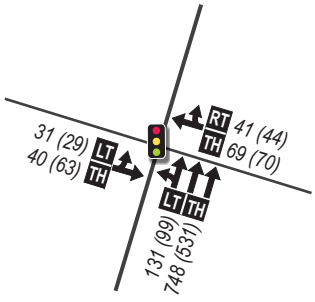
A21. *SW 4th Ave. @ SW Hall St.*



A22. *SW Broadway @ SW College St.*



A23. *SW 6th Ave. @ SW College St.*



LEGEND

00. - Study Intersection No.
STOP - Stop Sign
- Yield Sign
- Traffic Signal
- Lane Configuration
- Bus Only Lane
AM (PM) - Peak Hour Traffic Volumes
LT TH RT - Volume Turn Movement
Left•Thru•Right

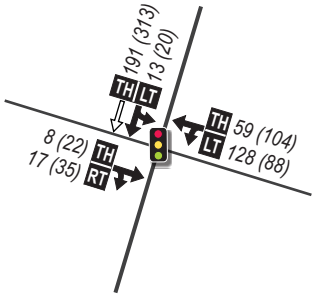
DKS

No Scale

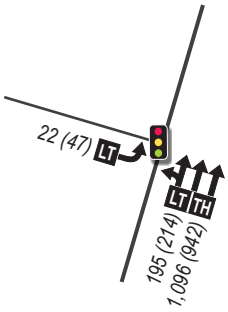
figure **3.3-14a**

2035 Light Rail Alternative
A1: Barbur AM/PM Peak Hour
Segment A: Inner Portland

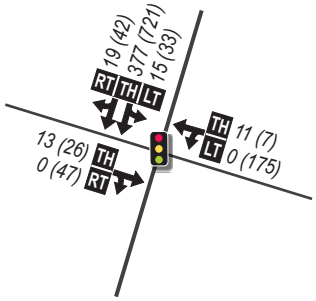
A24. *SW 5th Ave. @ SW College St.*



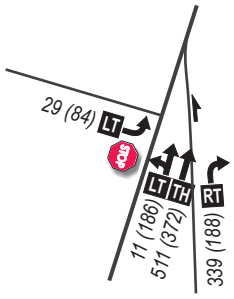
A25. *SW 4th Ave. @ SW College St.*



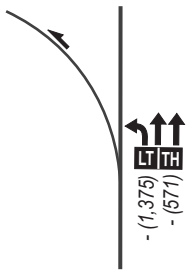
A26. *SW Broadway @ SW Jackson St.*



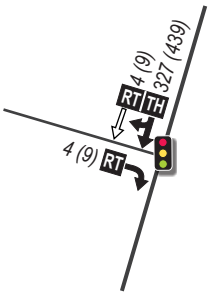
A27. *SW 6th Ave. @ SW Jackson St./ I-405 Off-Ramp*



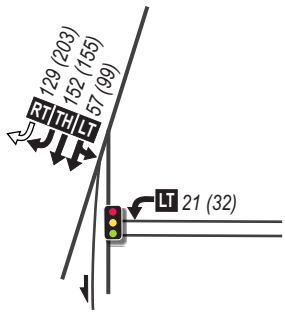
A28. *SW 6th Ave. @ I-405/Hwy. 26 On-Ramp*



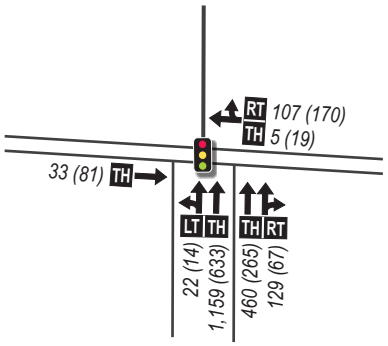
A29. *SW 5th Ave. @ SW Jackson St.*



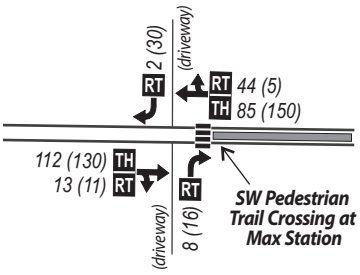
A30. *SW 5th Ave./I-405 On-Ramp @ SW Lincoln St.*



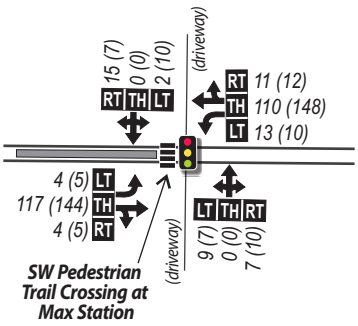
A31. *SW 4th Ave./I-405 WB Off-Ramp @ SW Lincoln St.*



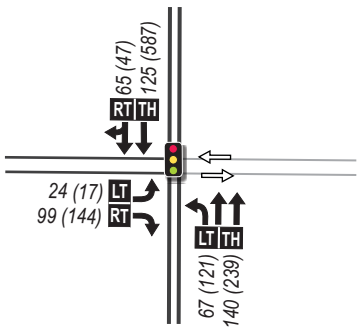
A32. *SW 3rd Ave. @ SW Lincoln St.*



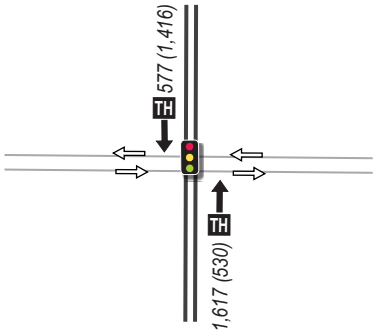
A33. *SW 2nd Ave. @ SW Lincoln St.*



A34. *SW 1st Ave. @ SW Lincoln St.*



A35. *SW Naito Pkwy. @ SW Lincoln St.*



LEGEND

00. - Study Intersection No.
STOP - Stop Sign
- Yield Sign
- Traffic Signal
- Lane Configuration
- Bus Only Lane
AM (PM) - Peak Hour Traffic Volumes
LT TH RT - Volume Turn Movement
Left•Thru•Right

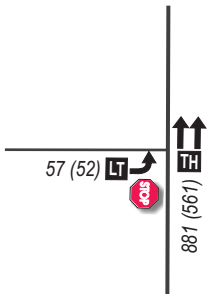
DKS

No Scale

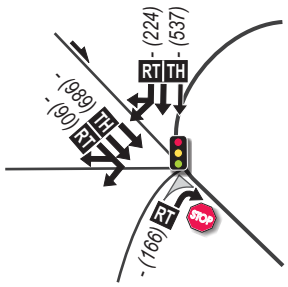
figure **3.3-14b**

2035 Light Rail Alternative
A1: Barbur AM/PM Peak Hour
Segment A: Inner Portland

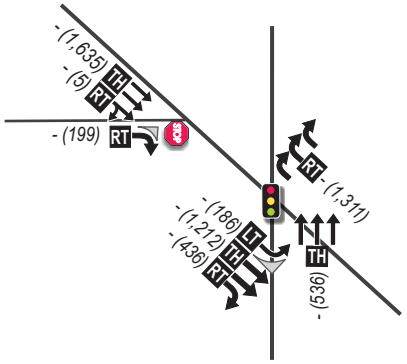
A36. *SW 4th Ave. @ SW Grant St.*



A37. *SW Broadway @ I-405/SW Lincoln St.*

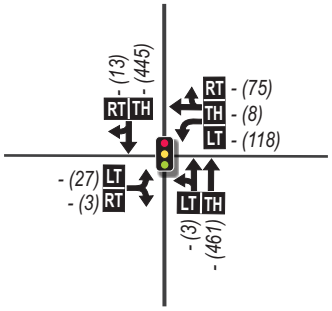


A38. *SW Broadway/SW Grant St. @ SW 6th Ave.*

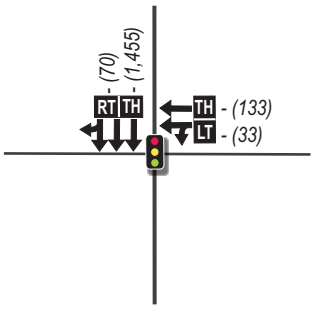


A39. *SW Broadway @ SW 5th Ave.*

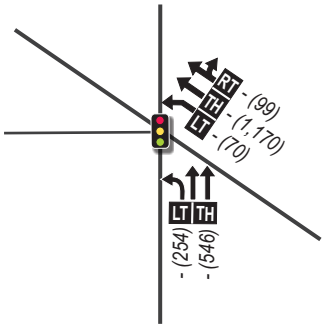
A40. *SW 6th Ave. @ SW Caruthers St.*



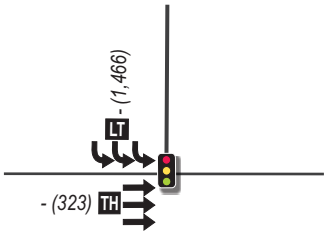
A41. *SW 5th Ave. @ SW Caruthers St.*



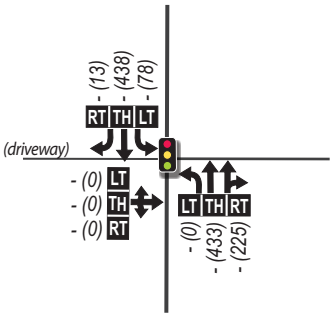
A42. *SW 4th Ave. @ SW Caruthers St./ SW Broadway*



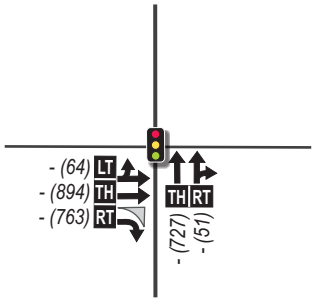
A43. *SW 5th Ave. @ SW Sheridan St.*



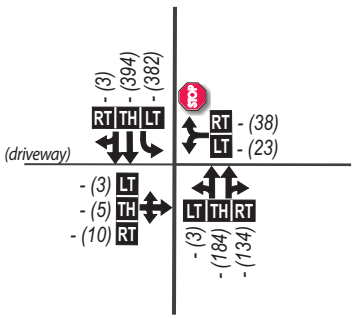
A44. *SW 6th Ave./SW Terwilliger Blvd. @ SW Sheridan St.*



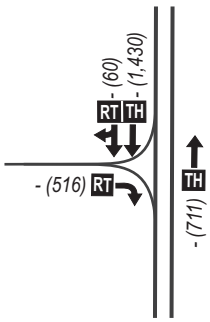
A45. *SW 4th Ave./SW Barbur Blvd. @ SW Sheridan St.*



A46. *SW 1st Ave. @ SW Sheridan St.*



A47. *SW Naito Pkwy. @ SW Sheridan St.*



LEGEND

00. - Study Intersection No.
STOP - Stop Sign
YIELD - Yield Sign
- Traffic Signal
- Lane Configuration
- Bus Only Lane
AM (PM) - Peak Hour Traffic Volumes
LT TH RT - Volume Turn Movement
Left•Thru•Right

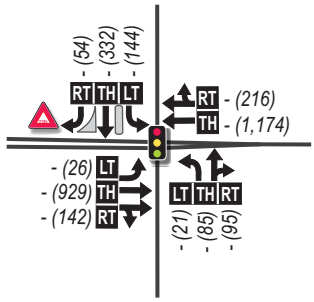
DKS

No Scale

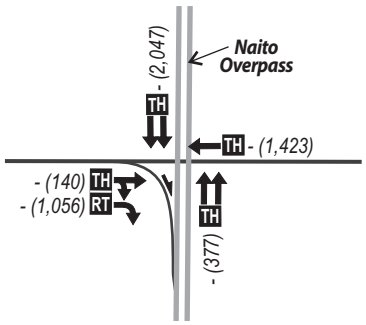
figure **3.3-14c**

2035 Light Rail Alternative
A1: Barbur AM/PM Peak Hour
Segment A: Inner Portland

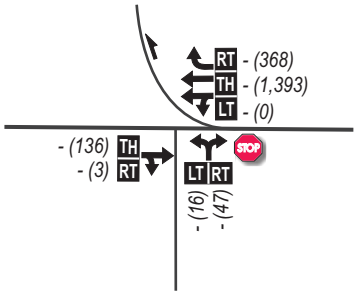
A48. *SW 1st Ave. @ SW Arthur St.*



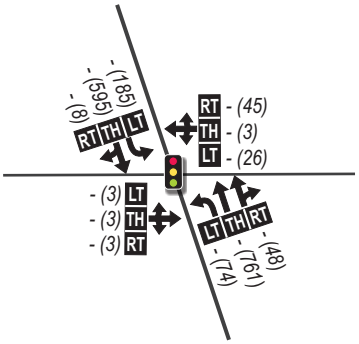
A49. *SW Naito Pkwy. @ SW Arthur St.*



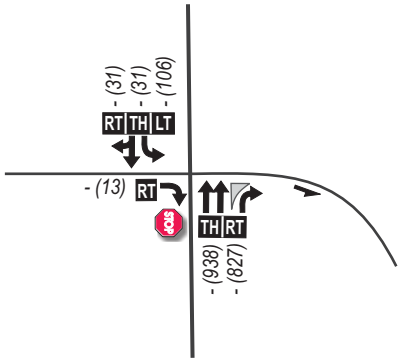
A50. *SW Naito Pkwy. @ SW Kelly St.*



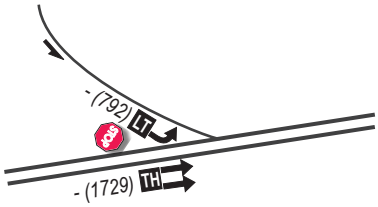
A52. *SW Barbur Blvd. @ SW Hooker St.*



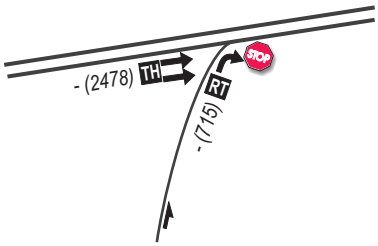
A56. *SW Kelly St. @ SW Porter St./SW Hood Ave.*



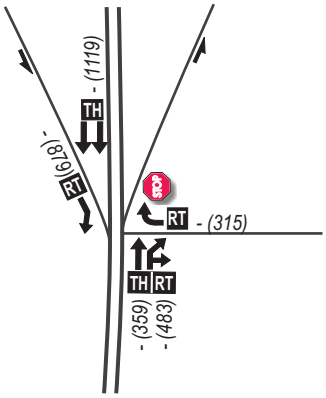
A61. *Ross Island Brg. @ Naito Pkwy.*



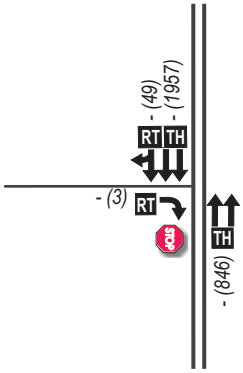
A62. *Ross Island Brg. @ Kelly Ramps*



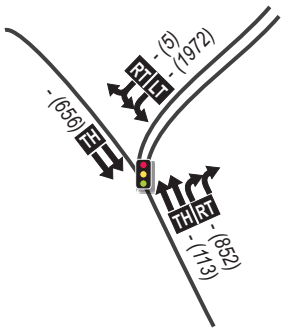
A69. *SW Naito Pkwy. @ Gibbs/Naito Ramps*



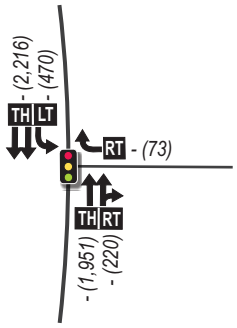
A72. *SW Naito Pkwy. @ SW Whitaker St.*



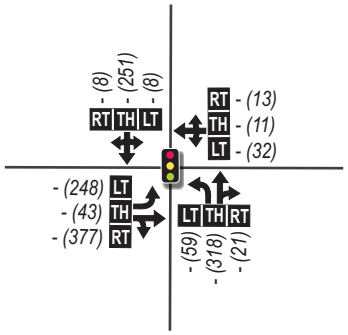
A78. *SW Barbur Blvd. @ SW Naito Pkwy.*



A80. *SW Barbur Blvd. @ SW Bancroft St.*



A81. *SW Corbett Blvd. @ SW Bancroft St.*



LEGEND

00. - Study Intersection No.
STOP - Stop Sign
- Yield Sign
- Traffic Signal
- Lane Configuration
- Bus Only Lane
AM (PM) - Peak Hour Traffic Volumes
LT TH RT - Volume Turn Movement
Left•Thru•Right

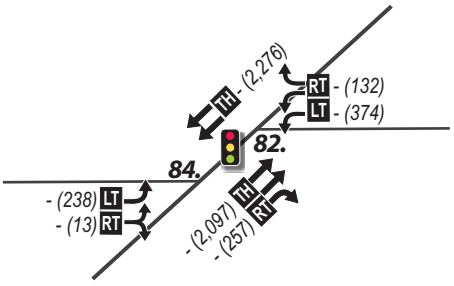
DKS

No Scale

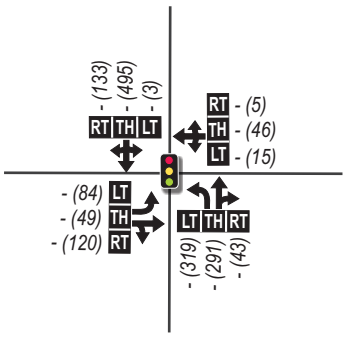
figure **3.3-14d**

2035 Light Rail Alternative
A1: Barbur AM/PM Peak Hour
Segment A: Inner Portland

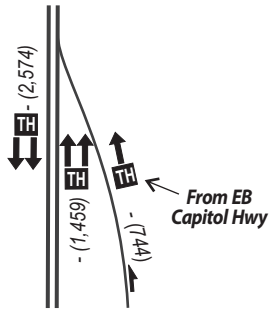
A82. *SW Barbur Blvd. @ SW Hamilton St. (East)*
A84. *SW Barbur Blvd. @ SW Hamilton St. (West)*



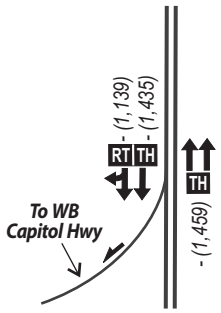
A83. *SW Hamilton Blvd. @ SW Corbett Ave.*



A85. *SW Barbur Blvd. @ SW Capitol Hwy. EB*



A86. *SW Barbur Blvd. @ SW Capitol Hwy. WB*



LEGEND

00. - Study Intersection No.
STOP - Stop Sign
- Yield Sign
- Traffic Signal
- Lane Configuration
- Bus Only Lane
AM (PM) - Peak Hour Traffic Volumes
LT TH RT - Volume Turn Movement
Left•Thru•Right

DKS

No Scale

figure **3.3-14e**

2035 Light Rail Alternative
A1: Barbur AM/PM Peak Hour
Segment A: Inner Portland

Alternative A2-BH: Naito with Bridgehead Reconfiguration

Alternative A2-BH is described in Section 3.3.1. Both the AM Synchro analysis and the PM Synchro analysis for Alternative A2-BH are shown in Table 3.3-14. Intersections that do not meet the mobility target are shaded gray for each failing peak hour. The peak- hour forecasted volumes for Alternative A2-BH are shown graphically in Figure 3.3-15.

Table 3.3-14. Alternative A2-BH: Naito with Bridgehead, 2035 HCM (Synchro) Analysis

					2035 Alternative A2-BH: Naito with Bridgehead								
						AM				PM			
ID	Intersection	Note	Mobility Target		Control	Delay	LOS	V/C	WLANE	Delay	LOS	V/C	WLANE
A2	SW Naito Pkwy. on-ramp/Hawthorne Br.	1	PBOT 2nd HR	0.99	TWSC	PM Only				10.5 [70.3]	B [F]	0.92	NBLn1
A12	SW 1st Ave./SW Harrison St.	1	PBOT 2nd HR	0.99	Signal					22.2	C	0.58	-
A13	SW Naito Pkwy./ SW Harrison St.	1	PBOT 2nd HR	0.99	Signal					35.4	D	0.78	-
A21	SW 4th Ave./SW Hall St.	1	PBOT 2nd HR	0.99	Signal					27.0	C	0.35	-
A25	SW 4th Ave./SW College St.	1	PBOT 2nd HR	0.99	Signal					8.6	A	0.38	-
A27	SW 6th Ave./SW Jackson St./I-405 northbound off-ramp	1	ODOT Ramp	0.85	TWSC					4.8 [24.7]	A [C]	0.25	EBLn1
A31	SW 4th Ave./I-405 northbound off-ramp/SW Lincoln St.	1	ODOT Ramp	0.85	Signal					15.1	B	0.48	-
A34	SW 1st Ave./SW Lincoln St.	1	PBOT 2nd HR	0.99	Signal					23.5	C	0.51	-
A35	SW Naito Pkwy./ SW Lincoln St.	1	PBOT 2nd HR	0.99	Signal					33.7	C	0.88	-
A37	SW Broadway Ave./ I-405 southbound off-ramps/SW Lincoln St.	1	ODOT Ramp	0.85	Signal					18.5	B	0.60	-
A38	SW Broadway Ave./SW Grant St./SW 6th Ave.	1	PBOT 1st HR	0.99	Signal					18.4	B	0.82	-
A39	SW Broadway Ave./SW 5th Ave.	1	PBOT 1st HR	0.99	Signal					21.6	C	0.75	-
A42	SW 4th Ave./SW Caruthers St./SW Broadway Ave.	1	PBOT 1st HR	0.99	Signal					29.3	C	0.71	-
A45	SW 4th Ave./SW Barbur Blvd./SW Sheridan St.	1	PBOT 1st HR	0.99	Signal					13.4	B	0.66	-
A48	SW 1st Ave./SW Arthur St.	1	PBOT 1st HR	0.99	Signal					40.9	D	0.85	-
A56	SW Kelly Ave./SW Porter St./SW Hood Ave.	1	ODOT Ramp	0.85	Signal	20.5	C	0.54	-	25.2	C	0.77	-
A61	Ross Island Br. (SW Woods St.)/SW Naito Pkwy.	1	ODOT/PBOT 1st HR	0.99	Signal	18.5	B	0.87	-	26.3	C	0.89	-
A62	Ross Island Br./SW Kelly Ave. ramp	1	ODOT/PBOT 1st HR	0.99	Signal	26.3	C	0.66	-	44.8	D	0.99	-

ID	Intersection	Note	Mobility Target		2035 Alternative A2-BH: Naito with Bridgehead								
						AM				PM			
					Control	Delay	LOS	V/C	WLANE	Delay	LOS	V/C	WLANE
A69	SW Naito Pkwy./SW Gibbs St.	1	ODOT/PBOT 1st HR	0.99	Signal	27.3	C	0.71	-	24.9	C	0.90	-
A78	SW Barbur Blvd./SW Naito Pkwy.	1	ODOT/PBOT 1st HR	0.99	Signal	44.3	D	0.95	-	33.7	C	0.89	-
A80	SW Barbur Blvd./ SW Bancroft St.	1	ODOT/PBOT 1st HR	0.99	Signal	**54.2**	**D**	**1.10**	**-**	24.3	C	0.84	-
A81	SW Corbett Blvd. SW Bancroft St.	1	PBOT 1st HR	0.99	Signal	28.5	C	0.48	-	28.6	C	0.42	-
A82/A84	SW Barbur Blvd./ SW Hamilton St.	1	ODOT/PBOT 1st HR	0.99	Signal	**63.7**	**E**	**1.09**	**-**	28.1	C	0.97	-
A83	SW Corbett St./SW Hamilton St.	1	PBOT 1st HR	0.99	Signal	43.3	D	0.89	-	29.5	C	0.63	-

Key: Worst Major [Worst stop-controlled delay] for TWSC intersections.
V/C represents intersection average for signals and worst movement for stop control intersections.
HR = hour; Ln = lane; PBOT = Portland Bureau of Transportation; EB = eastbound; NB = northbound.
1. Intersection analysis completed as part of 2016 SWC study with review by ODOT, PBOT and Metro.

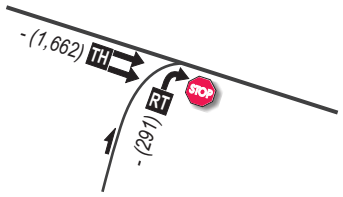
As shown in Table 3.3-14, analysis based on the 2010 HCM indicates that the following intersections would fail to meet mobility targets in 2035 for Alternative A2-BH.

AM Peak Hour:

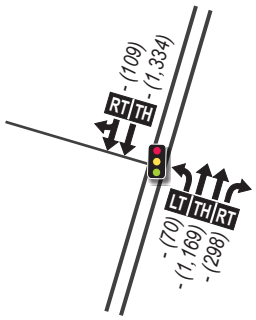
- **SW Barbur Boulevard at SW Bancroft Street.** This new signal would fail to meet mobility targets under future volume conditions, primarily because of the conflict between increased northbound though volumes and the heavy southbound left-turn movement shifted to this intersection from SW Barbur Boulevard and SW Hamilton Street.
- **SW Barbur Boulevard at SW Hamilton Street.** This intersection would fail to meet mobility targets because of higher northbound through volumes and a capacity reduction from three to two northbound lanes.

As indicated in previous sections, these operations results do not account for queue spillback at some of the key study area bottlenecks, such as the I-405 northbound on-ramp. The impacts of these bottlenecks will be discussed further in the Build Alternatives Simulation Queuing and Operations sections.

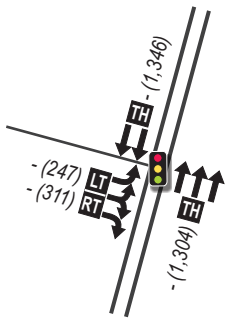
A2. *SW Naito Pkwy. On-Ramp @ Hawthorne Brg.*



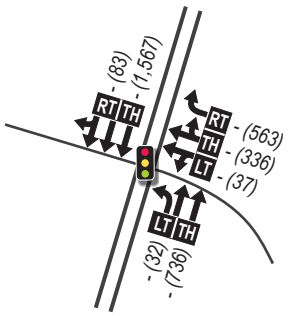
A3. *SW Naito Pkwy. @ SW Jefferson St.*



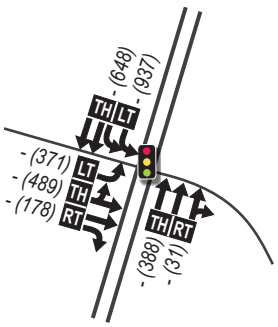
A4. *SW Naito Pkwy. @ SW Columbia St.*



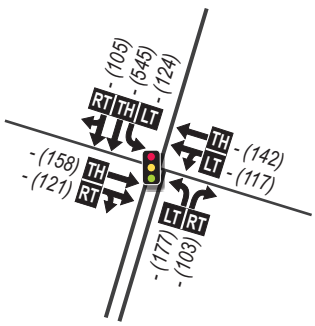
A6. *SW Naito Pkwy. @ SW Clay St.*



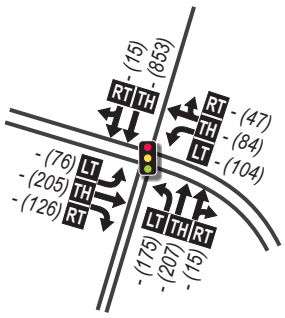
A8. *SW Naito Pkwy. @ SW Market St.*



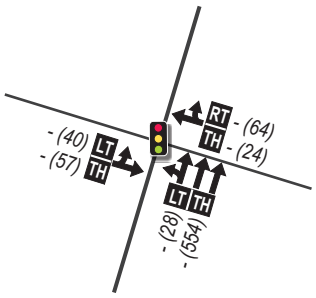
A12. *SW 1st Ave. @ SW Harrison St.*



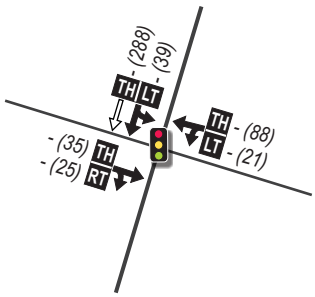
A13. *SW Naito Pkwy. @ SW Harrison St.*



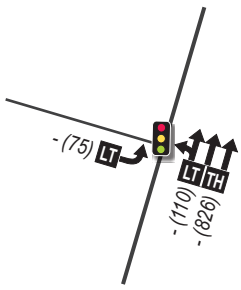
A19. *SW 6th Ave. @ SW Hall St.*



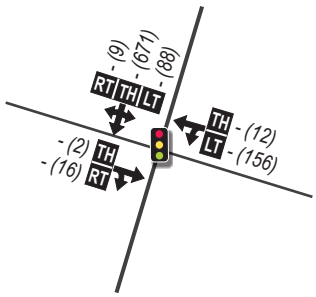
A20. *SW 5th Ave. @ SW Hall St.*



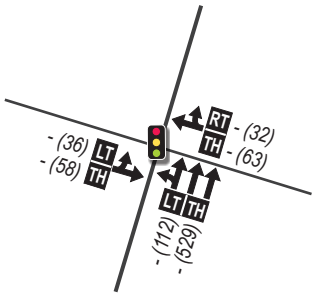
A21. *SW 4th Ave. @ SW Hall St.*



A22. *SW Broadway @ SW College St.*



A23. *SW 6th Ave. @ SW College St.*



LEGEND

00. - Study Intersection No.
STOP - Stop Sign
- Yield Sign
- Traffic Signal
- Lane Configuration
- Bus Only Lane
AM (PM) - Peak Hour Traffic Volumes
LT TH RT - Volume Turn Movement
Left•Thru•Right

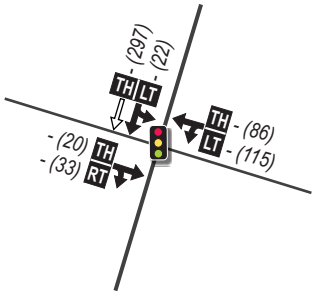
DKS

No Scale

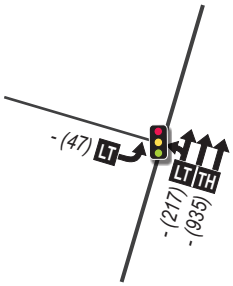
figure **3.3-15a**

2035 Light Rail Alternative
A2: Naito with Bridgehead AM/PM Peak Hour
Segment A: Inner Portland

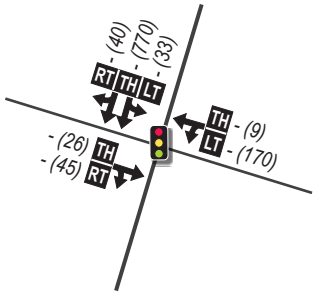
A24. *SW 5th Ave. @ SW College St.*



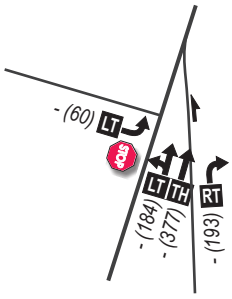
A25. *SW 4th Ave. @ SW College St.*



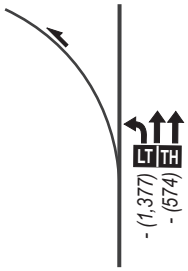
A26. *SW Broadway @ SW Jackson St.*



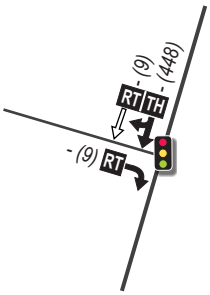
A27. *SW 6th Ave. @ SW Jackson St./ I-405 Off-Ramp*



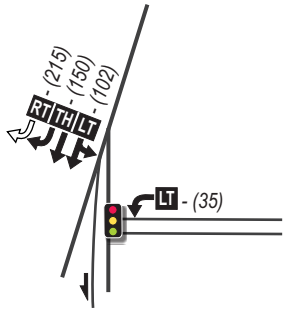
A28. *SW 6th Ave. @ I-405/Hwy. 26 On-Ramp*



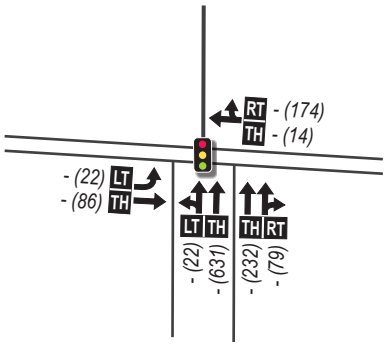
A29. *SW 5th Ave. @ SW Jackson St.*



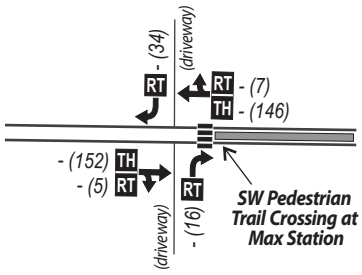
A30. *SW 5th Ave./I-405 On-Ramp @ SW Lincoln St.*



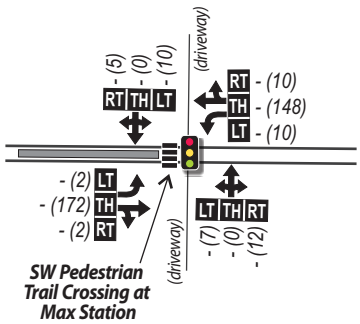
A31. *SW 4th Ave./I-405 WB Off-Ramp @ SW Lincoln St.*



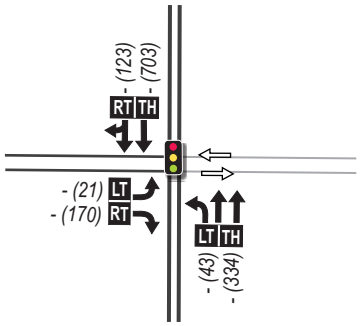
A32. *SW 3rd Ave. @ SW Lincoln St.*



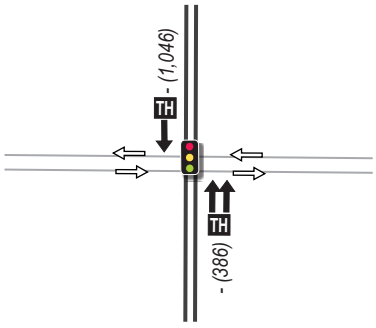
A33. *SW 2nd Ave. @ SW Lincoln St.*



A34. *SW 1st Ave. @ SW Lincoln St.*



A35. *SW Naito Pkwy. @ SW Lincoln St.*



LEGEND

00. - Study Intersection No.
STOP - Stop Sign
- Yield Sign
- Traffic Signal
- Lane Configuration
- Bus Only Lane
AM (PM) - Peak Hour Traffic Volumes
LT TH RT - Volume Turn Movement
Left•Thru•Right

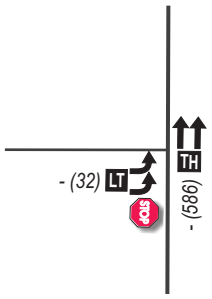
DKS

No Scale

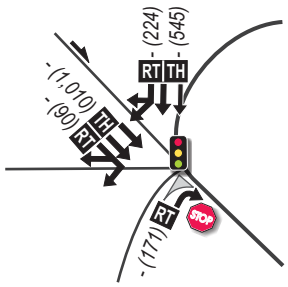
figure **3.3-15b**

2035 Light Rail Alternative
A2: Naito with Bridgehead AM/PM Peak Hour
Segment A: Inner Portland

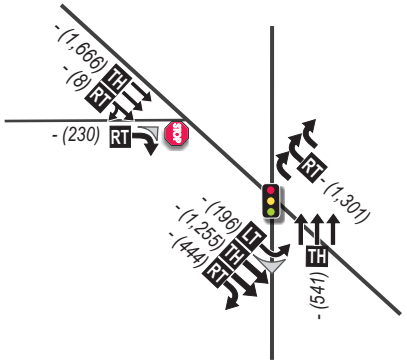
A36. *SW 4th Ave. @ SW Grant St.*



A37. *SW Broadway @ I-405/SW Lincoln St.*

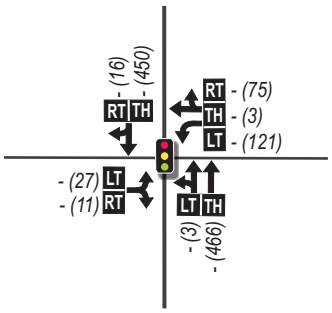


A38. *SW Broadway/SW Grant St. @ SW 6th Ave.*

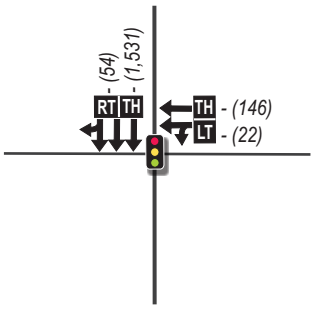


A39. *SW Broadway @ SW 5th Ave.*

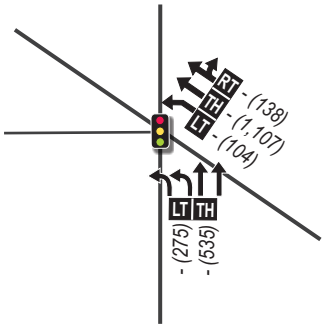
A40. *SW 6th Ave. @ SW Caruthers St.*



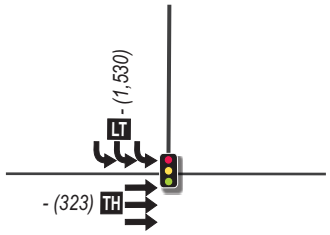
A41. *SW 5th Ave. @ SW Caruthers St.*



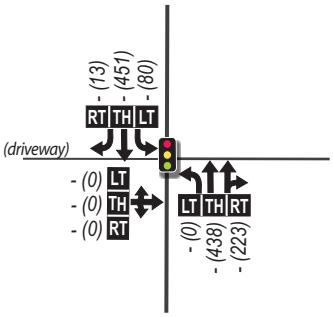
A42. *SW 4th Ave. @ SW Caruthers St./ SW Broadway*



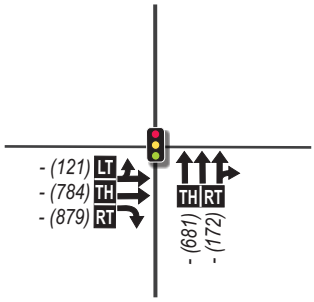
A43. *SW 5th Ave. @ SW Sheridan St.*



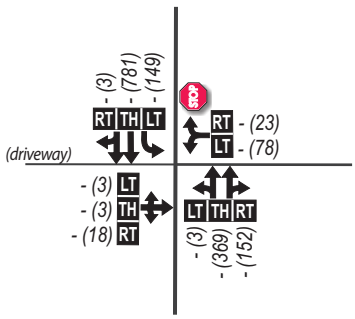
A44. *SW 6th Ave./SW Terwilliger Blvd. @ SW Sheridan St.*



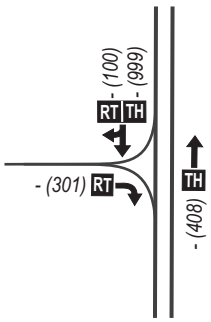
A45. *SW 4th Ave./SW Barbur Blvd. @ SW Sheridan St.*



A46. *SW 1st Ave. @ SW Sheridan St.*



A47. *SW Naito Pkwy. @ SW Sheridan St.*



LEGEND

00. - Study Intersection No.
STOP - Stop Sign
YIELD - Yield Sign
- Traffic Signal
- Lane Configuration
- Bus Only Lane
AM (PM) - Peak Hour Traffic Volumes
LT TH RT - Volume Turn Movement
Left•Thru•Right

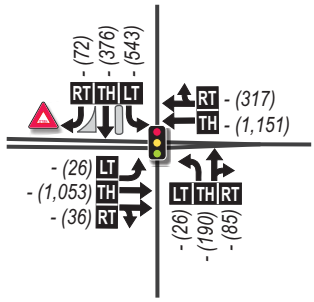
DKS

No Scale

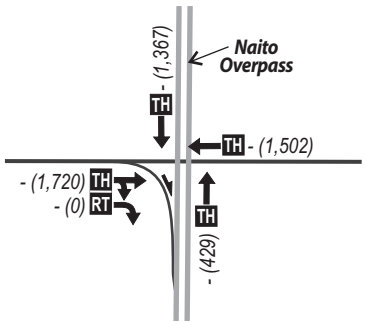
figure **3.3-15c**

2035 Light Rail Alternative
A2: Naito with Bridgehead AM/PM Peak Hour
Segment A: Inner Portland

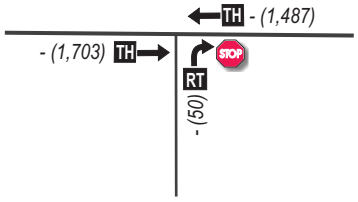
A48. *SW 1st Ave. @ SW Arthur St.*



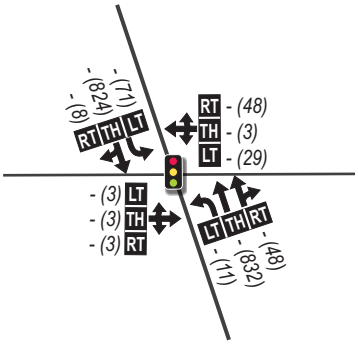
A49. *SW Naito Pkwy. @ SW Arthur St.*



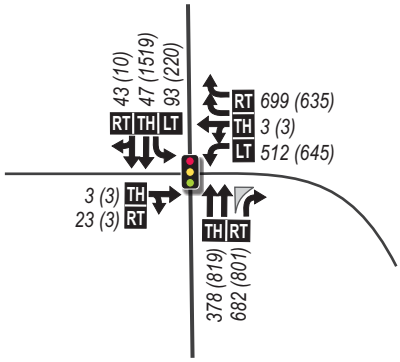
A50. *SW Naito Pkwy. @ SW Kelly St.*



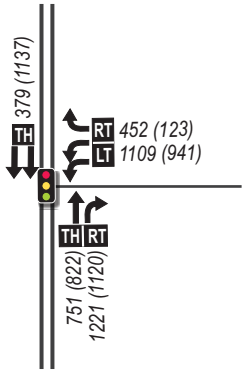
A52. *SW Barbur Blvd. @ SW Hooker St.*



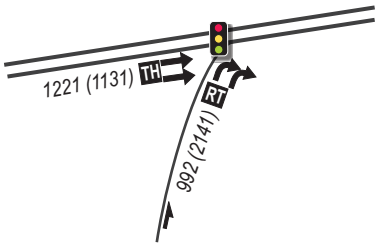
A56. *SW Kelly St. @ SW Porter St./SW Hood Ave.*



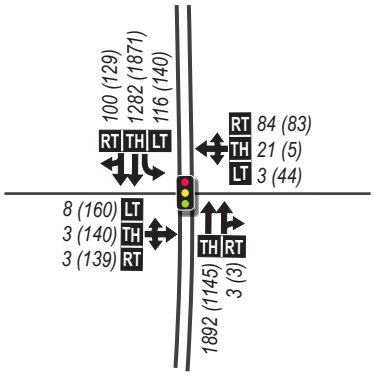
A61. *Ross Island Brg. @ Naito Pkwy.*



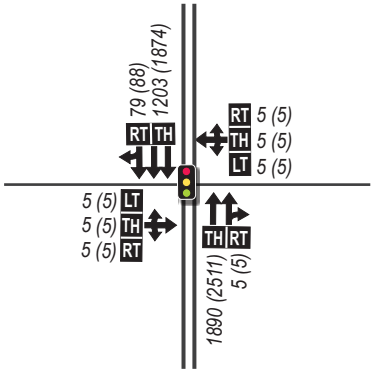
A62. *Ross Island Brg. @ Kelly Ramps*



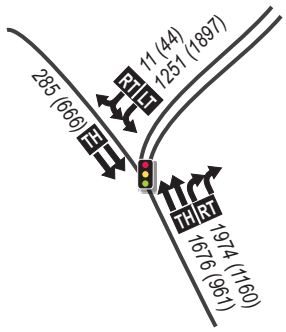
A69. *SW Naito Pkwy. @ Gibbs/Naito Ramps*



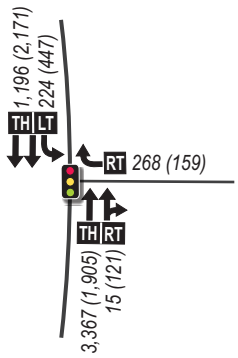
A72. *SW Naito Pkwy. @ SW Whitaker St.*



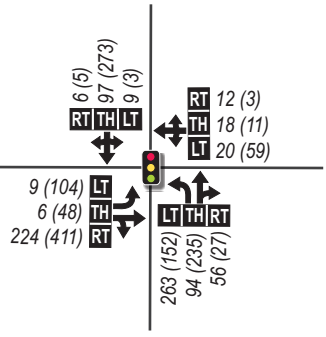
A78. *SW Barbur Blvd. @ SW Naito Pkwy.*



A80. *SW Barbur Blvd. @ SW Bancroft St.*



A81. *SW Corbett Blvd. @ SW Bancroft St.*



LEGEND

00. - Study Intersection No.
STOP - Stop Sign
- Yield Sign
- Traffic Signal
- Lane Configuration
- Bus Only Lane
AM (PM) - Peak Hour Traffic Volumes
LT TH RT - Volume Turn Movement
Left•Thru•Right

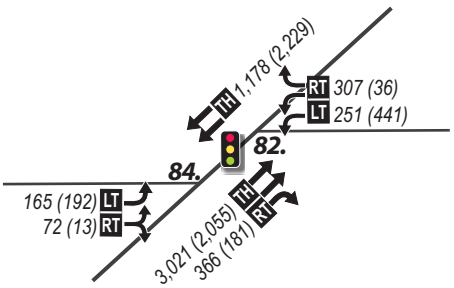
DKS

No Scale

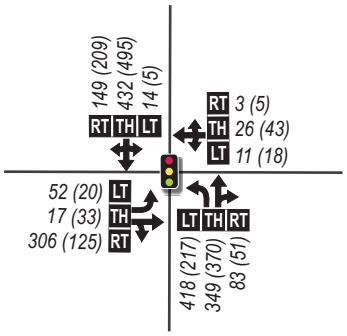
figure **3.3-15d**

2035 Light Rail Alternative
A2: Naito with Bridgehead AM/PM Peak Hour
Segment A: Inner Portland

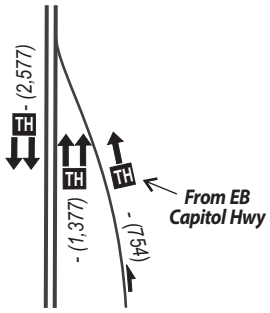
A82. *SW Barbur Blvd. @ SW Hamilton St. (East)*
A84. *SW Barbur Blvd. @ SW Hamilton St. (West)*



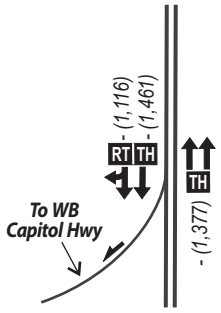
A83. *SW Hamilton Blvd. @ SW Corbett Ave.*



A85. *SW Barbur Blvd. @ SW Capitol Hwy. EB*



A86. *SW Barbur Blvd. @ SW Capitol Hwy. WB*



LEGEND

00. - Study Intersection No.
STOP - Stop Sign
- Yield Sign
- Traffic Signal
- Lane Configuration
- Bus Only Lane
AM (PM) - Peak Hour Traffic Volumes
LT TH RT - Volume Turn Movement
Left•Thru•Right

DKS

No Scale

figure **3.3-15e**

2035 Light Rail Alternative
A2: Naito with Bridgehead AM/PM Peak Hour
Segment A: Inner Portland

Alternative A2-LA: Naito with Limited Access

Alternative A2-LA is described in Section 3.3.1. The PM Synchro analysis for Alternative A2-LA is shown in Table 3.3-15. Intersections that do not meet the mobility target are shaded gray for each failing peak hour. The peak-hour forecasted volumes for Alternative A2-LA are shown graphically in Figure 3.3-16.

Table 3.3-15. Alternative A2-LA: Naito with Limited Access, 2035 HCM (Synchro) Analysis

					2035 Alternative A2-LA: Naito Limited Access				
						PM			
ID	Intersection	Note	Mobility Target		Control	Delay	LOS	V/C	WLANE
A2	SW Naito Pkwy. on-ramp / Hawthorne Br.	1	PBOT 2nd HR	0.99	TWSC	10.9 [74.2]	B [F]	0.94	NBLn1
A12	SW 1st Ave./SW Harrison St.	1	PBOT 2nd HR	0.99	Signal	16.1	B	0.49	-
A13	SW Naito Pkwy./SW Harrison St.	1	PBOT 2nd HR	0.99	Signal	**73.7**	**E**	**1.01**	**-**
A21	SW 4th Ave./SW Hall St.	1	PBOT 2nd HR	0.99	Signal	20.2	C	0.35	-
A25	SW 4th Ave./SW College St.	1	PBOT 2nd HR	0.99	Signal	10.0	A	0.34	-
A27	SW 6th Ave./SW Jackson St./I-405 northbound off-ramp	1	ODOT Ramp	0.85	TWSC	5.9 [26.7]	A [D]	0.32	EBLn1
A31	SW 4th Ave./I-405 northbound off-ramp/SW Lincoln St.	1	ODOT Ramp	0.85	Signal	12.3	B	0.47	-
A34	SW 1st Ave./SW Lincoln St.	1	PBOT 2nd HR	0.99	Signal	32.6	C	0.43	-
A35	SW Naito Pkwy./SW Lincoln St.	1	PBOT 2nd HR	0.99	Signal	10.7	B	0.63	-
A37	SW Broadway Ave./I-405 southbound off-ramp/SW Lincoln St.	1	ODOT Ramp	0.85	Signal	18.4	B	0.60	-
A38	SW Broadway Ave./SW Grant St./ SW 6th Ave.	1	PBOT 1st HR	0.99	Signal	17.3	B	0.80	-
A39	SW Broadway Ave./SW 5th Ave.	1	PBOT 1st HR	0.99	Signal	21.9	C	0.73	-
A42	SW 4th Ave./SW Caruthers St./SW Broadway Ave.	1	PBOT 1st HR	0.99	Signal	36.0	D	0.70	-
A45	SW 4th Ave./SW Barbur Blvd./SW Sheridan St.	1	PBOT 1st HR	0.99	Signal	13.9	B	0.60	-
A48	SW 1st Ave./SW Arthur St.	1	PBOT 1st HR	0.99	Signal	27.9	C	0.86	-
A56	SW Kelly Ave./SW Porter St./SW Hood Ave.	1	ODOT Ramp	0.85	TWSC	1.1 [10.8]	A [B]	0.15	SBL
A61	Ross Island Br./SW Naito Pkwy.	1	ODOT/PBOT 1st HR	0.99	TWSC	**279 [>300]**	**F [F]**	**>2.0**	**SBLn1**
A62	Ross Island Br./SW Kelly Ave. ramps	1	ODOT/PBOT 1st HR	0.99	TWSC	**>300 [>300]**	**F [F]**	**>2.0**	**NBRn1**
A69	SW Naito Pkwy. /SW Gibbs St./SW Naito Pkwy. ramps	1	ODOT/PBOT 1st HR	0.99	Signal	**62.5**	**E**	**1.00**	**-**
A78	SW Barbur Blvd./SW Naito Pkwy./ped. crossing	1	ODOT/PBOT 1st HR	0.99	Signal	0.1 [14.1]	A [B]	0.03	EBLn1
A80	SW Barbur Blvd./SW Bancroft St.	1	ODOT/PBOT 1st HR	0.99	Signal	7.8	A	0.50	-
A81	SW Corbett Blvd./SW Bancroft St.	1	PBOT 1st HR	0.99	TWSC	72.8 [234.8]	F [F]	1.39	
A82/A84	SW Barbur Blvd./SW Hamilton St.	1	ODOT/PBOT 1st HR	0.99	Signal	**50.6**	**D**	**1.00**	**-**
A83	SW Corbett St./SW Hamilton St.	1	PBOT 1st HR	0.99	Signal	69.5	E	0.64	-

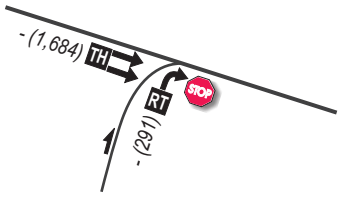
Key: Worst Major [Worst stop-controlled delay] for TWSC intersections.

V/C represents intersection average for signals and worst movement for stop control intersections.

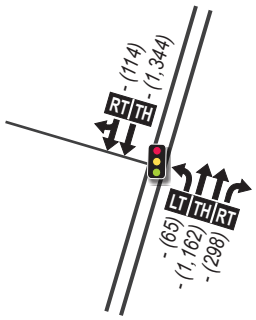
HR = hour; Ln = lane; PBOT = Portland Bureau of Transportation; EB = eastbound; NB = northbound; SB = southbound.

1. Intersection analysis completed as part of 2016 SWC study with review by ODOT, PBOT and Metro.

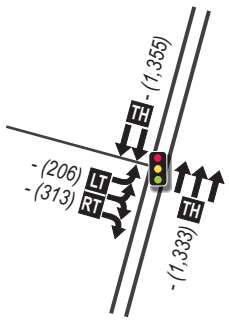
A2. *SW Naito Pkwy. On-Ramp @ Hawthorne Brg.*



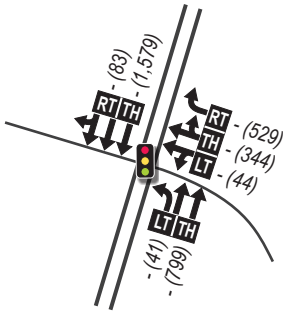
A3. *SW Naito Pkwy. @ SW Jefferson St.*



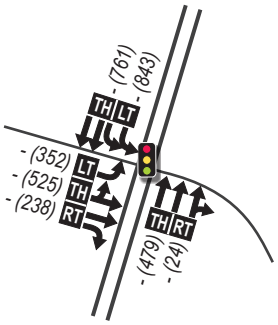
A4. *SW Naito Pkwy. @ SW Columbia St.*



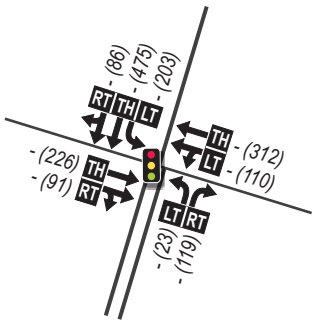
A6. *SW Naito Pkwy. @ SW Clay St.*



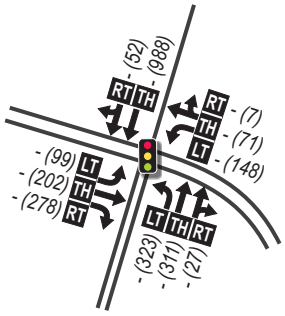
A8. *SW Naito Pkwy. @ SW Market St.*



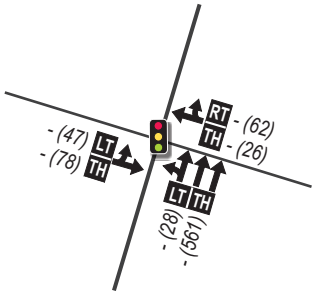
A12. *SW 1st Ave. @ SW Harrison St.*



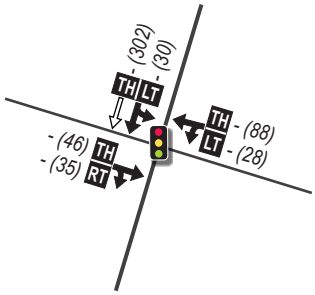
A13. *SW Naito Pkwy. @ SW Harrison St.*



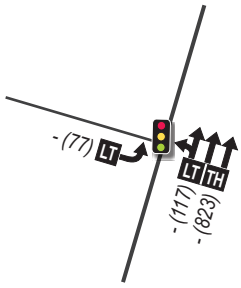
A19. *SW 6th Ave. @ SW Hall St.*



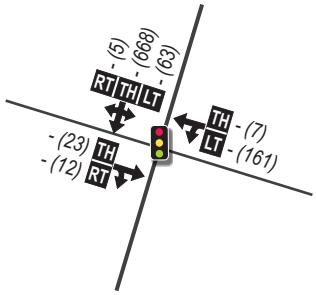
A20. *SW 5th Ave. @ SW Hall St.*



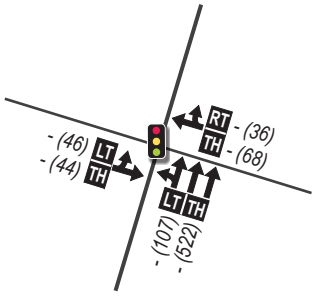
A21. *SW 4th Ave. @ SW Hall St.*



A22. *SW Broadway @ SW College St.*



A23. *SW 6th Ave. @ SW College St.*



LEGEND

00. - Study Intersection No.
STOP - Stop Sign
- Yield Sign
- Traffic Signal
- Lane Configuration
- Bus Only Lane
AM (PM) - Peak Hour Traffic Volumes
LT TH RT - Volume Turn Movement
Left•Thru•Right

DKS

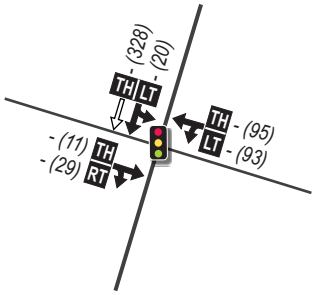
No Scale

figure **3.3-16a**

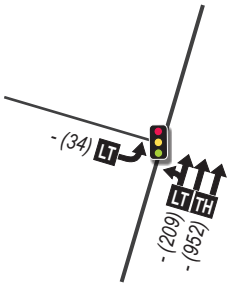
2035 Light Rail Alternative A2-LA:
Naito with Limited Access PM Peak Hour

Segment A: Inner Portland

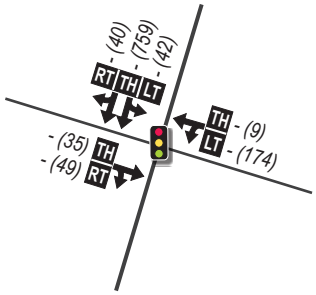
A24. *SW 5th Ave. @ SW College St.*



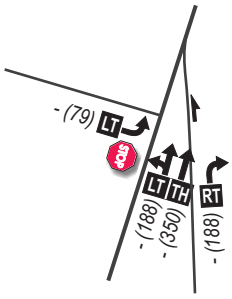
A25. *SW 4th Ave. @ SW College St.*



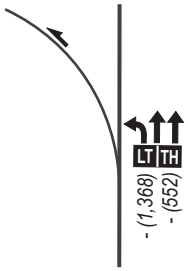
A26. *SW Broadway @ SW Jackson St.*



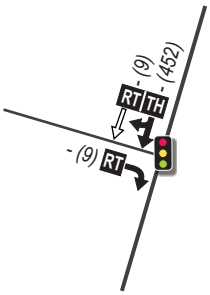
A27. *SW 6th Ave. @ SW Jackson St./ I-405 Off-Ramp*



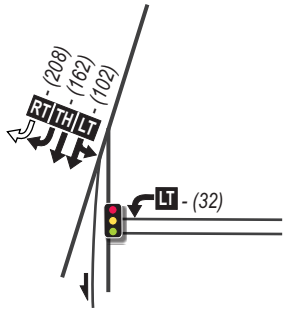
A28. *SW 6th Ave. @ I-405/Hwy. 26 On-Ramp*



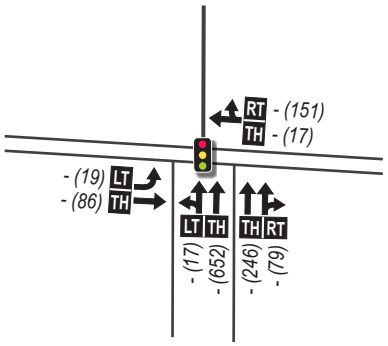
A29. *SW 5th Ave. @ SW Jackson St.*



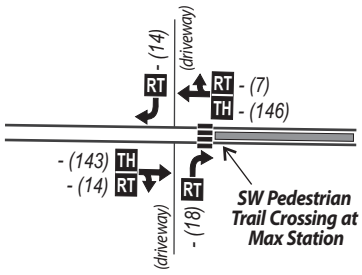
A30. *SW 5th Ave./I-405 On-Ramp @ SW Lincoln St.*



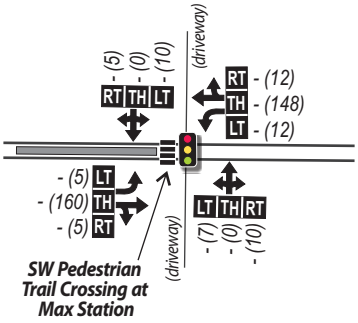
A31. *SW 4th Ave./I-405 WB Off-Ramp @ SW Lincoln St.*



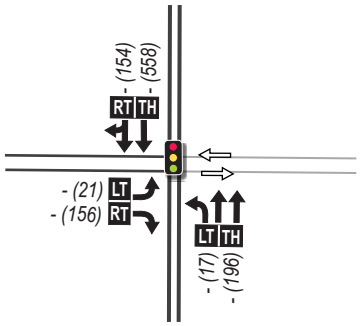
A32. *SW 3rd Ave. @ SW Lincoln St.*



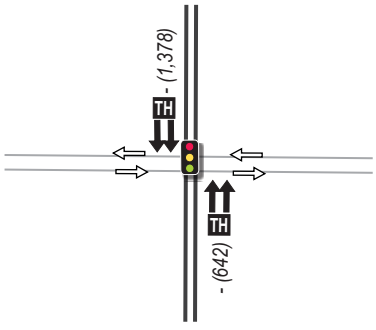
A33. *SW 2nd Ave. @ SW Lincoln St.*



A34. *SW 1st Ave. @ SW Lincoln St.*



A35. *SW Naito Pkwy. @ SW Lincoln St.*



LEGEND

00. - Study Intersection No.
STOP - Stop Sign
- Yield Sign
- Traffic Signal
- Lane Configuration
- Bus Only Lane
AM (PM) - Peak Hour Traffic Volumes
LT TH RT - Volume Turn Movement
Left•Thru•Right

DKS

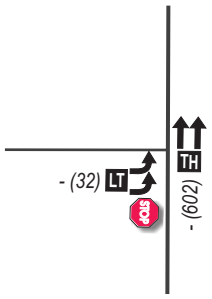
No Scale

figure **3.3-16b**

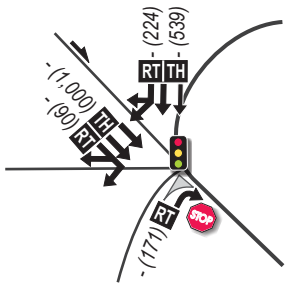
2035 Light Rail Alternative A2-LA: Naito with Limited Access PM Peak Hour

Segment A: Inner Portland

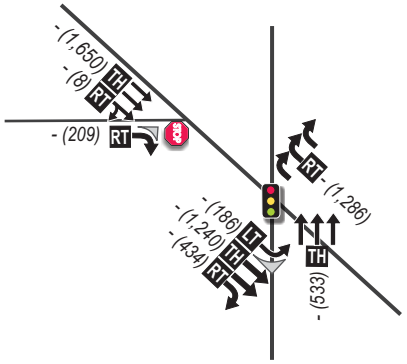
A36. *SW 4th Ave. @ SW Grant St.*



A37. *SW Broadway @ I-405/SW Lincoln St.*

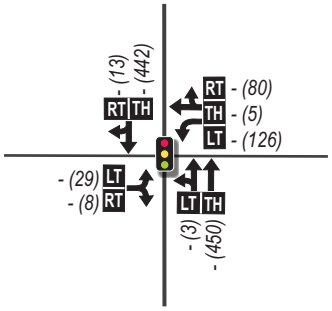


A38. *SW Broadway/SW Grant St. @ SW 6th Ave.*

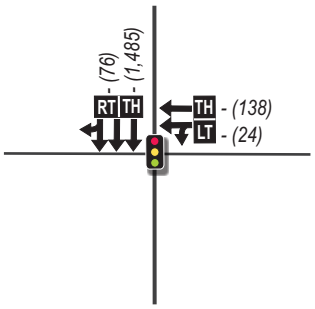


A39. *SW Broadway @ SW 5th Ave.*

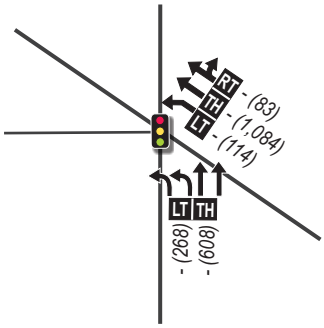
A40. *SW 6th Ave. @ SW Caruthers St.*



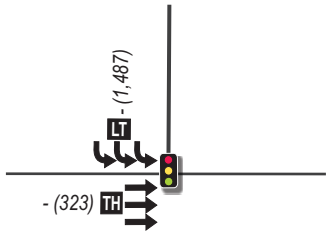
A41. *SW 5th Ave. @ SW Caruthers St.*



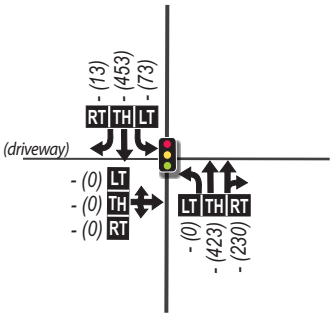
A42. *SW 4th Ave. @ SW Caruthers St./ SW Broadway*



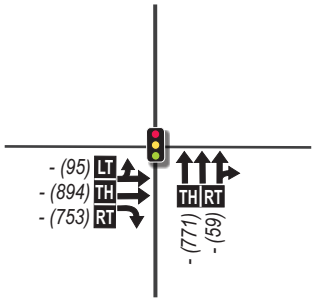
A43. *SW 5th Ave. @ SW Sheridan St.*



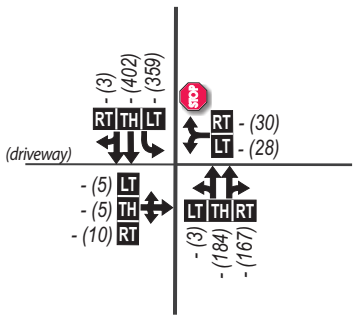
A44. *SW 6th Ave./SW Terwilliger Blvd. @ SW Sheridan St.*



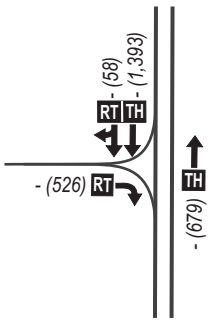
A45. *SW 4th Ave./SW Barbur Blvd. @ SW Sheridan St.*



A46. *SW 1st Ave. @ SW Sheridan St.*



A47. *SW Naito Pkwy. @ SW Sheridan St.*



LEGEND

00. - Study Intersection No.
STOP - Stop Sign
YIELD - Yield Sign
- Traffic Signal
- Lane Configuration
- Bus Only Lane
AM (PM) - Peak Hour Traffic Volumes
LT TH RT - Volume Turn Movement
Left•Thru•Right

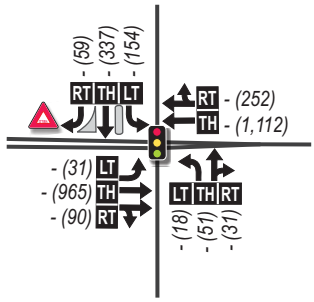
DKS

No Scale

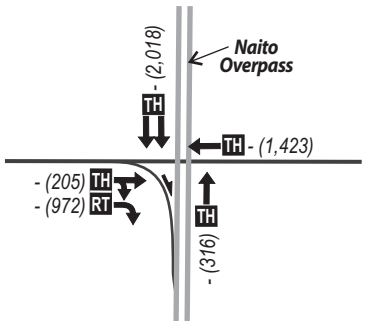
figure **3.3-16c**

2035 Light Rail Alternative A2-LA:
Naito with Limited Access PM Peak Hour
Segment A: Inner Portland

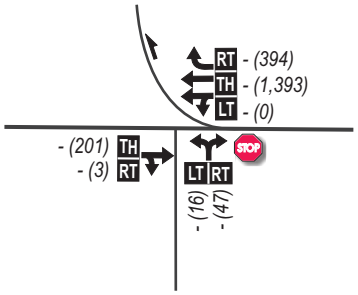
A48. *SW 1st Ave. @ SW Arthur St.*



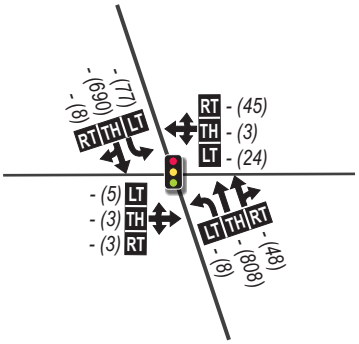
A49. *SW Naito Pkwy. @ SW Arthur St.*



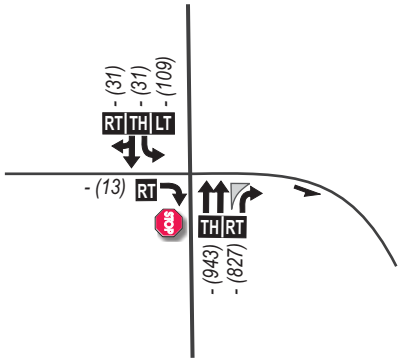
A50. *SW Naito Pkwy. @ SW Kelly St.*



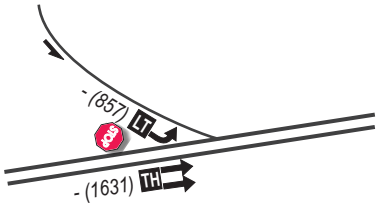
A52. *SW Barbur Blvd. @ SW Hooker St.*



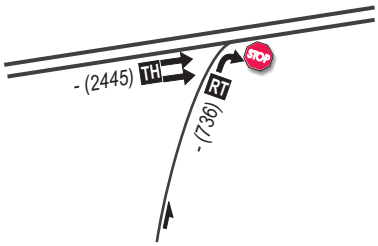
A56. *SW Kelly St. @ SW Porter St./SW Hood Ave.*



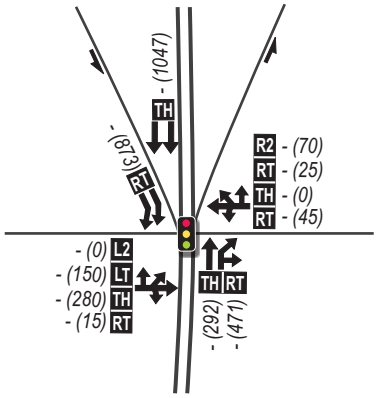
A61. *Ross Island Brg. @ Naito Pkwy.*



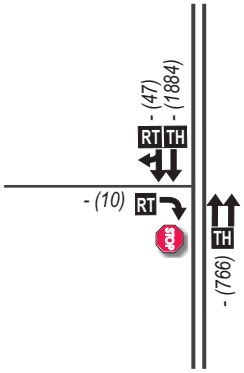
A62. *Ross Island Brg. @ Kelly Ramps*



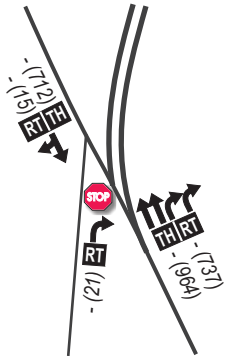
A69. *SW Naito Pkwy. @ Gibbs/Naito Ramps*



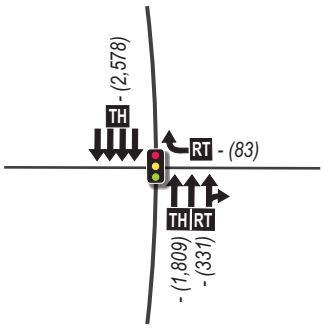
A72. *SW Naito Pkwy. @ SW Whitaker St.*



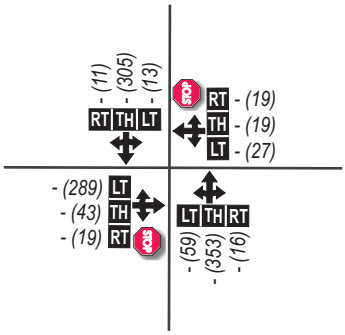
A78. *SW Barbur Blvd. @ SW Naito/ SW Abernathy St.*



A80. *SW Barbur Blvd. @ SW Bancroft St.*



A81. *SW Corbett Blvd. @ SW Bancroft St.*



LEGEND

00. - Study Intersection No.
STOP - Stop Sign
- Yield Sign
- Traffic Signal
- Lane Configuration
- Bus Only Lane
AM (PM) - Peak Hour Traffic Volumes
L2 Hard Left | LT TH RT Left•Thru•Right | R2 Hard Right - Volume Turn Movement

DKS

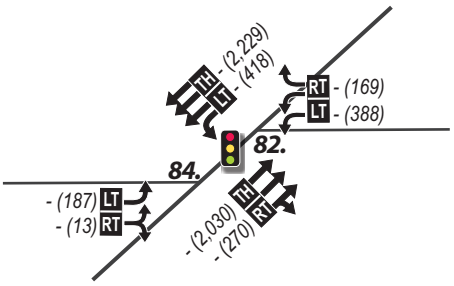
No Scale

figure **3.3-16d**

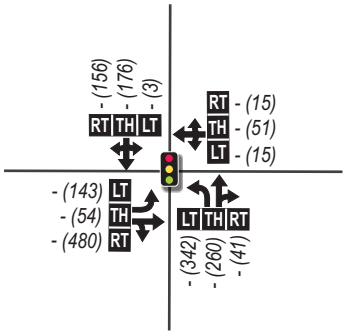
2035 Light Rail Alternative A2-LA: Naito with Limited Access PM Peak Hour

Segment A: Inner Portland

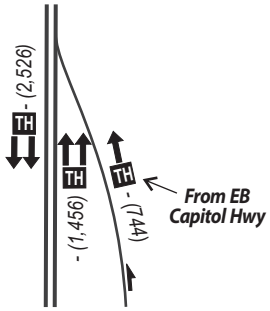
A82. *SW Barbur Blvd. @ SW Hamilton St. (East)*
A84. *SW Barbur Blvd. @ SW Hamilton St. (West)*



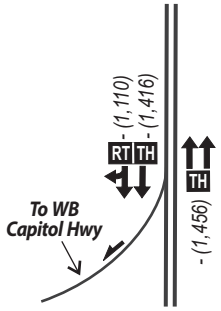
A83. *SW Hamilton Blvd. @ SW Corbett Ave.*



A85. *SW Barbur Blvd. @ SW Capitol Hwy. EB*



A86. *SW Barbur Blvd. @ SW Capitol Hwy. WB*



LEGEND

- **00.** - Study Intersection No.
- STOP - Stop Sign
- Yield Sign
- Traffic Signal
- Lane Configuration
- Bus Only Lane
- *AM (PM)* - Peak Hour Traffic Volumes
- LT TH RT - Volume Turn Movement (Left•Thru•Right)

DKS

No Scale

figure **3.3-16e**

2035 Light Rail Alternative A2-LA:
Naito with Limited Access PM Peak Hour

Segment A: Inner Portland

The HCM analysis provided in Table 3.3-15 indicates that the following intersections would fail to meet mobility targets under PM peak-hour conditions in 2035 for Alternative A2-LA:

- **SW Naito Parkway and SW Harrison Street.** This intersection operates above the mobility target, largely due to the demand for northbound left turns.
- **SW Naito Parkway northbound ramp to Ross Island Bridge.** This intersection would continue to operate above the mobility target.
- **SW Barbur Boulevard and SW Hamilton Street.** This intersection controls several conflicting movements. The northbound left, westbound left and southbound through all generate volume to capacity ratios of at or above 0.95.
- **SW Kelly Avenue and Ross Island Bridge.** This intersection would continue to operate above the mobility target.
- **SW Naito Parkway and SW Gibbs Street.** The high southbound volume from westbound Ross Island Bridge combined with the high southbound SW Naito Parkway volumes would push this intersection to capacity. The wide cross section and forecasted high pedestrian volumes (because of the new light rail station) also would decrease the efficiency of the SW Gibbs Street movements, represented by increased lost time per phase for SW Gibbs Street.

As indicated in previous sections, these operations results do not account for queue spillback at some of the key study area bottlenecks, such as the Ross Island Bridgehead and the I-405 northbound on-ramp from SW 6th Avenue. The impacts of these bottlenecks will be discussed further in the Build Alternatives Simulation Queuing and Operations sections.

Alternative A1-BH: Barbur with Bridgehead

Alternative A1-BH is described in Section 3.3.1. The PM Synchro analysis for Alternative A1-BH is shown in Table 3.3-16. Intersections that do not meet the mobility target are shaded gray for each failing peak hour. The peak-hour forecasted volumes for Alternative A1-BH are shown graphically in Figure 3.3-17.

Table 3.3-16. Alternative A1-BH: Barbur with Bridgehead, 2035 HCM (Synchro) Analysis

					2035 Alternative A1-BH: Barbur Bridgehead				
						PM			
ID	Intersection	Note	Mobility Target		Control	Delay	LOS	V/C	WLANE
A2	SW Naito Pkwy. on-ramp /Hawthorne Br.	1	PBOT 2nd HR	0.99	TWSC	10.3 [69.8]	B [F]	0.92	NBLn1
A12	SW 1st Ave./SW Harrison St.	1	PBOT 2nd HR	0.99	Signal	50.9	D	0.62	-
A13	SW Naito Pkwy./SW Harrison St.	1	PBOT 2nd HR	0.99	Signal	28.3	C	0.66	-
A21	SW 4th Ave./SW Hall St.	1	PBOT 2nd HR	0.99	Signal	24.1	C	0.34	-
A25	SW 4th Ave./SW College St.	1	PBOT 2nd HR	0.99	Signal	11.5	B	0.37	-
A27	SW 6th Ave./SW Jackson St./I-405 northbound off-ramp	1	ODOT Ramp	0.85	TWSC	4.8 [24.8]	A [C]	0.25	EBLn1
A31	SW 4th Ave./I-405 northbound off-ramp/SW Lincoln St.	1	ODOT Ramp	0.85	Signal	10.4	B	0.44	-
A34	SW 1st Ave./SW Lincoln St.	1	PBOT 2nd HR	0.99	Signal	21.0	C	0.53	-
A35	SW Naito Pkwy./SW Lincoln St.	1	PBOT 2nd HR	0.99	Signal	5.1	A	0.44	-

ID	Intersection	Note	Mobility Target		2035 Alternative A1-BH: Barbur Bridgehead				
						PM			
					Control	Delay	LOS	V/C	WLANE
A37	SW Broadway Ave./I-405 southbound off-ramps/SW Lincoln St.	1	ODOT Ramp	0.85	Signal	18.4	B	0.60	-
A38	SW Broadway Ave./SW Grant St./SW 6th Ave.	1	PBOT 1st HR	0.99	Signal	18.7	B	0.82	-
A39	SW Broadway Ave./SW 5th Ave.	1	PBOT 1st HR	0.99	Signal	23.2	C	0.75	-
A42	SW 4th Ave./SW Caruthers St./SW Broadway Ave.	1	PBOT 1st HR	0.99	Signal	25.8	C	0.68	-
A45	SW 4th Ave./SW Barbur Blvd./SW Sheridan St.	1	PBOT 1st HR	0.99	Signal	13.4	B	0.61	-
A48	SW 1st Ave./SW Arthur St.	1	PBOT 1st HR	0.99	Signal	38.7	D	0.82	-
A56	SW Kelly Ave./SW Porter St./SW Hood Ave.	1	ODOT Ramp	0.85	Signal	25.7	C	0.78	-
A61	Ross Island Br. (SW Woods St.)/SW Naito Pkwy.	1	ODOT/PBOT 1st HR	0.99	Signal	23.7	C	0.95	-
A62	Ross Island Br./SW Kelly Ave. ramp	1	ODOT/PBOT 1st HR	0.99	Signal	45.3	D	0.99	-
A69	SW Naito Pkwy./SW Gibbs St.	1	ODOT/PBOT 1st HR	0.99	Signal	25.9	C	0.93	-
A78	SW Barbur Blvd./SW Naito Pkwy.	1	ODOT/PBOT 1st HR	0.99	Signal	43.2	D	0.92	-
A80	SW Barbur Blvd./SW Bancroft St.	1	ODOT/PBOT 1st HR	0.99	Signal	22.6	C	0.84	-
A81	SW Corbett Blvd./SW Bancroft St.	1	PBOT 1st HR	0.99	Signal	78.4	E	0.61	-
A82/A84	SW Barbur Blvd./SW Hamilton St	1	ODOT/PBOT 1st HR	0.99	Signal	28.3	C	0.96	-
A83	SW Corbett St./SW Hamilton St.	1	PBOT 1st HR	0.99	Signal	38.7	D	0.70	-

Key: Worst Major [Worst stop-controlled delay] for TWSC intersections.

V/C represents intersection average for signals and worst movement for stop control intersections.

HR = hour; Ln = lane; PBOT = Portland Bureau of Transportation; EB = eastbound; NB = northbound.

1. Intersection analysis completed as part of 2016 SWC study with review by ODOT, PBOT and Metro.

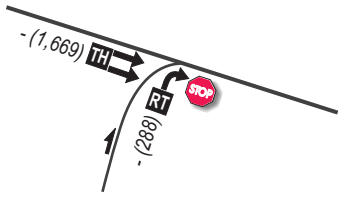
As shown in Table 3.3-16, HCM analysis indicated that all intersections studied would to meet PM peak mobility targets in 2035 for Alternative A1-BH. Two intersections were identified for Alternative A2-BH that do not meet the mobility target under AM peak-hour conditions, and would be expected to also not meet the mobility target for Alternative A1-BH.

AM Peak Hour (see Alternative A2-BH):

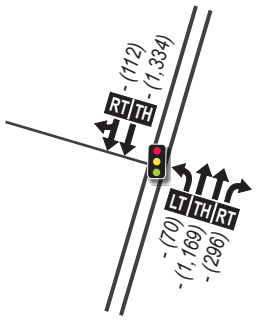
- **SW Barbur Boulevard at SW Bancroft Street.** This new signal would fail to meet mobility targets under future volume conditions, primarily because of the conflict between increased northbound though volumes and the heavy southbound left-turn movement shifted to this intersection from SW Barbur Boulevard and SW Hamilton Street.

- **SW Barbur Boulevard at SW Hamilton Street.** This intersection would fail to meet mobility targets because of higher northbound through volumes and a capacity reduction from three to two northbound lanes.

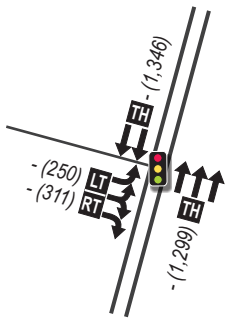
A2. *SW Naito Pkwy. On-Ramp @ Hawthorne Brg.*



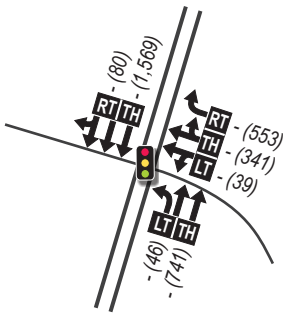
A3. *SW Naito Pkwy. @ SW Jefferson St.*



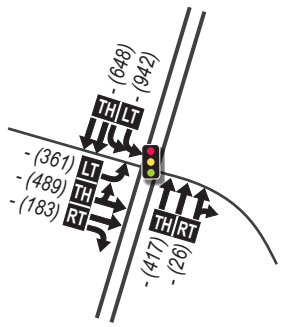
A4. *SW Naito Pkwy. @ SW Columbia St.*



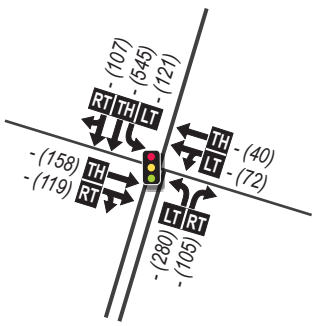
A6. *SW Naito Pkwy. @ SW Clay St.*



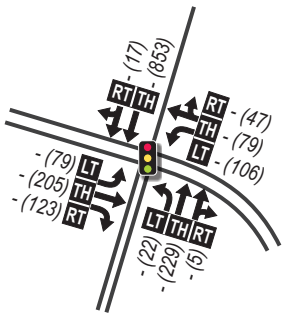
A8. *SW Naito Pkwy. @ SW Market St.*



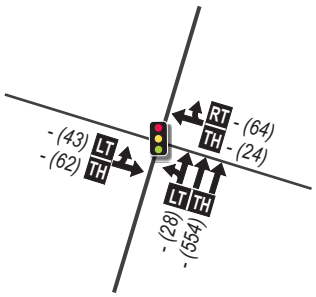
A12. *SW 1st Ave. @ SW Harrison St.*



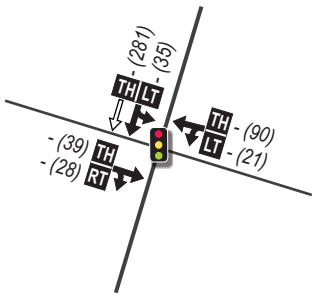
A13. *SW Naito Pkwy. @ SW Harrison St.*



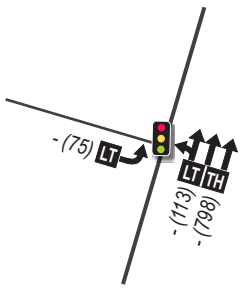
A19. *SW 6th Ave. @ SW Hall St.*



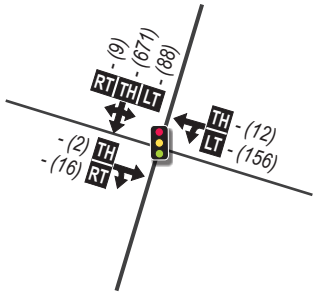
A20. *SW 5th Ave. @ SW Hall St.*



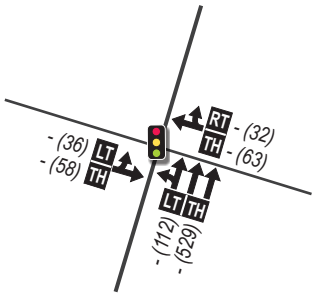
A21. *SW 4th Ave. @ SW Hall St.*



A22. *SW Broadway @ SW College St.*



A23. *SW 6th Ave. @ SW College St.*



LEGEND

00. - Study Intersection No.
STOP - Stop Sign
- Yield Sign
- Traffic Signal
- Lane Configuration
- Bus Only Lane
AM (PM) - Peak Hour Traffic Volumes
LT TH RT - Volume Turn Movement
Left•Thru•Right

DKS

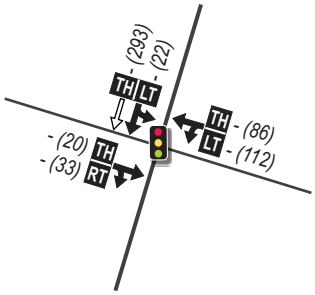
No Scale

figure **3.3-17a**

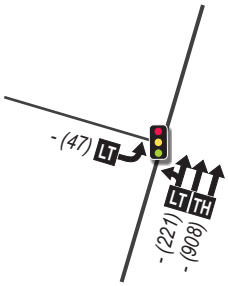
2035 Light Rail Alternative A1: Barbur with Bridgehead PM Peak Hour

Segment A: Inner Portland

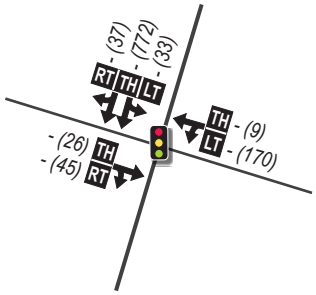
A24. *SW 5th Ave. @ SW College St.*



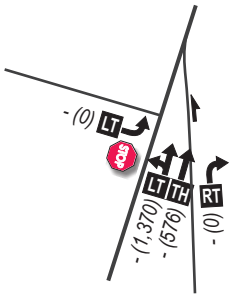
A25. *SW 4th Ave. @ SW College St.*



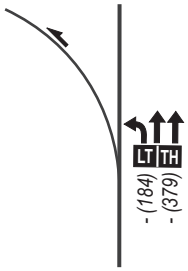
A26. *SW Broadway @ SW Jackson St.*



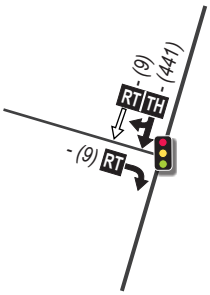
A27. *SW 6th Ave. @ SW Jackson St./ I-405 Off-Ramp*



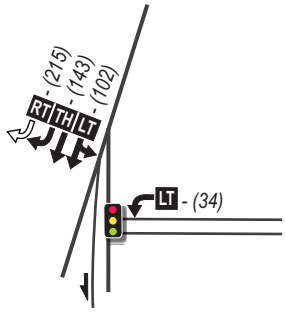
A28. *SW 6th Ave. @ I-405/Hwy. 26 On-Ramp*



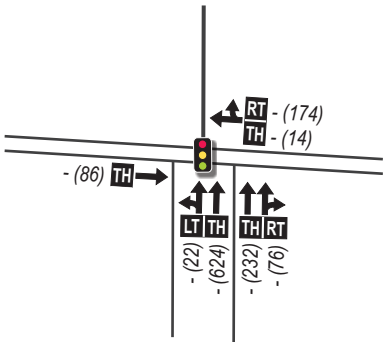
A29. *SW 5th Ave. @ SW Jackson St.*



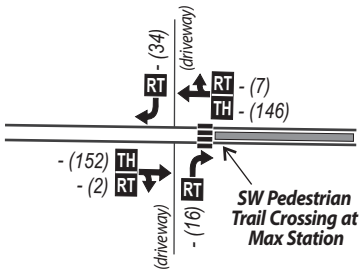
A30. *SW 5th Ave./I-405 On-Ramp @ SW Lincoln St.*



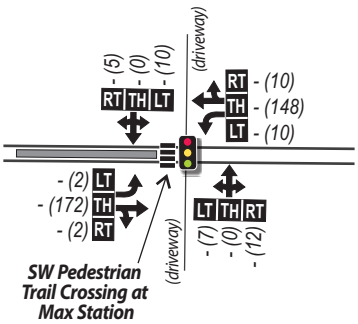
A31. *SW 4th Ave./I-405 WB Off-Ramp @ SW Lincoln St.*



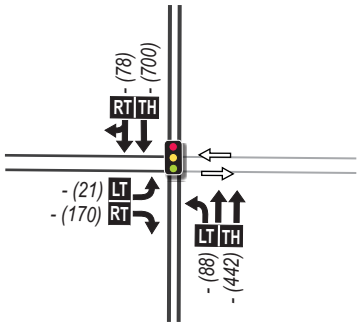
A32. *SW 3rd Ave. @ SW Lincoln St.*



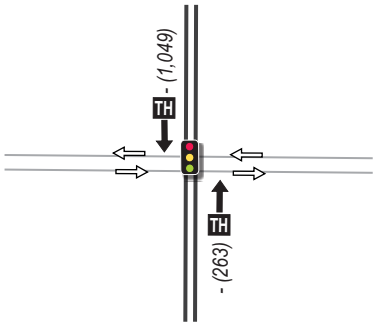
A33. *SW 2nd Ave. @ SW Lincoln St.*



A34. *SW 1st Ave. @ SW Lincoln St.*



A35. *SW Naito Pkwy. @ SW Lincoln St.*



LEGEND

00. - Study Intersection No.
STOP - Stop Sign
- Yield Sign
- Traffic Signal
- Lane Configuration
- Bus Only Lane
AM (PM) - Peak Hour Traffic Volumes
LT TH RT - Volume Turn Movement
Left•Thru•Right

DKS

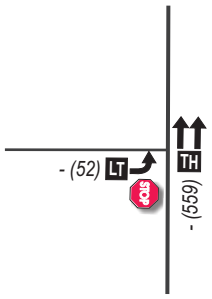
No Scale

figure **3.3-17b**

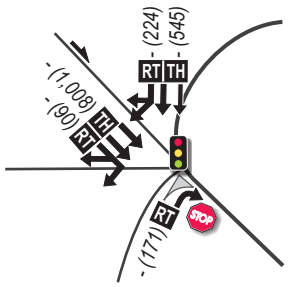
2035 Light Rail Alternative A1: Barbur with Bridgehead PM Peak Hour

Segment A: Inner Portland

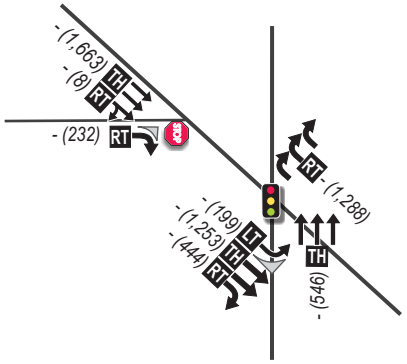
A36. *SW 4th Ave. @ SW Grant St.*



A37. *SW Broadway @ I-405/SW Lincoln St.*

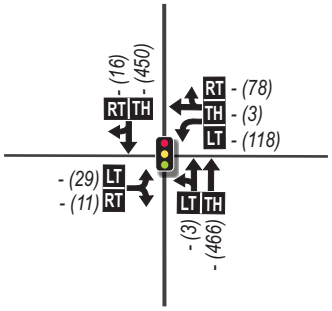


A38. *SW Broadway/SW Grant St. @ SW 6th Ave.*

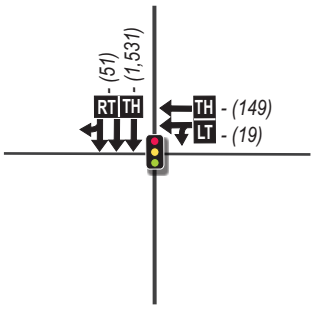


A39. *SW Broadway @ SW 5th Ave.*

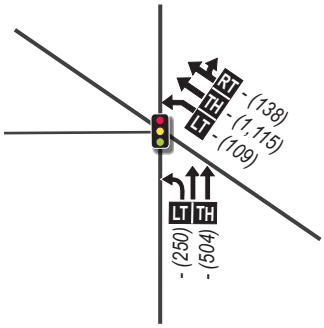
A40. *SW 6th Ave. @ SW Caruthers St.*



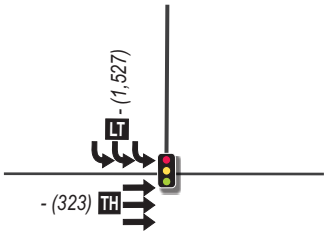
A41. *SW 5th Ave. @ SW Caruthers St.*



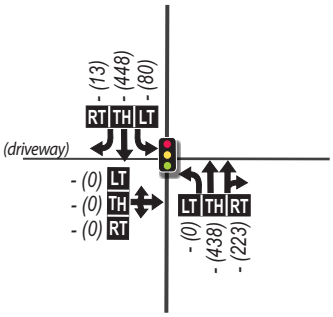
A42. *SW 4th Ave. @ SW Caruthers St./ SW Broadway*



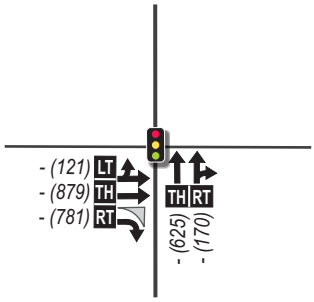
A43. *SW 5th Ave. @ SW Sheridan St.*



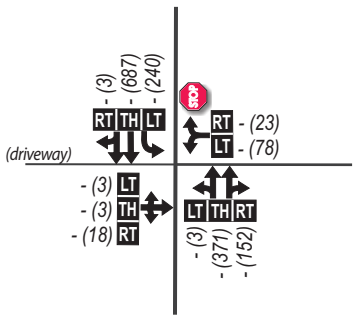
A44. *SW 6th Ave./SW Terwilliger Blvd. @ SW Sheridan St.*



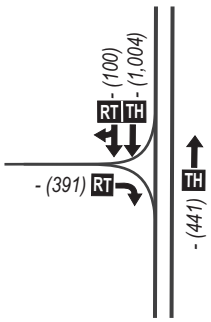
A45. *SW 4th Ave./SW Barbur Blvd. @ SW Sheridan St.*



A46. *SW 1st Ave. @ SW Sheridan St.*



A47. *SW Naito Pkwy. @ SW Sheridan St.*



LEGEND

00. - Study Intersection No.
STOP - Stop Sign
- Yield Sign
- Traffic Signal
- Lane Configuration
- Bus Only Lane
AM (PM) - Peak Hour Traffic Volumes
LT TH RT - Volume Turn Movement
Left•Thru•Right

DKS

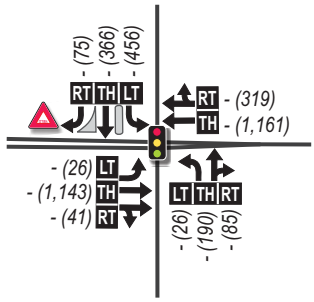
No Scale

figure **3.3-17c**

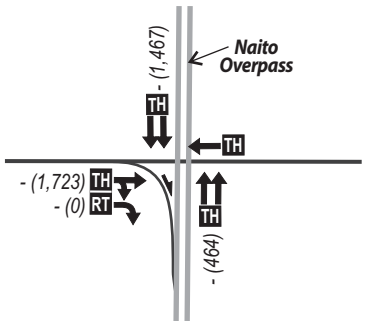
2035 Light Rail Alternative A1: Barbur with Bridgehead PM Peak Hour

Segment A: Inner Portland

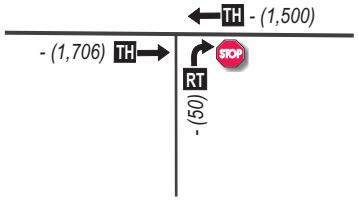
A48. *SW 1st Ave. @ SW Arthur St.*



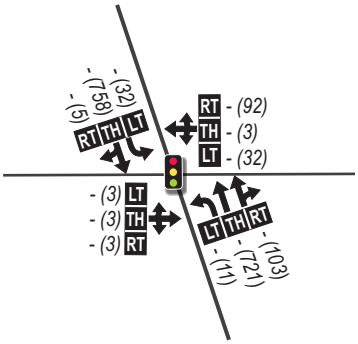
A49. *SW Naito Pkwy. @ SW Arthur St.*



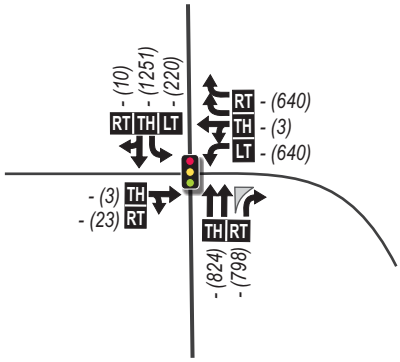
A50. *SW Naito Pkwy. @ SW Kelly St.*



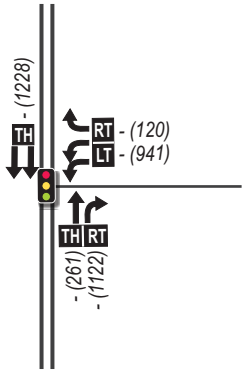
A52. *SW Barbur Blvd. @ SW Hooker St.*



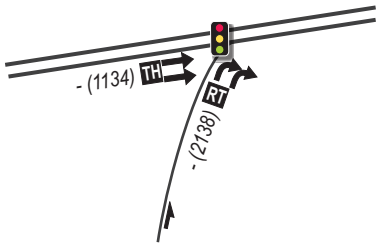
A56. *SW Kelly St. @ SW Porter St./SW Hood Ave.*



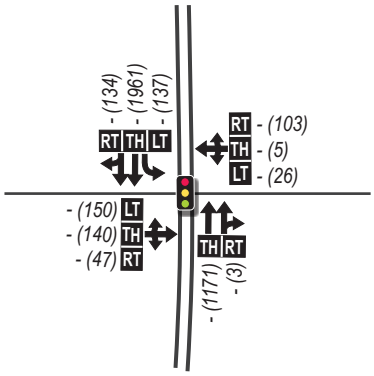
A61. *Ross Island Brg. @ Naito Pkwy.*



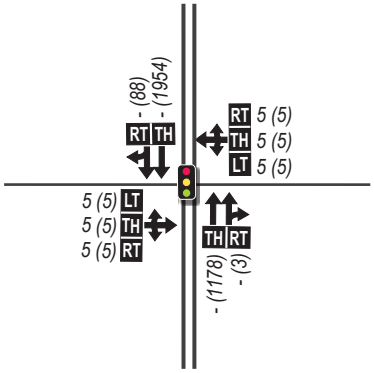
A62. *Ross Island Brg. @ Kelly Ramps*



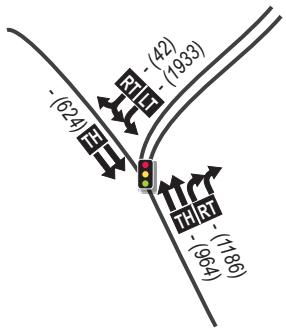
A69. *SW Naito Pkwy. @ Gibbs/Naito Ramps*



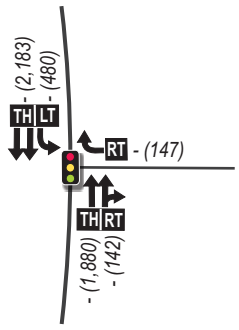
A72. *SW Naito Pkwy. @ SW Whitaker St.*



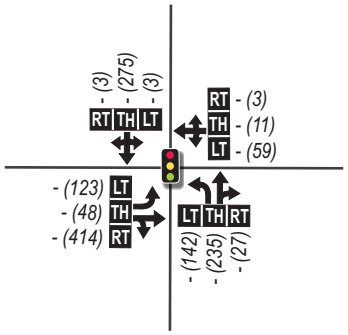
A78. *SW Barbur Blvd. @ SW Naito/ SW Abernathy St.*



A80. *SW Barbur Blvd. @ SW Bancroft St.*



A81. *SW Corbett Blvd. @ SW Bancroft St.*



LEGEND

00. - Study Intersection No.
STOP - Stop Sign
- Yield Sign
- Traffic Signal
- Lane Configuration
- Bus Only Lane
AM (PM) - Peak Hour Traffic Volumes
LT TH RT - Volume Turn Movement
Left•Thru•Right

DKS

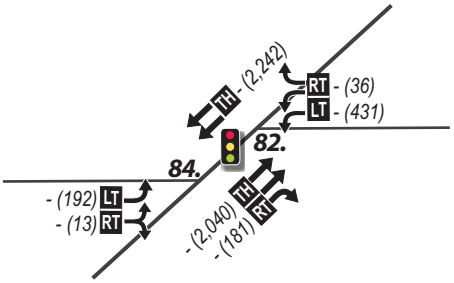
No Scale

figure **3.3-17d**

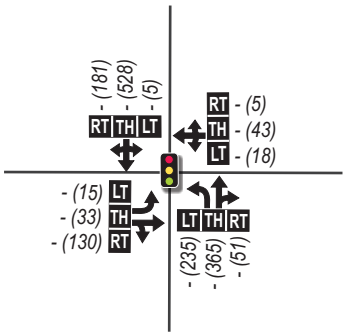
2035 Light Rail Alternative A1: Barbur with Bridgehead PM Peak Hour

Segment A: Inner Portland

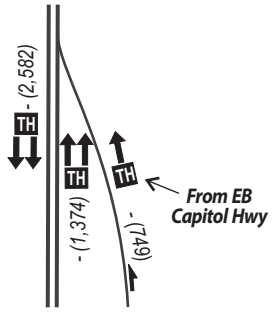
A82. *SW Barbur Blvd. @ SW Hamilton St. (East)*
A84. *SW Barbur Blvd. @ SW Hamilton St. (West)*



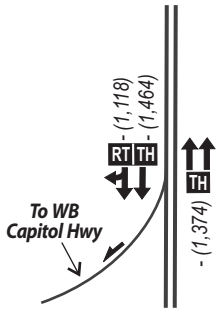
A83. *SW Hamilton Blvd. @ SW Corbett Ave.*



A85. *SW Barbur Blvd. @ SW Capitol Hwy. EB*



A86. *SW Barbur Blvd. @ SW Capitol Hwy. WB*



LEGEND

00. - Study Intersection No.
STOP - Stop Sign
- Yield Sign
- Traffic Signal
- Lane Configuration
- Bus Only Lane
AM (PM) - Peak Hour Traffic Volumes
LT TH RT - Volume Turn Movement
Left•Thru•Right

DKS

No Scale

figure **3.3-17e**

2035 Light Rail Alternative A1: Barbur with Bridgehead PM Peak Hour

Segment A: Inner Portland

Alternative A2-BH-LT – Naito Bridgehead with Left Turn

The Naito Bridgehead with Left Turn Alternative is described in Section 3.3.1. The PM Synchro analysis for Alternative A2-BH-LT is shown in Table 3.3-17. Intersections that do not meet the mobility target are shaded gray for each failing peak hour. The peak hour forecasted volumes for the alternative are shown graphically in Figure 3.3-18.

Table 3.3-17. HCM (Synchro) Segment A (A2-BH LT) 2035 Light Rail Alternative Analysis

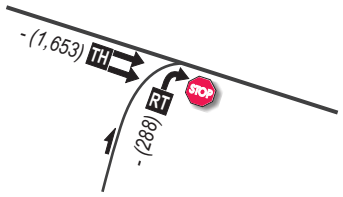
					2035 Alternative A2-BH-LT: Naito Bridgehead with Left Turns				
						PM			
ID	Intersection	Note	Mobility Target		Control	Delay	LOS	V/C	WLANE
A2	SW Naito Pkwy. on-Ramp / Hawthorne Bridge.	1	PBOT 2nd HR	0.99	TWSC	9.9 [67]	A [F]	0.91	NBLn1
A12	SW 1st Ave. / SW Harrison St.	1	PBOT 2nd HR	0.99	Signal	20.2	C	0.54	-
A13	SW Naito Pkwy. / SW Harrison St.	1	PBOT 2nd HR	0.99	Signal	48.0	D	0.83	-
A21	SW 4th Ave. / SW Hall St.	1	PBOT 2nd HR	0.99	Signal	24.9	C	0.35	-
A25	SW 4th Ave. / SW College St.	1	PBOT 2nd HR	0.99	Signal	12.7	B	0.39	-
A27	SW 6th Ave. / SW Jackson St./I-405 northbound off-ramp	1	ODOT Ramp	0.85	TWSC	4.8 [24.5]	A [C]	0.25	EBLn1
A31	SW 4th Ave./I-405 northbound off-ramp /SW Lincoln St.	1	ODOT Ramp	0.85	Signal	15.1	B	0.48	-
A34	SW 1st Ave. / SW Lincoln St.	1	PBOT 2nd HR	0.99	Signal	24.2	C	0.50	-
A35	SW Naito Pkwy. / SW Lincoln St.	1	PBOT 2nd HR	0.99	Signal	42.1	D	0.95	-
A37	SW Broadway / I-405 southbound off-ramp/SW Lincoln St.	1	ODOT Ramp	0.85	Signal	18.6	B	0.60	-
A38	SW Broadway/SW Grant St. / SW 6th Ave.	1	PBOT 1st HR	0.99	Signal	18.5	B	0.82	-
A39	SW Broadway/SW 5th Ave.	1	PBOT 1st HR	0.99	Signal	21.4	C	0.74	-
A42	SW 4th Ave. / SW Caruthers St./SW Broadway	1	PBOT 1st HR	0.99	Signal	29.6	C	0.71	-
A45	SW 4th Ave./SW Barbur Blvd./SW Sheridan St.	1	PBOT 1st HR	0.99	Signal	13.5	B	0.66	-
A48	SW 1st Ave. / SW Arthur St.	1	PBOT 1st HR	0.99	Signal	37.9	D	0.83	-
A56	SW Kelly Ave. / SW Porter St./SW Hood Ave.	1	ODOT Ramp	0.85	Signal	26.1	C	0.77	-
A61	Ross Island Bridge (SW Woods St.)/ SW Naito Pkwy.	1	PBOT 1st HR	0.99	Signal	33.8	C	0.97	-
A62	Ross Island Bridge/SW Kelly Avenue ramp	1	ODOT/PBOT 1st HR	0.99	Signal	**49.4**	**D**	**1.00**	**-**
A69	SW Naito Pkwy. / SW Gibbs St.	1	ODOT/PBOT 1st HR	0.99	Signal	27.9	C	0.91	-
A78	SW Barbur Blvd. / SW Naito Pkwy./Ped crossing	1	ODOT/PBOT 1st HR	0.99	Signal	30.3	C	0.88	-
A80	SW Barbur Blvd. / SW Bancroft St.	1	ODOT/PBOT 1st HR	0.99	Signal	24.9	C	0.83	-
A81	SW Corbett Ave. / SW Bancroft St.	1	PBOT 1st HR	0.99	Signal	30.8	C	0.51	-
A82/A84	SW Barbur Blvd. / SW Hamilton St	1	ODOT/PBOT 1st HR	0.99	Signal	26.4	C	0.96	-
A83	SW Corbett Ave. / SW Hamilton St.	1	PBOT 1st HR	0.99	Signal	36.5	D	0.78	-

Key: Worst Major [Worst stop-controlled delay] for TWSC intersections
V/C represents intersection average for signals and worst movement for stop control intersections

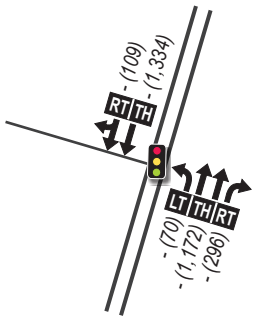
1. Intersection analysis completed as part of 2016 SWC study with review by ODOT, PBOT and Metro.

As shown in Table 3.3-17, HCM analysis indicated the intersection of Ross Island Bridge Ramps at SW Kelly Avenue ramp as failing to meet mobility targets under PM peak-period conditions. This intersection fails to meet standards due to high volumes on both the northbound and eastbound approaches.

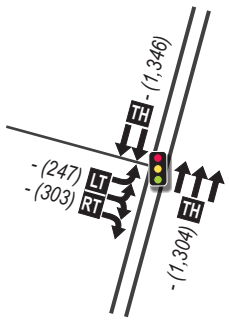
A2. *SW Naito Pkwy. On-Ramp @ Hawthorne Brg.*



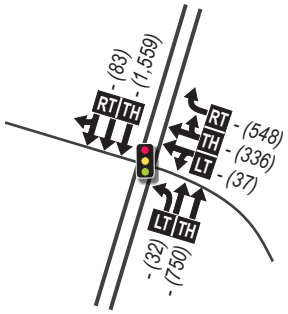
A3. *SW Naito Pkwy. @ SW Jefferson St.*



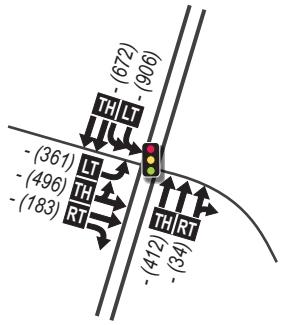
A4. *SW Naito Pkwy. @ SW Columbia St.*



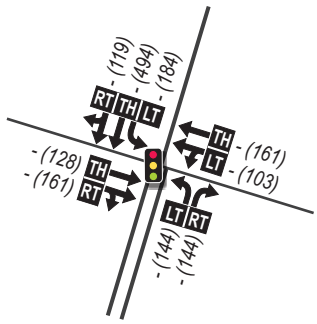
A6. *SW Naito Pkwy. @ SW Clay St.*



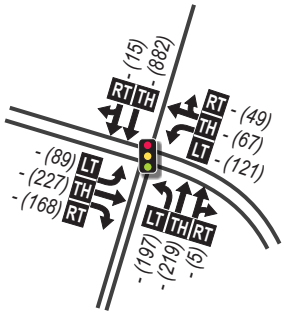
A8. *SW Naito Pkwy. @ SW Market St.*



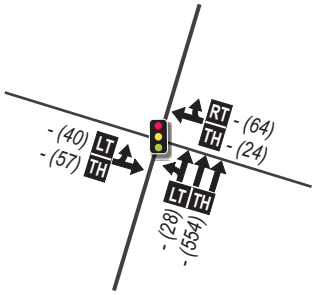
A12. *SW 1st Ave. @ SW Harrison St.*



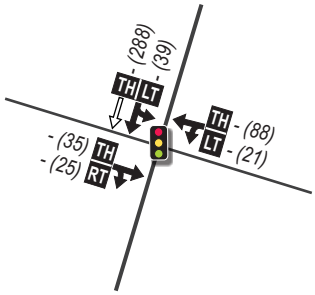
A13. *SW Naito Pkwy. @ SW Harrison St.*



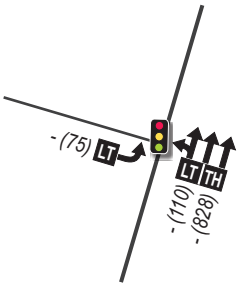
A19. *SW 6th Ave. @ SW Hall St.*



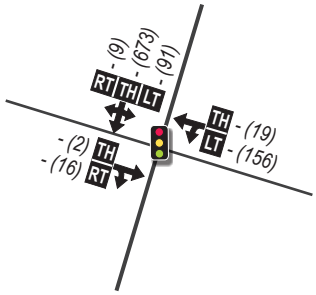
A20. *SW 5th Ave. @ SW Hall St.*



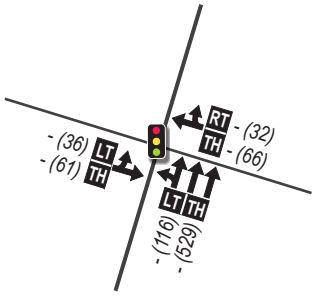
A21. *SW 4th Ave. @ SW Hall St.*



A22. *SW Broadway @ SW College St.*



A23. *SW 6th Ave. @ SW College St.*



LEGEND

00. - Study Intersection No.
STOP - Stop Sign
- Yield Sign
- Traffic Signal
- Lane Configuration
- Bus Only Lane
AM (PM) - Peak Hour Traffic Volumes
LT TH RT - Volume Turn Movement
Left•Thru•Right

DKS

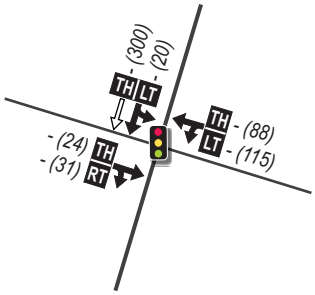
No Scale

figure **3.3-18a**

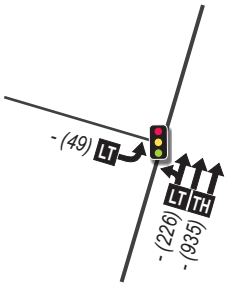
2035 Light Rail Alternative A2: Naito with Bridgehead and Left Turn PM Peak Hour

Segment A: Inner Portland

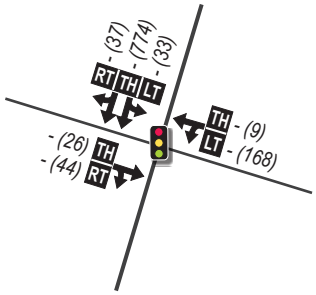
A24. *SW 5th Ave. @ SW College St.*



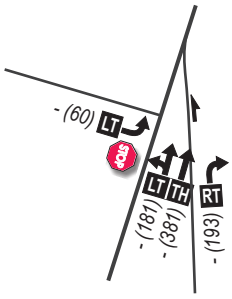
A25. *SW 4th Ave. @ SW College St.*



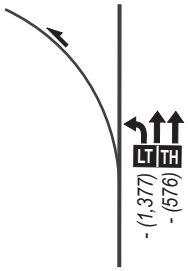
A26. *SW Broadway @ SW Jackson St.*



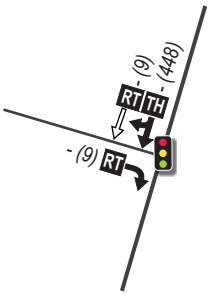
A27. *SW 6th Ave. @ SW Jackson St./ I-405 Off-Ramp*



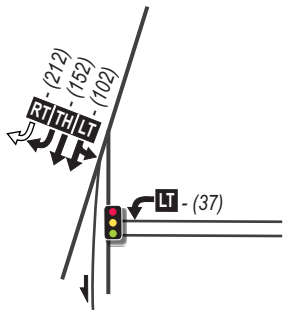
A28. *SW 6th Ave. @ I-405/Hwy. 26 On-Ramp*



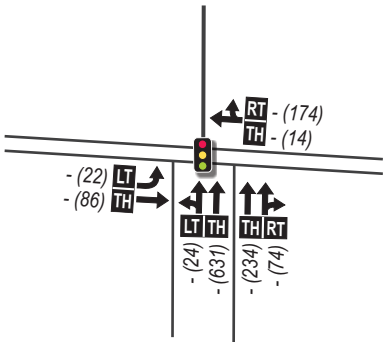
A29. *SW 5th Ave. @ SW Jackson St.*



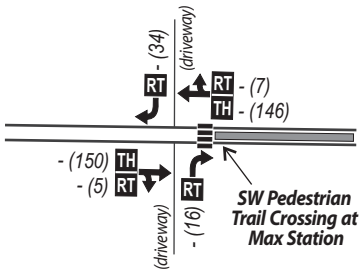
A30. *SW 5th Ave./I-405 On-Ramp @ SW Lincoln St.*



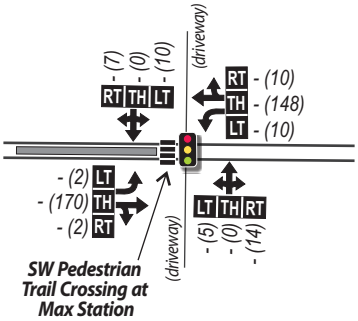
A31. *SW 4th Ave./I-405 WB Off-Ramp @ SW Lincoln St.*



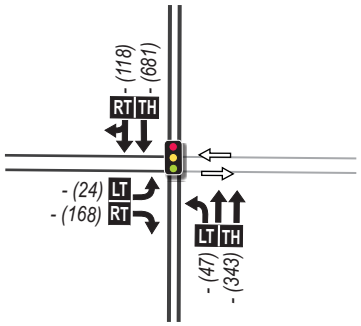
A32. *SW 3rd Ave. @ SW Lincoln St.*



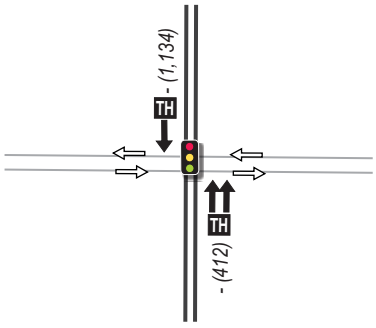
A33. *SW 2nd Ave. @ SW Lincoln St.*



A34. *SW 1st Ave. @ SW Lincoln St.*



A35. *SW Naito Pkwy. @ SW Lincoln St.*



LEGEND

00. - Study Intersection No.
STOP - Stop Sign
- Yield Sign
- Traffic Signal
- Lane Configuration
- Bus Only Lane
AM (PM) - Peak Hour Traffic Volumes
LT TH RT - Volume Turn Movement
Left•Thru•Right

DKS

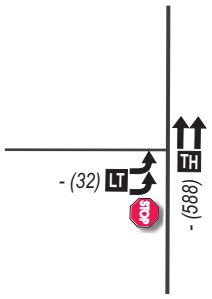
No Scale

figure **3.3-18b**

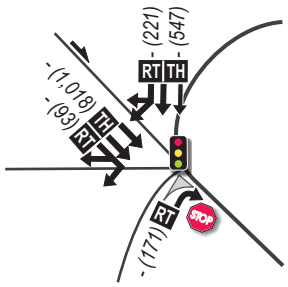
2035 Light Rail Alternative A2: Naito with Bridgehead and Left Turn PM Peak Hour

Segment A: Inner Portland

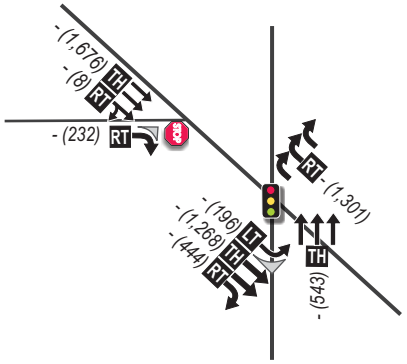
A36. *SW 4th Ave. @ SW Grant St.*



A37. *SW Broadway @ I-405/SW Lincoln St.*

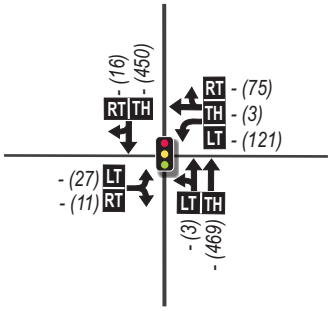


A38. *SW Broadway/SW Grant St. @ SW 6th Ave.*

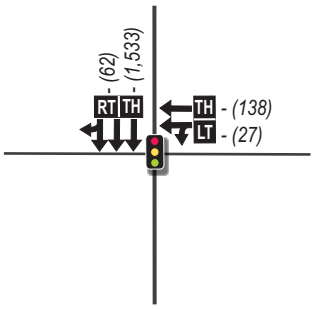


A39. *SW Broadway @ SW 5th Ave.*

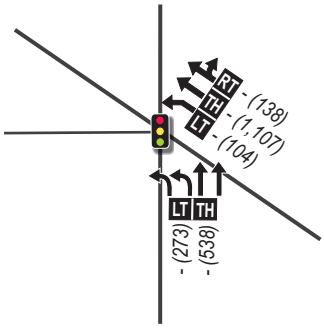
A40. *SW 6th Ave. @ SW Caruthers St.*



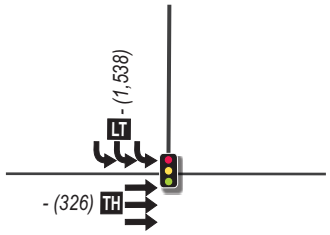
A41. *SW 5th Ave. @ SW Caruthers St.*



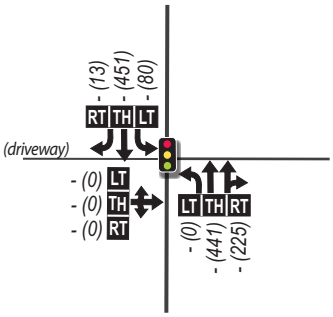
A42. *SW 4th Ave. @ SW Caruthers St./ SW Broadway*



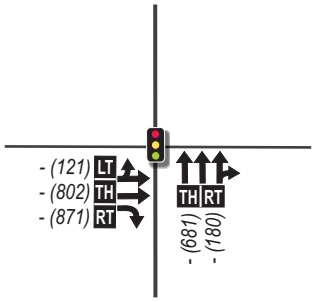
A43. *SW 5th Ave. @ SW Sheridan St.*



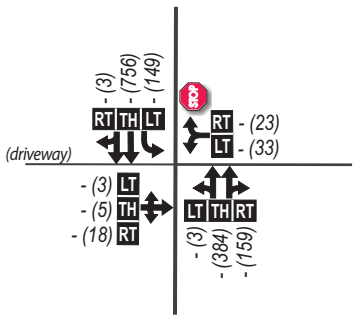
A44. *SW 6th Ave./SW Terwilliger Blvd. @ SW Sheridan St.*



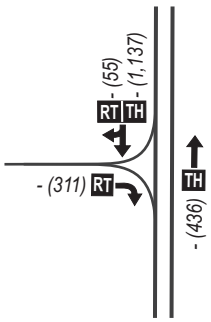
A45. *SW 4th Ave./SW Barbur Blvd. @ SW Sheridan St.*



A46. *SW 1st Ave. @ SW Sheridan St.*



A47. *SW Naito Pkwy. @ SW Sheridan St.*



LEGEND

00. - Study Intersection No.
STOP - Stop Sign
- Yield Sign
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- Lane Configuration
- Bus Only Lane
AM (PM) - Peak Hour Traffic Volumes
LT TH RT - Volume Turn Movement
Left•Thru•Right

DKS

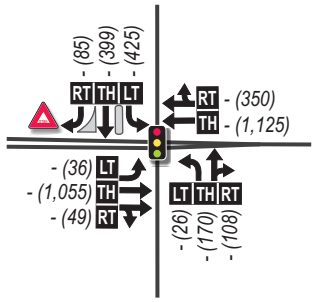
No Scale

figure **3.3-18c**

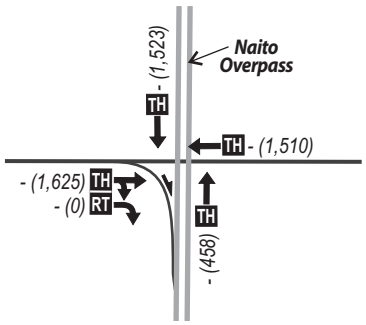
2035 Light Rail Alternative A2: Naito with Bridgehead and Left Turn PM Peak Hour

Segment A: Inner Portland

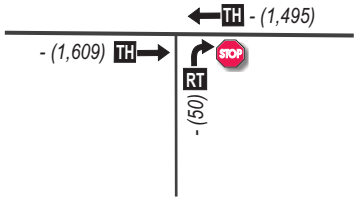
A48. *SW 1st Ave. @ SW Arthur St.*



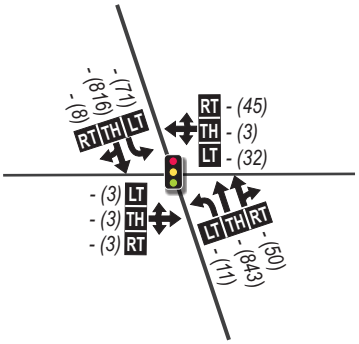
A49. *SW Naito Pkwy. @ SW Arthur St.*



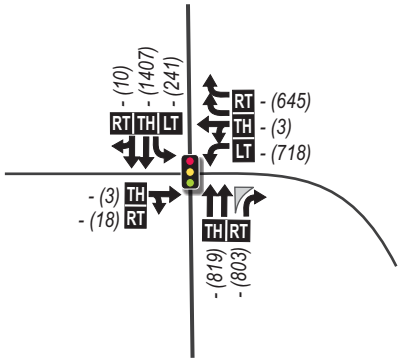
A50. *SW Naito Pkwy. @ SW Kelly St.*



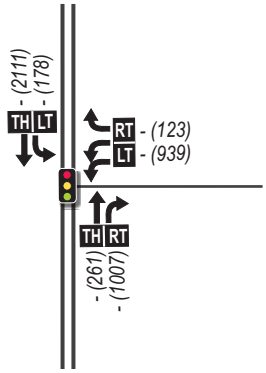
A52. *SW Barbur Blvd. @ SW Hooker St.*



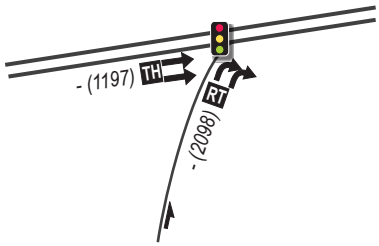
A56. *SW Kelly St. @ SW Porter St./SW Hood Ave.*



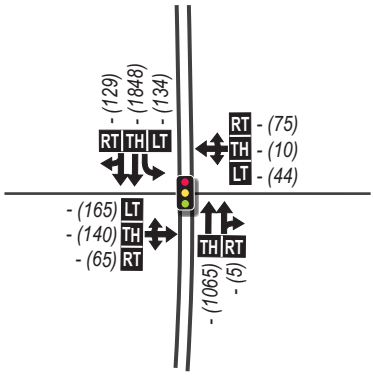
A61. *Ross Island Brg. @ Naito Pkwy.*



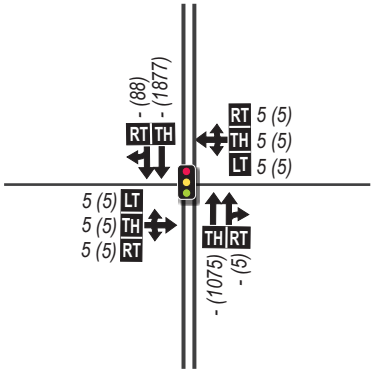
A62. *Ross Island Brg. @ Kelly Ramps*



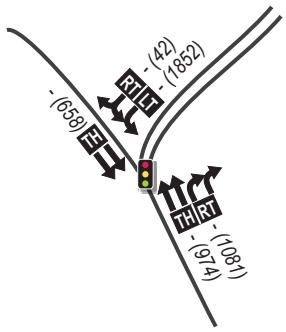
A69. *SW Naito Pkwy. @ Gibbs/Naito Ramps*



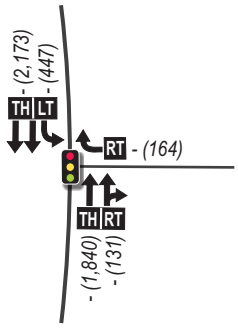
A72. *SW Naito Pkwy. @ SW Whitaker St.*



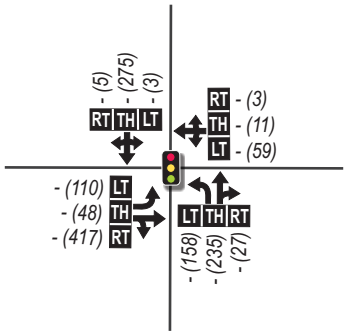
A78. *SW Barbur Blvd. @ SW Naito/ SW Abernathy St.*



A80. *SW Barbur Blvd. @ SW Bancroft St.*



A81. *SW Corbett Blvd. @ SW Bancroft St.*



LEGEND

00. - Study Intersection No.
STOP - Stop Sign
- Yield Sign
- Traffic Signal
- Lane Configuration
- Bus Only Lane
AM (PM) - Peak Hour Traffic Volumes
LT TH RT - Volume Turn Movement
Left•Thru•Right

DKS

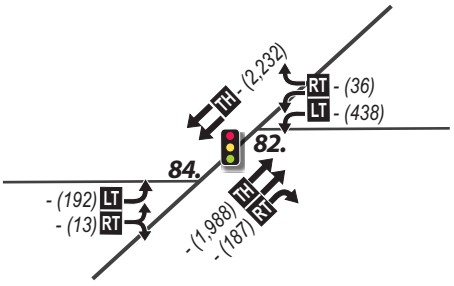
No Scale

figure **3.3-18d**

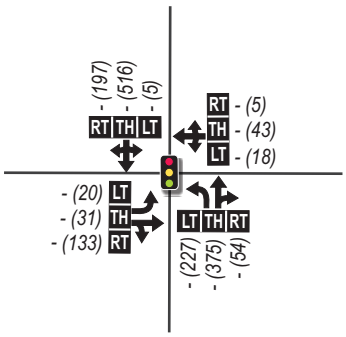
2035 Light Rail Alternative A2: Naito with Bridgehead and Left Turn PM Peak Hour

Segment A: Inner Portland

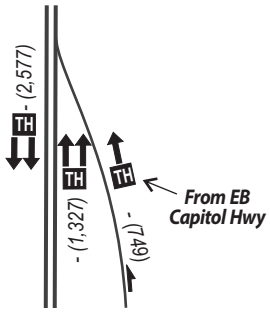
A82. *SW Barbur Blvd. @ SW Hamilton St. (East)*
A84. *SW Barbur Blvd. @ SW Hamilton St. (West)*



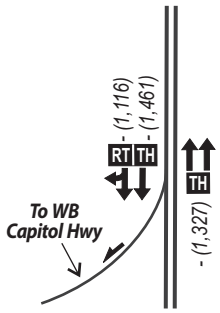
A83. *SW Hamilton Blvd. @ SW Corbett Ave.*



A85. *SW Barbur Blvd. @ SW Capitol Hwy. EB*



A86. *SW Barbur Blvd. @ SW Capitol Hwy. WB*



LEGEND

00. - Study Intersection No.
STOP - Stop Sign
- Yield Sign
- Traffic Signal
- Lane Configuration
- Bus Only Lane
AM (PM) - Peak Hour Traffic Volumes
LT TH RT - Volume Turn Movement
Left•Thru•Right

DKS

No Scale

figure **3.3-18e**

2035 Light Rail Alternative A2: Naito with Bridgehead and Left Turn PM Peak Hour

Segment A: Inner Portland

2035 Light Rail Alternatives Simulation Queuing and Operations Analysis

Simulation models for the light rail alternatives were developed from all three of the No-Build Alternative models (Downtown AM, Hamilton AM, and Segment A PM). No changes were made to the modeling assumptions, but volumes and vehicle routing patterns were updated based on the 2035 Metro regional travel demand model.

As with the existing conditions and No-Build Alternative models, performance metrics such as delay, travel times, and 95th percentile queues were pulled from each of the models. These metrics are included in Appendix R. The four system-wide metrics used for the existing models (vehicles served, latent vehicle demand, unserved demand at key gateways, and total vehicle hours of delay) were also pulled from the simulation model. Using the same methodology as used for the existing models, peak-hour 15-minute queue figures were also created for each model for the light rail alternatives.

Alternative A1: Barbur

Alternative A1 was modeled in the Downtown AM and Segment A PM model areas. The Hamilton model area was not analyzed for the AM because operations with Alternative A1 are expected to be similar to operations with Alternative A2-BH for the area modeled.

The system-wide metrics for the Downtown AM model for Alternative A1 are summarized in Table 3.3-18.

Table 3.3-18. Segment A Downtown Alternative A1 AM Simulation System Measures

Measure	Simulation Result (7-9 a.m.)		
Total Vehicles Served	14,510 vehicles		
Latent Vehicle Demand	0 vehicles		
Total Vehicle Hours of Delay	140 vehicle-hours		
Unserved Demand at Key Gateways			
Gateway	**Demand**	**Unserved Demand**	**Percent Unserved Demand**
None	N/A	N/A	N/A

As the system-wide metrics show, under Alternative A1 conditions, the Downtown AM model has the capacity to service the forecasted demand. Note that this does not guarantee that the demand is able to reach the downtown area, because regional bottlenecks occur outside the model. Appendix R includes the queuing for the Downtown AM model on 15-minute increments from 7:00-9:00 a.m. as averaged over 10 simulations for Alternative A1.

The Alternative A1 Downtown AM queuing plots in Appendix R highlight the main forecasted bottleneck locations for Alternative A1 in 2035, as simulated in the model. The only significant queue increase over the No-Build Alternative conditions occurs on northbound SW 4th Avenue, due in part to the conflicts resulting from the LRT northbound left-turn and eastbound right-turn movements at SW 4th Avenue and SW Lincoln Street. The signalized bicycle and pedestrian crossing at SW 4th Avenue and SW Grant Street, which is part of the Green Loop, also contributes to the northbound queues on SW 4th Avenue.

The system-wide metrics for the Alternative A1 Segment A PM model are summarized in Table 3.3-19.

Table 3.3-19. Segment A Alternative A1 PM Simulation System Measures

Measure		Simulation Result (4-6 p.m.)		
Total Vehicles Served		46,200 vehicles		
Latent Vehicle Demand		3,930 vehicles		
Total Vehicle Hours of Delay		7,050 vehicle-hours		
Unserved Demand at Key Gateways (4-6 p.m.)				
Gateway		**Demand (veh)**	**Unserved Demand (veh)**	**% Unserved Demand**
North	Eastbound SW Market St (East of SW 1st Ave)	2,390	50	2%
	Southbound SW Broadway (north of SW College St)	1,500	20	1%
	Southbound SW Naito Pkwy (north of Hawthorne St)	3,000	30	1%
	Southbound SW 5th Ave (north of SW Harrison St)	610	20	3%
South	Northbound SW Macadam Ave (I-5 northbound off-ramp)	**2,420**	**230**	**10%**
	Northbound Corbett Ave (south of Hamilton St)	1,290	<10	N/A
	Northbound SW Terwilliger Blvd (south of Broadway)	**1,370**	**130**	**9%**
	Eastbound SW Capitol Hwy (east of SW Terwilliger Blvd)	1,710	<10	N/A
	Northbound SW Terwilliger Blvd (south of Capitol Hwy)	350	<10	N/A
	Northbound SW Barbur Blvd (south of SW Capitol Hwy)	2,770	<10	N/A
East	Westbound SE Powell Blvd (east of SE Milwaukie Ave)	**3,280**	**1,350**	**41%**
	Northbound SE Milwaukie Ave (south of SE Powell Blvd)	**1,060**	**270**	**67%**
	Southbound SE Milwaukie Ave (north of SE Powell Blvd)	**1,620**	**120**	**7%**
	Southbound SE 8th Ave (99E northbound off-ramp)	**1,820**	**1,220**	**26%**
West	I-405 Southbound Off-Ramp at SW Broadway	2,050	<10	N/A
	Northbound SW Broadway Dr (south of SW Grant St)	700	10	1%
	Eastbound SW Hamilton St (west of SW Barbur Blvd)	**480**	**140**	**29%**
Throughput at System Bottlenecks (4-6 p.m.)				
Location		**Demand**	**Throughput**	**% Demand Served**
Ross Island Bridge Westbound at I-5		**4,970**	**2,060**	**41%**
Ross Island Bridge Eastbound at I-5		**6,300**	**5,740**	**91%**
SW Barbur Blvd Northbound at SW Hamilton St		4,060	3,980	98%
SW Barbur Blvd Southbound at SW Hamilton St		**4,910**	**4,190**	**85%**

Bold = Demand exceeds volume served by 5% or more

The system-wide metrics show that under Alternative A1 PM 2035 conditions, the Segment A PM model does not have the capacity to fully serve the forecasted demand. The causes of the unserved demand at key gateways are discussed in conjunction with discussion of the performance of key bottleneck locations later in this section. Appendix R includes the queuing for the Segment A PM model on 15-minute increments from 4:00-6:00 p.m. as averaged over 10 simulations for Alternative A1.

The Alternative A1 queuing plots in Appendix R highlight the main forecasted bottleneck locations for Alternative A1 in 2035, as simulated in the model. These key locations are summarized as follows:

- Downtown grid encompassed by SW Harrison Street, SW Jackson Street, SW Broadway and SW 4th Avenue. The downtown grid would continue to perform similar to the No-Build Alternative conditions.

- I-405 southbound off-ramp to SW Broadway. This location would face similar queue spillback issues as under the No-Build Alternative conditions.

- I-405 northbound on-ramp from SW 6th Avenue. The Metro regional travel demand model projects essentially no increase in total demand on the I-405 northbound on-ramp in the year 2035. However, upstream bottleneck issues would prevent the entire demand from reaching the intersection under the Alternative A1 2035 conditions, so the overall intersection performance and queuing appear to improve as result of the lower traffic volumes reaching the I-405 northbound on-ramp.

- SW Hooker Street and SW Barbur Boulevard. There would be increased northbound queuing at this location due to the northbound lane drop, new traffic signal, buses entering/exiting the shared transitway, and added U-turn volumes. This queue could impact operations as far south as SW Hamilton Street under worst-case conditions, with average queues being contained north of SW Naito Parkway.

- Ross Island Bridgehead westbound. The performance at this location would be similar to that under the No-Build Alternative conditions. The queue spillback issues triggered by the combination of westbound Ross Island Bridge to southbound I-5 and northbound SW Macadam Avenue to eastbound Ross Island Bridge would affect the westbound SE Powell Boulevard, northbound SE Milwaukie Street, southbound SE 8th Avenue (ramp from OR 99E), and southbound SW Water Avenue gateways. However, demand for the I-5 northbound to Ross Island Bridge eastbound increases due to volumes shifting off Barbur to avoid the capacity constraints of the northbound lane reduction between Capitol Hwy and SW Naito Parkway. This increased demand on northbound Macadam Avenue leads to increased unserved demand and queuing at this gateway.

- Intersection of SW Naito Parkway and SW Barbur Boulevard. The second southbound lane on SW Barbur Boulevard opens up approximately 50' north of this intersection, according to the design plans. With the long cycle required to run the intersection effectively, the 50' of storage does not provide much of an increase in throughput, as the southbound movement will queue into the single lane section quickly and extend up SW Barbur Boulevard, occasionally passing SW Hooker Street and even inhibiting westbound traffic flow on SW Sheridan Street.

- Intersection of SW Bancroft Street and SW Barbur Boulevard. The southbound left-turn movement shifted from SW Hamilton Street and SW Barbur Boulevard to the new signal at this intersection would queue back into southbound SW Barbur Boulevard and ultimately up SW Naito Parkway to north of the Ross Island Bridgehead. The current design for Alternative A1 includes approximately 500 feet of southbound left-turn storage. The queuing issue is caused by:

    - slow right-turn speeds at the intersection of SW Bancroft Street and SW Corbett Avenue, about 120 feet east of the SW Bancroft Street and SW Barbur Boulevard intersection that ultimately impact the flow rate from the southbound left turn

    - insufficient storage for the southbound left turn (given the length of the signal cycle at SW Bancroft Street and SW Barbur Boulevard, the southbound left-turn storage does not suffice to serve a full southbound left-turn phase, leading to queue spillback every cycle).

- **Intersection of SW Hamilton Street and SW Corbett Avenue.** Queues at this intersection would remain, but overall traffic throughput would improve over the No-Build Alternative conditions due to the new signal.

- **Intersection of SW Hamilton Street and SW Barbur Boulevard.** Similar queuing issues as under No-Build conditions. The reduction in northbound through lanes on SW Barbur Boulevard does not appear to have much impact at this location during the PM period.

Overall, the projected PM peak-hour conditions in Segment A under Alternative A1 indicate high levels of congestion and large unserved demand. In reality, driving behaviors would likely shift regionally with further route diversion, mode shift and peak spreading to avoid the large delays incurred by the unserved demand attempting to enter the study area during the peak two hours.

Alternative A2-BH: Naito with Bridgehead

Alternative A2-BH was modeled in the Hamilton AM model and Segment A PM model areas. The Downtown AM model was not performed for Alternative A2-BH as it would perform similarly to Alternative A1. Because AM conditions were modeled only for the Hamilton AM model area, the system-wide metrics are not comparable to the PM conditions.

The system-wide metrics for the Alternative A2-BH Hamilton AM model are summarized in Table 3.3-20.

Table 3.3-20. Segment A Hamilton Alternative A2-BH AM Simulation System Measures

Measure	Simulation Result (7-9 a.m.)		
Total Vehicles Served	20,300 vehicles		
Latent Vehicle Demand	880 vehicles		
Total Vehicle Hours of Delay	1,570 vehicle-hours		
Unserved Demand at Key Gateways			
Gateway	**Demand (veh)**	**Unserved Demand (veh)**	**Percent Unserved Demand**
Northbound Corbett Ave (south of Hamilton St)	**1,540**	**150**	**10%**
Ross Island Bridge Westbound (at Hwy 99E)	6,490	170	3%
Eastbound SW Capitol Hwy (east of Terwilliger Blvd)	2,740	30	1%
Northbound SW Barbur Blvd (south of SW Capitol Hwy)	**4,100**	**540**	**13%**

Bold = Demand exceeds volume served by 5% or more

The system-wide metrics show that under Alternative A2-BH AM conditions in 2035, the Hamilton AM model does not have the capacity to fully serve the forecasted demand. The causes of the unserved demand at key gateways are discussed in conjunction with discussion of the performance of key bottleneck locations later in this section. Appendix R includes the queuing for the Hamilton AM model on 15-minute increments from 7:00-9:00 a.m. as averaged over 10 simulations for the No-Build Alternative.

The Alternative A2-BH Hamilton AM queuing plots in Appendix R highlight the main forecasted bottleneck locations for Alternative A2-BH in 2035, as simulated in the model. These key locations are summarized as follows:

- **Ross Island Bridge Bridgehead Westbound:** Queue from the new traffic signals at SW Naito Parkway and SW Woods Street, and SW Kelly Avenue and SW Porter Street create queuing shockwaves that extend across the Ross Island Bridge throughout the AM peak period.

- **Intersection of SW Hamilton Street and SW Barbur Boulevard.** Northbound queues would continue to spill back, reaching the SW Capitol Highway merge.

- **Intersection of SW Hamilton Street and SW Corbett Avenue.** Traffic operations at this intersection would improve compared to the No-Build Alternative conditions as a result of an added signal.

- **Merge of eastbound SW Capitol Highway and northbound SW Barbur Boulevard.** With the reduction from three to two lanes, once the first northbound queue shockwave from SW Hamilton Street reaches the merge at the SW Capitol Highway ramp, the merge becomes congested and queues back up on SW Capitol Highway to SW Terwilliger Boulevard and down SW Barbur Boulevard.

- **Intersection of SW Capitol Highway and SW Terwilliger Boulevard.** Operations at this intersection would be impacted by the queue spillback from northbound SW Barbur Boulevard.

Overall, the Alternative A2-BH peak-hour traffic conditions for the Hamilton AM model indicate high levels of congestion and large unserved demand. In reality, driving behaviors would likely shift regionally with further route diversion, mode shift and peak spreading to avoid the large delays incurred by the unserved demand attempting to enter the study area during the peak two hours.

The system-wide metrics for the Alternative A2-BH Segment A PM model are summarized in Table 3.3-21.

Table 3.3-21. Segment A Alternative A2-BH PM Simulation System Measures

Measure		Simulation Result (4-6 p.m.)		
Total Vehicles Served		46,900 vehicles		
Latent Vehicle Demand		3,680 vehicles		
Total Vehicle Hours of Delay		7,910 vehicle-hours		
Unserved Demand at Key Gateways (4-6 p.m.)				
Gateway		**Demand (veh)**	**Unserved Demand (veh)**	**% Unserved Demand**
North	Eastbound SW Market St (East of SW 1st Ave)	**2,410**	**980**	**41%**
	Southbound SW Broadway (north of SW College St)	1,630	30	2%
	Southbound SW Naito Pkwy (north of Hawthorne St)	**2,970**	**440**	**15%**
	Southbound SW 5th Ave (north of SW Harrison St)	**610**	**70**	**12%**
South	Northbound SW Macadam Ave (I-5 northbound off-ramp)	2,570	<10	N/A
	Northbound Corbett Ave (south of Hamilton St)	1,240	20	2%
	Northbound SW Terwilliger Blvd (south of Broadway)	1,320	50	3%
	Eastbound SW Capitol Hwy (east of SW Terwilliger Blvd)	1,730	<10	N/A
	Northbound SW Terwilliger Blvd (south of Capitol Hwy)	350	<10	N/A
	Northbound SW Barbur Blvd (south of SW Capitol Hwy)	2,620	30	1%
East	Westbound SE Powell Blvd (east of SE Milwaukie Ave)	**3,320**	**700**	**21%**
	Northbound SE Milwaukie Ave (south of SE Powell Blvd)	**1,080**	**170**	**15%**

Table 3.3-21. Segment A Alternative A2-BH PM Simulation System Measures

Measure		Simulation Result (4-6 p.m.)		
	Southbound SE Milwaukie Ave (north of SE Powell Blvd)	1,600	10	1%
	Southbound SE 8th Ave (99E northbound off-ramp)	**1,930**	**590**	**31%**
West	I-405 Southbound Off-Ramp at SW Broadway	**2,090**	**120**	**6%**
	Northbound SW Broadway Dr (south of SW Grant St)	**770**	**30**	**11%**
	Eastbound SW Hamilton St (west of SW Barbur Blvd)	390	10	3%
Throughput at System Bottlenecks (4-6 p.m.)				
Location		**Demand**	**Throughput**	**% Demand Served**
Ross Island Bridge Westbound at I-5		**5,270**	**3,610**	**68%**
Ross Island Bridge Eastbound at I-5		**6,440**	**6,000**	**93%**
SW Barbur Blvd Northbound at SW Hamilton St		3,830	3,750	98%
SW Barbur Blvd Southbound at SW Hamilton St		**4,830**	**3,970**	**82%**

Bold = Demand exceeds volume served by 5% or more

The system-wide metrics show that under Alternative A2-BH PM conditions in 2035, the Segment A PM model does not have the capacity to fully serve the forecasted demand. The causes of the unserved demand at key gateways are discussed in conjunction with discussion of the performance of key bottleneck locations later in this section. Appendix R includes the queuing for the Segment A PM model on 15-minute increments from 4:00-6:00 p.m. as averaged over 10 simulations for Alternative A2-BH.

The Alternative A2-BH queuing plots in Appendix R highlight the main forecasted bottleneck locations for Alternative A2-BH in 2035, as simulated in the model. These key locations are summarized as follows:

- **SW Naito Parkway at SW Lincoln Street.** The southbound SW Naito Parkway lane drop between SW Harrison Street and SW Lincoln Street would create queue spillback issues that in turn would create queues on SW Columbia Street, SW Market Street, SW 1st Avenue and SW Naito Parkway, as reflected in the key gateways unserved demand measures.

- **Downtown grid encompassed by SW Harrison Street, SW Jackson Street, SW Broadway and SW 4th Avenue.** The downtown grid would continue to perform similar to the No-Build Alternative conditions.

- **I-405 northbound on-ramp from SW 6th Avenue.** Queue spillback would impact operations at SW 1st Avenue and SW Arthur Street, and at the new signal at SW Kelly Avenue and SW Porter Street.

- **SW Kelly Avenue and SW Porter Street.** Queue spillback from the I-405 on-ramp at SW 6th Avenue would hinder northbound traffic at this intersection, and would generate westbound queues that stretch across the Ross Island Bridge and through SE Milwaukie Avenue.

- **SW Naito Parkway and Ross Island Bridge.** Westbound traffic from the new signal rarely would queue back to SW Kelly Avenue. However, queue spillback from the southbound left at SW Bancroft Street and SW Barbur Boulevard occasionally would impede southbound traffic on SW Naito Parkway at the Ross Island Bridgehead, SW Gibbs Street and SW Whitaker Street.

- **Intersection of SW Bancroft Street and SW Barbur Boulevard.** The southbound left-turn movement shifted from SW Hamilton Street and SW Barbur Boulevard to the new signal at this intersection would queue back into southbound SW Barbur Boulevard and ultimately up SW Naito Parkway to north of the Ross Island Bridgehead. The Draft EIS Alternative A2-BH design includes approximately 500 feet of southbound left-turn storage. The queuing issue is a result of the following conditions:
  - slow right-turn speeds at the intersection of SW Bancroft Street and SW Corbett Avenue, about 120 feet east of the SW Bancroft Street and SW Barbur Boulevard intersection that would ultimately impact the flow rate from the southbound left turn
  - insufficient storage for the southbound left turn (given the length of the signal cycle at SW Bancroft Street and SW Barbur Boulevard, the southbound left-turn storage would not suffice to serve a full southbound left-turn phase, leading to queue spillback every cycle).
- **Intersection of SW Hamilton Street and SW Corbett Avenue.** Queues at this intersection would remain, but overall traffic throughput would improve compared to conditions under the No-Build Alternative as a result of the new signal.
- **Intersection of SW Hamilton Street and SW Barbur Boulevard.** While eastbound SW Hamilton Street queuing issues would remain, the northbound queues on SW Barbur Boulevard would be reduced to less than those under existing conditions because of the shift of the southbound left turn to SW Bancroft Street.

Overall, the Alternative A2-BH PM peak-hour conditions indicate high levels of congestion and large unserved demand in Segment A. In reality, driving behaviors would likely shift regionally with further route diversion, mode shift and peak spreading to avoid the large delays incurred by the unserved demand attempting to enter the study area during the peak two hours.

Alternative A2-LA: Naito with Limited Access

Alternative A2-LA was modeled in the Segment A PM model area only. This alternative involves the following four major geometric revisions that impact operations:

- removal of SW Grover Street underpass and replacement with at-grade signalized intersection at SW Gibbs Street and SW Naito Parkway
- flip of southbound SW Naito Parkway with southbound SW Barbur Boulevard as they merge north of SW Bancroft Street
- extension of the southbound left-turn lane at SW Hamilton Street and SW Barbur Boulevard through SW Bancroft Street
- northbound lane-drop on SW Barbur Boulevard between the SW Capitol Highway merge and SW Hamilton Street (same as all other alignment alternatives).

The system-wide metrics for the Alternative A2-LA Segment A PM model are summarized in Table 3.3-22.

Table 3.3-22. Segment A Alternative A2-LA PM Simulation System Measures

Measure		Simulation Result (4-6 p.m.)		
Total Vehicles Served		46,960 vehicles		
Latent Vehicle Demand		3,870 vehicles		
Total Vehicle Hours of Delay		7,370 vehicle-hours		
Unserved Demand at Key Gateways (4-6 p.m.)				
Gateway		**Demand (veh)**	**Unserved Demand (veh)**	**% Unserved Demand**
North	Eastbound SW Market St (East of SW 1st Ave)	2,420	<10	N/A
	Southbound SW Broadway (north of SW College St)	**1,590**	**90**	**5%**
	Southbound SW Naito Pkwy (north of Hawthorne St)	3,000	30	1%
	Southbound SW 5th Ave (north of SW Harrison St)	590	<10	N/A
South	Northbound SW Macadam Ave (I-5 northbound off-ramp)	2,380	70	3%
	Northbound Corbett Ave (south of Hamilton St)	**1,240**	**240**	**19%**
	Northbound SW Terwilliger Blvd (south of Broadway)	1,340	<10	N/A
	Eastbound SW Capitol Hwy (east of SW Terwilliger Blvd)	1,710	<10	N/A
	Northbound SW Terwilliger Blvd (south of Capitol Hwy)	350	<10	N/A
	Northbound SW Barbur Blvd (south of SW Capitol Hwy)	**2,750**	**260**	**10%**
East	Westbound SE Powell Blvd (east of SE Milwaukie Ave)	**3,300**	**1,400**	**42%**
	Northbound SE Milwaukie Ave (south of SE Powell Blvd)	**1,060**	**260**	**25%**
	Southbound SE Milwaukie Ave (north of SE Powell Blvd)	1,620	20	1%
	Southbound SE 8th Ave (99E northbound off-ramp)	**1,830**	**1,030**	**56%**
West	I-405 Southbound Off-Ramp at SW Broadway	2,110	10	1%
	Northbound SW Broadway Dr (south of SW Grant St)	**730**	**160**	**21%**
	Eastbound SW Hamilton St (west of SW Barbur Blvd)	**380**	**250**	**66%**
Throughput at System Bottlenecks (4-6 p.m.)				
Location		**Demand**	**Throughput**	**% Demand Served**
Ross Island Bridge Westbound at I-5		**5,030**	**3,610**	**46%**
Ross Island Bridge Eastbound at I-5		**6,210**	**6,000**	**90%**
SW Barbur Blvd Northbound at SW Hamilton St		**4,050**	**3,480**	**86%**
SW Barbur Blvd Southbound at SW Hamilton St		**4,780**	**3,930**	**82%**

Bold = Demand exceeds volume served by 5% or more

The system-wide metrics show that under Alternative A2-LA PM conditions in 2035, the Segment A PM model does not have the capacity to fully serve the forecasted demand. The causes of the unserved demand at key gateways are discussed in conjunction with discussion of the performance of key bottleneck locations later in this section. Appendix R includes the queuing for the Segment A PM model on 15-minute increments from 4:00-6:00 p.m. as averaged over 10 simulations for Alternative A2-LA.

The Alternative A2-LA queuing plots in Appendix R highlight the main forecasted bottleneck locations for Alternative A2-LA in 2035, as simulated in the model. These key locations are summarized as follows:

- Downtown grid encompassed by SW Harrison Street, SW Jackson Street, SW Broadway, Avenue and SW 4th Avenue. The downtown grid would continue to perform similar to the No-Build Alternative conditions.

- **I-405 northbound on-ramp from SW 6th Avenue.** Because of upstream bottlenecks, queue spillback from the I-405 northbound on-ramp would decrease compared to the No-Build Alternative conditions due to reduced throughput.

- **SW Naito Parkway and SW Gibbs Street.** Simulation analysis of this intersection indicated multiple bottlenecks. The permissive eastbound left turn from SW Gibbs Street would have limited capacity as a result of queue spillback from the SW Naito Parkway and Ross Island Bridgehead intersections. The westbound queue would spill back up SW 1st Avenue and would reduce capacity at the intersection of SW 1st Avenue and SW Arthur Street. Queues then would spill back to the I-405 southbound off-ramp and southbound SW Broadway. In addition, with the amount of high-volume vehicle phases and long mainline pedestrian crossing time, the green-time phasing for the southbound movement from westbound Ross Island Bridge to SW Naito Parkway would be insufficient to serve the demand.

- **SW Barbur Boulevard and SW Pennoyer Street.** With the geometry of Alternative A2-LA, southbound vehicles on SW Barbur Boulevard would no longer be able to make a southbound left turn at SW Barbur Boulevard and SW Hamilton Street. To accommodate this movement (approximately half of the total southbound left-turn volume at SW Barbur Boulevard and SW Hamilton Street), a new signal at SW Barbur Boulevard and SW Pennoyer Street with protected left-turn phasing is included in Alternative A2-LA. The new signal would allow vehicles on southbound SW Barbur Boulevard to access SW Naito Parkway farther to the north. The southbound left-turn queues from this intersection occasionally would queue outside of the lane storage, but dissipate later in the PM period.

- **Intersection of SW Hamilton Street and SW Corbett Avenue.** Queues at this intersection would remain, but overall traffic throughput would improve compared to the No-Build Alternative conditions as a result of a new signal.

- **Intersection of SW Hamilton Street and SW Barbur Boulevard.** Eastbound SW Hamilton Street queuing issues would remain. In addition, lane reductions on northbound SW Barbur Boulevard would lead to longer northbound queues, ultimately impacting the SW Capitol Highway and SW Barbur Boulevard merge capacity.

Overall, the Alternative A2-LA PM peak-hour conditions in Segment A indicate high levels of congestion and large unserved demand. In reality, driving behaviors would likely shift regionally with further route diversion, mode shift and peak spreading to avoid the large delays incurred by the unserved demand attempting to enter the study area during the peak two hours.

Alternative A1-BH: Barbur with Bridgehead

Alternative A1-BH was modeled in the Segment A PM model only. This alternative combines the Ross Island Bridgehead improvements from Alternative A2-BH with the Alternative A1 light rail alignment on SW Barbur Boulevard and was not included as a stand-alone alternative in the Draft EIS. Because Alternative A1-BH is not a stand-alone Draft EIS alternative, the following mitigations for congestion issues identified in other alternatives were tested:

- extend two-lane southbound SW Naito Parkway to SW Sheridan Street, rather than between SW Harrison Street and SW Lincoln Street

- extend two-lane portions of southbound SW Naito Parkway from 50 feet north of new Ross Island Bridge intersection to SW Porter Street
- extend southbound left-turn lane pocket at SW Barbur Boulevard and SW Bancroft Street from about 550 feet to 950 feet
- convert eastbound SW Bancroft Street to right turn only at SW Corbett Avenue, shift SW Bancroft Street as far north as possible within the existing cross section and use the added space to create a wider-radius eastbound right turn
- extend the second southbound though lane at SW Barbur Boulevard and SW Naito Parkway north to SW Condor Avenue

The system-wide metrics for the Alternative A1-BH Segment A PM model are summarized in Table 3.3-23.

Table 3.3-23. Segment A Alternative A1-BH PM Simulation System Measures

Measure		Simulation Result (4-6 p.m.)		
Total Vehicles Served		44,710 vehicles		
Latent Vehicle Demand		5,070 vehicles		
Total Vehicle Hours of Delay		8,130 vehicle-hours		
Unserved Demand at Key Gateways (4-6 p.m.)				
Gateway		**Demand (veh)**	**Unserved Demand (veh)**	**% Unserved Demand**
North	Eastbound SW Market St (East of SW 1st Ave)	**2,370**	**890**	**37%**
	Southbound SW Broadway (north of SW College St)	**1,640**	**260**	**16%**
	Southbound SW Naito Pkwy (north of Hawthorne St)	**2,970**	**1,010**	**34%**
	Southbound SW 5th Ave (north of SW Harrison St)	**560**	**120**	**21%**
South	Northbound SW Macadam Ave (I-5 northbound off-ramp)	2,370	<10	N/A
	Northbound Corbett Ave (south of Hamilton St)	**1,290**	**260**	**20%**
	Northbound SW Terwilliger Blvd (south of Broadway)	**1,310**	**90**	**6%**
	Eastbound SW Capitol Hwy (east of SW Terwilliger Blvd)	1,730	120	7%
	Northbound SW Terwilliger Blvd (south of Capitol Hwy)	350	<10	N/A
	Northbound SW Barbur Blvd (south of SW Capitol Hwy)	**2,600**	**530**	**20%**
East	Westbound SE Powell Blvd (east of SE Milwaukie Ave)	**3,320**	**400**	**12%**
	Northbound SE Milwaukie Ave (south of SE Powell Blvd)	**1,070**	**50**	**5%**
	Southbound SE Milwaukie Ave (north of SE Powell Blvd)	1,600	<10	N/A
	Southbound SE 8th Ave (99E northbound off-ramp)	**1,910**	**330**	**17%**
West	I-405 Southbound Off-Ramp at SW Broadway	**2,080**	**420**	**20%**
	Northbound SW Broadway Dr (south of SW Grant St)	**780**	**200**	**26%**
	Eastbound SW Hamilton St (west of SW Barbur Blvd)	**370**	**100**	**28%**
Throughput at System Bottlenecks (4-6 p.m.)				
Location		**Demand**	**Throughput**	**% Demand Served**
Ross Island Bridge Westbound at I-5		**5,260**	**3,980**	**76%**
Ross Island Bridge Eastbound at I-5		**6,480**	**5.350**	**82%**
SW Barbur Blvd Northbound at SW Hamilton St		**3.900**	**2,840**	**73%**
SW Barbur Blvd Southbound at SW Hamilton St		**4,970**	**3,830**	**77%**

Bold = Demand exceeds volume served by 5% or more

The system-wide metrics show that under PM 2035 conditions for Alternative A1-BH, the Segment A PM model does not have the capacity to fully serve the forecasted demand. The causes of the unserved demand at key gateways are discussed in conjunction with discussion of the performance of key bottleneck locations later in this section. Appendix R includes the queuing for the Segment A PM model on 15-minute increments from 4:00-6:00 p.m. as averaged over 10 simulations for Alternative A1-BH.

The Alternative A1-BH queuing plots in Appendix R highlight the main forecasted bottleneck locations for Alternative A1-BH in 2035, as simulated in the model. These key locations are summarized as follows:

- Downtown grid encompassed by SW Harrison Street, SW Jackson Street, SW Broadway and SW 4th Avenue. The downtown grid would continue to perform similar to the No-Build Alternative conditions.

- I-405 northbound on-ramp from SW 6th Avenue – As a result of upstream bottlenecks, queue spillback from the I-405 northbound on-ramp would decrease compared to the No-Build Alternative conditions due to reduced throughput.

- SW Naito Parkway at SW Lincoln Street. The southbound SW Naito Parkway lane drop between SW Harrison Street and SW Lincoln Street would create queue spillback issues that in turn would create queues on SW Columbia Street, SW Market Street, SW 1st Avenue and SW Naito Parkway, as reflected in the key gateways unserved demand measures.

- SW Naito Parkway and SW Gibbs Street. Southbound queue spillback from this intersection occasionally would reach SW Naito Parkway and the Ross Island Bridge. Queue shockwaves then would extend north, impacting operations at the SW Naito Parkway lane drop at SW Sheridan Street.

- SW Hooker Street and SW Barbur Boulevard. There would be increased northbound queuing at this location due to the lane drop, new signal, buses entering/existing the shared transitway, and U-turn volumes. This queue would impact operations as far south as SW Hamilton Street.

- Intersection of SW Naito Parkway and SW Barbur Boulevard. The second southbound lane on SW Barbur Boulevard opens up approximately 50’ north of this intersection, according to the design plans. With the long cycle required to run the intersection effectively, the 50’ of storage does not provide much of an increase in throughput, as the southbound movement will queue into the single lane section quickly and extend up SW Barbur Boulevard, occasionally passing SW Hooker Street and even inhibiting westbound traffic flow on SW Sheridan Street.

- Intersection of SW Bancroft Street and SW Barbur Boulevard. The southbound left-turn movement shifted from SW Hamilton Street and SW Barbur Boulevard to the new signal at this intersection would queue back into southbound SW Barbur Boulevard and ultimately up SW Naito Parkway to north of the Ross Island Bridgehead. The current design Alternative A2-BH design includes approximately 500 feet of southbound left-turn storage. The queuing issue is a result of the following conditions:

- slow right-turn speeds at the intersection of SW Bancroft Street and SW Corbett Avenue, about 120 feet east of the SW Bancroft Street and SW Barbur Boulevard intersection that would ultimately impact the flow rate from the southbound left turn

- insufficient storage for the southbound left turn (given the length of the signal cycle at SW Bancroft Street and SW Barbur Boulevard, the southbound left-turn storage would not suffice to serve a full southbound left-turn phase, leading to queue spillback every cycle)

- **SW Barbur Boulevard and SW Sheridan Street/SW 4th Avenue and SW Caruthers Street/SW Broadway.** The northbound left turn at SW 4th Avenue and SW Caruthers Street/SW Broadway would be reduced from two lanes under the No-Build Alternative to one lane in this alternative. This lane reduction would lead to queue spillback issues that ultimately would impact queues on northbound SW Terwilliger Boulevard and southbound SW Broadway.

Overall, the Alternative A1-BH peak-hour conditions in Segment A indicate high levels of congestion and large unserved demand. In reality, driving behaviors would likely shift regionally with further route diversion, mode shift and peak spreading to avoid the large delays incurred by the unserved demand attempting to enter the study area during the peak two hours.

Alternative A2-BH-LT – Naito Bridgehead with Left Turn

The A2-BH-LT (Naito Bridgehead with Left Turn) alignment scenario was modeled in the Segment A PM model only. This alternative is very similar to A2-BH, the exception being a signalized southbound left turn at the intersection of SW Naito Parkway and SW Woods Street to access the Ross Island Bridge.

The system-wide metrics for the Alternative A2-BH-LT Segment A PM model are summarized in Table 3.3-24.

Table 3.3-24. Segment A Alternative A2-BH-LT PM Simulation System Measures

Measure		Simulation Result (4-6 p.m.)		
Total Vehicles Served		47,000 vehicles		
Latent Vehicle Demand		3,870 vehicles		
Total Vehicle Hours of Delay		7,370 vehicle-hours		
Unserved Demand at Key Gateways (4-6 p.m.)				
Gateway		**Demand (veh)**	**Unserved Demand (veh)**	**% Unserved Demand**
North	Eastbound SW Market St (East of SW 1st Ave)	**2,410**	**1,240**	**51%**
	Southbound SW Broadway (north of SW College St)	**1,630**	**90**	**6%**
	Southbound SW Naito Pkwy (north of Hawthorne St)	**2,970**	**470**	**16%**
	Southbound SW 5th Ave (north of SW Harrison St)	**610**	**60**	**10%**
South	Northbound SW Macadam Ave (I-5 northbound off-ramp)	2,770	<10	N/A
	Northbound Corbett Ave (south of Hamilton St)	1,240	<10	N/A
	Northbound SW Terwilliger Blvd (south of Broadway)	1,320	20	1%
	Eastbound SW Capitol Hwy (east of SW Terwilliger Blvd)	1,730	<10	N/A
	Northbound SW Terwilliger Blvd (south of Capitol Hwy)	350	<10	N/A
	Northbound SW Barbur Blvd (south of SW Capitol Hwy)	2420	<10	N/A
East	Westbound SE Powell Blvd (east of SE Milwaukie Ave)	**3,320**	**790**	**24%**
	Northbound SE Milwaukie Ave (south of SE Powell Blvd)	**1,080**	**230**	**22%**

Table 3.3-24. Segment A Alternative A2-BH-LT PM Simulation System Measures

Measure		Simulation Result (4-6 p.m.)		
	Southbound SE Milwaukie Ave (north of SE Powell Blvd)	1,600	<10	N/A
	Southbound SE 8th Ave (99E northbound off-ramp)	**1,930**	**630**	**32%**
West	I-405 Southbound Off-Ramp at SW Broadway	2,090	70	3%
	Northbound SW Broadway Dr (south of SW Grant St)	**770**	**80**	**10%**
	Eastbound SW Hamilton St (west of SW Barbur Blvd)	390	<10	N/A
Throughput at System Bottlenecks (4-6 p.m.)				
Location		**Demand**	**Throughput**	**% Demand Served**
Ross Island Bridge Westbound at I-5		**5,260**	**3,480**	**66%**
Ross Island Bridge Eastbound at I-5		**6,440**	**6,080**	**94%**
SW Barbur Blvd Northbound at SW Hamilton St		3.820	3,670	96%
SW Barbur Blvd Southbound at SW Hamilton St		**4,830**	**3,990**	**83%**

Bold = Demand exceeds volume served by 5% or more

The system-wide metrics show that under Alternative A2-BH-LT PM 2035 conditions, the Segment A model does not have the capacity to fully serve the forecasted demand. The causes of the unserved demand at key gateways are discussed in conjunction with discussion of key bottleneck location performance later in this section. Appendix R includes the queuing for the Segment A PM model on 15-minute increments from 4:00-6:00 p.m. as averaged over 10 simulations for Alternative A2-BH-LT.

The Alternative A2-BH-LT queuing plots in Appendix R highlight the main forecasted bottleneck locations for Alternative A2-BH-LT in 2035, as simulated in the model. Overall, the alternative performs very similar to Alternative A2-BH with one key exception. Adding a southbound left turn lane at SW Naito Parkway and SW Gibbs Street increase demand on SW Naito Parkway, which already has capacity issues due to the southbound lane drop between SW Harrison Street and SW Lincoln Street. The added demand accelerates the A2-BH merge issue, leading to additional unserved demand from the downtown gateways into the model.

Overall, similar to all the alternatives the PM peak hour conditions in Segment A modeled in Alternative A2-BH-LT indicate high levels of congestion and large unserved demand. In reality, driving behaviors would likely shift regionally with further route diversion, mode shift and peak spreading to avoid the large delays incurred by the unserved demand attempting to enter the study area during the peak two hours.

2045 HCM Operations for the No-Build Alternative

The following analysis evaluates the ramp terminal intersections for the I-405 off-ramps under the 2045 PM No-Build Alternative peak-hour conditions. Table 3.3-25 shows the Synchro analysis results for the 2045 No-Build Alternative. As shown, the V/C ratio under the No-Build Alternative for both ramps would remain well below mobility targets.

Table 3.3-25. Segment A 2045 No-Build Alternative HCM (Synchro) Analysis

ID	Intersection	Note	Mobility Target		2045 No-Build				
						PM			
					Control	Delay	LOS	V/C	WLANE
A23	SW 6th Ave. & SW College St.		ODOT Ramp	0.85	Signal	8.5	A	0.34	-
A31	SW 4th Ave./I-405 northbound off-ramp/SW Lincoln St.		ODOT Ramp	0.85	Signal	15.3	B	0.49	-

2045 HCM Operations for the Light Rail Alternatives

The following analysis evaluates the ramp terminal intersections for the I-405 off-ramps under 2045 PM peak-hour conditions for the light rail alternatives. Table 3.3-26 shows Synchro analysis results for the 2045 light rail alternatives. As shown, the V/C ratio for both ramps would increase marginally over V/C ratios for those ramps under the No-Build Alternative but would remain well below mobility targets.

Table 3.3-26. Segment A 2045 Light Rail Alternatives HCM (Synchro) Analysis

ID	Intersection	Note	Mobility Target		2045 Light Rail				
						PM			
					Control	Delay	LOS	V/C	WLANE
A23	SW 6th Ave. & SW College St.		ODOT Ramp	0.85	Signal	8.5	A	0.35	-
A31	SW 4th Ave./I-405 northbound off-ramp/SW Lincoln St.		ODOT Ramp	0.85	Signal	11.7	B	0.50	

3.3.5. Segment A Preliminary Signal Warrant Analysis

Intersections with proposed traffic signals were evaluated for a preliminary signal warrants analysis. Details of the warrants analysis can be found in Appendix D. Intersections (indicated below by their alphanumeric ID) with proposed traffic signals in at least one of the alignment alternatives and that would meet signal warrants for the future year (2035) are:

- A56: SW Kelly Avenue/SW Hood Avenue
- A78: SW Barbur Boulevard/SW Naito Parkway

Traffic signals that do not or would not meet signal warrants for the existing year 2015 or future year 2035 are:

- A53: SW Naito Parkway/SW Hooker Street
- A72: SW Naito Parkway/SW Whitaker Street

3.3.6. Segment A Access Spacing

Segment A is entirely within Portland city limits. However, many study area intersections are on SW Barbur Boulevard (Highway 99 West), which is part of the Oregon Highway System (OHS) and is classified as a District Highway by ODOT. Additionally, ODOT standards apply to interchange ramp

terminals on state highways, and these ramp terminals could be reconfigured as part of the light rail alternatives.

Table 3.3-27 shows ODOT spacing standards for intersections in Segment A that have a newly proposed signal or that terminate a freeway ramp, under the denoted alignment alternatives.

Table 3.3-27: Segment A Access Spacing, ODOT Standards

Int. ID	Name	Alignment Alternative	Dist. to Nearest Ramp or Int. (feet)	Along Road	Class/Area	Speed Limit (mph)	Spacing Standard (feet)	Standard Met?
A31	SW 4th Ave./I-405 northbound off-ramp/SW Lincoln St.	A1	440	SW 4th Ave.	Fully Developed Urban	-	1,320	No
A51	SW Kelly Ave./SW Water Ave.	A2-BH	400	SW Kelly Ave.	District Highway	35	350	Yes
A53	SW Naito Pkwy./SW Hooker St.	A2-BH	260	SW Naito Pkwy.	District Highway	40	500	No
A56	SW Kelly Ave./SW Hood Ave.	A2-BH	300 (right-in, right-out)	SW Kelly Ave.	Fully Developed Urban	-	750	No
			700 (signal)	SW Kelly Ave.	Fully Developed Urban	-	1,320	No
A61	Ross Island Bridge/SW Naito Pkwy.	A2-BH	260	SW Naito Pkwy.	Fully Developed Urban	-	1,320	No
A62	Ross Island Bridge/SW Kelly Ave. ramps	A2-BH	855	SW Kelly Ave.	Fully Developed Urban	-	1,320	No
A69	SW Naito Pkwy./SW Gibbs St./SW Naito Pkwy. ramps	A2-BH, A2-LA	260	SW Naito Pkwy.	Fully Developed Urban	-	1,320	No
A72	SW Naito Pkwy./SW Whitaker St.	A2-BH	260	SW Naito Pkwy.	District Highway	40	500	No
A78	SW Barbur Blvd./SW Naito Pkwy.	A1, A2-BH	190	SW Barbur Blvd.	District Highway	35	350	No
A80	SW Barbur Blvd./SW Bancroft St.	All	125	SW Barbur Blvd.	District Highway	35	350	No
A82/ A84	SW Barbur Blvd./SW Hamilton St.	All	160	SW Barbur Blvd.	District Highway	35	350	No
A86	SW Barbur Blvd./SW Capitol Hwy.	All	1,740	SW Barbur Blvd.	Fully Developed Urban	-	1,320	Yes

Note: Speed limit is not a factor for ramp terminal spacing.

The relevant spacing standards for OHS district highways is found in Oregon Administrative Rules (OAR) 734-051-4020, in Table 6. Spacing for freeway interchanges and non-freeway interchanges with multilane crossroads are found in the same OAR under Table 8 and Table 10, respectively.

Additionally, OAR 734-051-4020 (8) (c) allows spacing exceptions to be made if the approach was originally constructed before January 1, 2012. Some conditions apply, most importantly subsection (C), which prescribes increased spacing when a highway project occurs, given that doing so would improve spacing or safety.

Exceptions to the ODOT spacing requirements may be submitted through a General Design Exception Request Form. However, if the City of Portland successfully acquires OR 99W (SW Barbur Boulevard, SW Naito Parkway), then a design exception would not be necessary. At the time of writing, negotiations for this jurisdictional transfer are ongoing.

The text in the OAR regarding Table 6 reads as follows, "The spacing standards in Tables 3 through 6 apply to the distance measured along the highway from the center of an existing or proposed private approach to the center of the nearest existing private connection, proposed approach, or public approach on the same side of the highway in both directions."

The City of Portland has no spacing standards, but the City Traffic Engineer will review spacing on all city-owned streets on a case-by-case basis.

3.3.7. Segment A Freight Impacts

The alignment alternatives in Segment A include the light rail operating on SW 4th Avenue, SW Barbur Boulevard, and/or SW Naito Parkway. Table 3.3-28 shows the freight-related designations of the portions of those streets with light rail under the various alignment alternatives.

Table 3.3-28: Freight Designations of Segment A – Roadways Affected by Light Rail Alternatives

Roadway	Alternatives	NHS	OHP Freight	Reduction Review[3]	Regional Freight	Local (Portland)
SW 4th Avenue	A1	No	No	No	No	Major Truck Street[1]
SW Barbur Boulevard north of SW Naito Pkwy.	A1	No	No	No	No	Major Truck Street
SW Barbur Boulevard south of SW Naito Pkwy.	A1 A2-BH A2-LA	**Yes**	No	No	No	Major Truck Street
SW Naito Pkwy.	A2-BH A2-LA	**Yes[2]**	No	No	No	Major Truck Street[2]
Ross Island Bridge access ramps	A2-BH	**Yes**	No	**Yes**	No	Major Truck Street

[1] SW 4th Avenue is a city Major Truck Street south of SW Caruthers Street only.

[2] SW Naito Parkway is a city Major Truck Street between I-405 and the Ross Island Bridge only and NHS south of the bridge.

[3] Reduction Review refers to ensuring that routes are available that can accommodate oversized freight.

With all of the alignment alternatives, the light rail design would maintain vehicle lanes wide enough to accommodate typical trucks throughout the corridor. Access impacts along the light rail alignment would be typically to small parcels without frequent access by large trucks. No significant impacts to freight trucks are anticipated in this segment.

3.3.8. Segment A On-Street Parking Impacts

With Alternative A1: Barbur, 16 two-hour limited spaces adjacent to Duniway Park would be eliminated. The utilization survey found that the spaces were lightly used on weekdays; however, it is likely that they would be more heavily used on weekends and during park events.

With Alternatives A2-BH: Naito with Bridgehead and A2-LA: Naito with Limited Access, 21 F-Zone Permit on-street parking spaces would be eliminated. These spaces were lightly used during the morning, but were more heavily used during the evening hours when most residents returned home from school or work. Eliminating these spaces would increase demand for on-street spaces on nearby streets and would likely require some residents to walk additional distance between their homes and their automobiles.

In some locations transit riders could choose to park and ride on neighborhood streets. In Segment A there would be no opportunity for such "hide and ride" activity, because all of the neighborhood streets in the vicinity of the proposed light rail stations are included the City of Portland neighborhood parking permit program, which limits nonresident parking to two hours between 7 a.m. and 6 p.m.

3.3.9. Segment A Light Rail Station Vehicular Access

In Segment A, there are no park and ride facilities and, as mentioned in the On-Street Parking Impacts section just above, there are no opportunities for "hide and ride" activity. Additionally, there are only two stations outside of the central city in Segment A. These two stations are not anticipated to generate many vehicle pick-up/drop-off trips, because this is a geographically constrained corridor, where trips from further out are likely to use stations located from SW Terwilliger Boulevard or farther out along the proposed line. Therefore, no significant impacts related to vehicular access to light rail stations in Segment A are expected.

3.3.10. Segment A Construction Impacts

In Segment A, there are six locations that have construction impacts with an approximate time frame of those impacts of one or two years. Table 3.3-29 summarizes the construction impacts in Segment A.

Table 3.3-29: Construction Impacts Summary, Segment A: Inner Portland

Location	Alignment Alternative(s)	Issue	Major Assumption	Approximate Time Frame
SW Naito Pkwy. bridge over I-405	A2-BH: Naito Bridgehead A2-LA: Naito Limited Access	Structure needs to be replaced to accommodate LRT and/or ped/bike	SW Naito Pkwy.: maintain one lane in each direction; multiple weekend closures; night closures I-405: intermittent traffic lane impacts; temporary nighttime closures	3 phases over 2 years
SW Barbur Blvd. bridge over I-405	A1: Barbur	New structure to accommodate LRT and/or ped/bike	I-405: intermittent traffic lane impacts; temporary nighttime closures	1 year
Ross Island Bridge west end	A2-BH: Naito Bridgehead A2-LA: Naito Limited Access	Bridgehead requires full reconstruction of SW Naito Pkwy. and bridge access ramps	SW Naito Pkwy.: maintain one lane for duration Ross Island Bridge connections to SW Naito Pkwy.: close for 3 to 6 months Eastbound SW Kelly Ave. to eastbound Ross Island Bridge connection: maintain with intermittent closures for tie-in Westbound Ross Island Bridge to SW Kelly Ave.: remains open I-5 ramps: maintain connections to Ross Island Bridge	2 years
SW Barbur Blvd./SW Naito Pkwy. confluence structure	All	Structure needs to be replaced to accommodate LRT and/or ped/bike	SW Barbur Blvd. and SW Naito Pkwy.: maintain one lane in each direction; multiple weekend closures; night closures	Phase construction over 2 years
SW Barbur Blvd./SW Capitol Hwy. eastbound flyover structure	All	Structure needs to be replaced to accommodate LRT and/or ped/bike	Eastbound flyover closed for 2 years; likely maintain westbound connection	Multiple phased construction stages over 2 years
SW Barbur Blvd. Newbury Viaduct structure and Vermont Viaduct structure	All	Structures need to be replaced to accommodate LRT and/or ped/bike	SW Barbur Blvd. at the Newbury and Vermont structures; maintain one lane in each direction	Multiple phased construction stages over 2 years

3.4. Segment A Mitigation

The following section addresses potential improvement measures based on the previously outlined impacts for the alternatives within the study area by mode. The recommendations have been divided into two categories: project-related mitigation, and non-project-related improvements. Project-related improvements would be specifically aimed at impacts associated with the implementation of the light rail alternatives. Non-project-related improvements are those that would likely be necessary even without the light rail alternatives. This section also provides comparison of the mitigated alternatives under PM conditions.

3.4.1. Potential Mitigation

Proposed measures to mitigate project-related traffic impacts to intersections within the study area are summarized in Table 3.4-1 below. Because of the complexity of the impacts and because many of the traffic problems are projected to occur with or without the project, further review will be required to

identify appropriate mitigation measures, as noted below. Further evaluation to impacts on local cut-through traffic will be evaluated on future phases of analysis.

Table 3.4-1. Potential Mitigation for Segment A: Inner Portland

ID #	Location	Impact	Impacted Alignment Alternative(s)	Proposed Mitigation
A56	SW Macadam Ave. ramp to SW Kelly Ave./SW Porter St. signal	Single lane from SW Macadam Ave. ramp to traffic signal results in significant queue out of model on SW Macadam Ave. towards I-5	A1-BH, A2-BH, A2-BH-LT	Restripe to allow 2 lanes to westbound approach, and left lane becomes option lane to southbound SW Hood Ave.
A13, A35	Southbound SW Naito Pkwy. lane drop between SW Harrison St. and SW Lincoln St.	Results in significant southbound queuing on SW Naito Pkwy.	A1-BH, A2-BH, A2-BH-LT	Mitigation extends dual lane section south to SW Sheridan St.
A70	Northbound transitway at SW Gibbs St.	Potential for buses to block LRT vehicle while waiting for queue jump phase exiting the transitway	A2-BH, A2-BH-LT	Design needs storage lane for bus to queue while waiting to exit transitway to northbound SW Naito Pkwy. without delaying LRT. Center storage lane assumed in all simulations per direction from TriMet/Metro.
A80	SW Barbur Blvd./ SW Bancroft St.	Southbound left demand would exceed single lane storage, resulting in queue spillback to southbound SW Barbur Blvd. during peak-hour conditions	A1, A1-BH, A2-BH, A2-BH-LT	2-stage Barbur pedestrian crossing. Lengthen southbound left-turn lane to 950 feet. Increase eastbound right-turn radius speed at SW Bancroft St./SW Corbett Ave. Alternatively, grade separate southbound left with undercrossing starting from right lane of SW Barbur Blvd. and connecting at level grade to SW Corbett Ave.
A81	SW Bancroft St./ SW Corbett Ave.	Two-way stop controlled intersection significantly over capacity	A1, A1-BH, A2-BH, A2-BH-LT	Signalize intersection with northbound left-turn and eastbound right-turn lanes. Interconnect with signal at SW Barbur Blvd. to hold eastbound right when southbound left at SW Barbur Blvd. is green.
A83	SW Hamilton St./SW Corbett Ave.	Four-way stop controlled intersection significantly over capacity	A1, A1-BH, A2-BH, A2-BH-LT, A2-LA	Signalize with southbound right-turn, northbound left-turn and eastbound right-turn lanes. Southbound right lane could be necessary to keep southbound through traffic flowing coming from SW Barbur Blvd. via SW Bancroft St.
A82, A85	SW Barbur Blvd./ SW Hamilton St.	During AM peak, northbound SW Barbur Blvd. queue shockwave reaches SW Barbur Blvd./SW Capitol Hwy. merge, resulting in eastbound SW Capitol Hwy. and northbound SW Barbur Blvd. queuing out of model	A1, A1-BH, A2-BH, A2-BH-LT, A2-LA	Additional green time/capacity needed northbound on SW Barbur Blvd. at SW Hamilton St. Extend third northbound lane to SW Hamilton St. This mitigation was not tested in Vissim.
A31	SW 4th Ave./SW Lincoln St./I-405 northbound off-ramp	Right turn conflict with bicycle and pedestrian facility	A1, A1-BH	Reconfigure lanes: single northbound through lane and right-turn-only lane. Hold right-turn signal phase during protected bike/ped. phase.
A61	SW Naito Pkwy./ Ross Island Bridge	Westbound right turn queue blocking westbound left lane	A1-BH, A2-BH, A2-BH-LT	Increase westbound right-turn lane length.
A61	SW Naito Pkwy./ Ross Island Bridge	Southbound SW Naito Pkwy. dual lane storage inadequate, resulting in significant queue spillback	A2-BH, A1-BH	Recommend extending southbound dual-lane section from 100 feet north back to SW Hooker St.

ID #	Location	Impact	Impacted Alignment Alternative(s)	Proposed Mitigation
A13	SW Naito Pkwy./ SW Harrison St.	V/C exceeds target of 0.99	A2-LA	Add a traffic signal and northbound left-turn lane at SW Naito Pkwy. and SW Sheridan St. and add a traffic signal to SW 1st Ave. and SW Sheridan St.
A69	SW Naito Pkwy./ SW Gibbs St.	V/C exceeds target of 0.99	A2-LA	Modify signal to two-stage pedestrian crossing.
A75	SW Naito Pkwy./ Pennoyer St.	Queue spillback from eastbound Pennoyer at Naito onto Barbur	A2-LA	Signal at southbound SW Naito Pkwy. & SW Pennoyer St.
A82	SW Barbur Blvd/ SW Hamilton St.	Lane change issues for southbound Barbur traffic attempting to access southbound left turn lane at Barbur/Hamilton	A2-LA	Lane divider, prevent southbound Barbur traffic from accessing southbound left turn lane

3.4.2. Mitigation Results

The initial analysis of the five DEIS Alternatives showed significant traffic performance deficiencies in each alternative. To better inform the Initial Route Proposal selection process, select proposed mitigations were tested across the different alternatives. The tested mitigations are shown as applied by alternative in Table 3.4-2. Mitigation evaluation focused on the Segment A PM Vissim models.

Table 3.4-2. Modeled Mitigations

Tested Mitigation	Alternatives				
	A1	A2-BH	A2-LA	A1-BH	A2-BH-LT
Extend SBL turn lane at Barbur/Bancroft from 550’ to 950’	X	X		X	X
Extend SBL turn lane at Barbur/Hamilton to 950’ (north of Bancroft)			X		
Convert Eastbound approach at Bancroft/Corbett to right turn only	X	X		X	X
Extend southbound two-lane section of Naito to Sheridan		X		X	X
Extend WBR turn lane storage at Naito/Woods		X		X	X
Extend second southbound lane at Naito/Woods to Porter		X		X	
Extend westbound Thru/Right lane at Kelly/Porter by 90’		X		X	X
Remove new ped crossing at Water/Ross Island Bridge (Woods)		X		X	X
Remove new SBL turn lane at Naito/Gibbs		X			X
Two-stage east-west ped crossings at Naito/Gibbs			X		
Signalize the Naito and Kelly Ramps onto the Ross Island Bridge, and add a lane divider on the Ross Island Bridge approach between the new signals			X		
New signal (SB Naito only) at Naito/Pennoyer			X		
Extend second southbound Barbur lane at Barbur/Naito by 100’	X	X		X	X
Convert northbound L-T-T to L-L-T at 4th/Caruthers/Broadway	X			X	

The mitigations included in Table 3.4-2 were coded into the PM Vissim models, and key measures were extracted and compared across the alternatives, as shown in Table 3.4-3.

Table 3.4-3. Mitigated Alternatives Comparative PM System Measures

Measure		Simulation Result (4-6 p.m.)					
		No-Build	**A1**	**A2-BH**	**A2-LA**	**A1-BH**	**A2-BH-LT**
Total Vehicles Served		47,200	46,200	49,400	49,100	50,800	48,500
Unserved Vehicle Demand		4,090	3,620	1,340	2,330	710	2,150
Total Vehicle Hours of Delay		7,520	6,880	5,260	5,880	4,140	5,940
Unserved Demand at Key Gateways (4-6 p.m.)							
Gateway		**Percent Unserved Demand**					
		No-Build	**A1**	**A2-BH**	**A2-LA**	**A1-BH**	**A2-BH-LT**
North	EB Market St	9%	7%	1%	6%	1%	0%
	SB Broadway	4%	1%	1%	3%	1%	3%
	SB Naito Pkwy	0%	2%	2%	3%	2%	2%
	SB 5th Ave	1%	4%	15%	0%	1%	16%
South	NB Macadam Ave	2%	8%	0%	2%	0%	0%
	NB Corbett Ave	6%	0%	0%	21%	1%	2%
	NB Terwilliger Blvd N	0%	3%	4%	0%	12%	2%
	EB Capitol Hwy	0%	0%	0%	15%	0%	1%
	NB Barbur Blvd	0%	0%	0%	25%	0%	3%
East	WB Powell Blvd	44%	34%	11%	1%	0%	19%
	NB Milwaukie Ave	32%	25%	7%	2%	0%	11%
	SB Milwaukie Ave	11%	6%	0%	0%	0%	1%
	SB 8th Ave	57%	60%	22%	5%	3%	30%
	SB Water Ave	0%	9%	17%	25%	30%	16%
West	I-405 SB Off-Ramp	1%	0%	1%	1%	0%	2%
	NB Broadway Dr	16%	0%	4%	3%	8%	9%
	EB Hamilton St	67%	33%	3%	71%	2%	4%
Throughput at System Bottlenecks (4-6 p.m.)							
Location		**Percent Demand Served**					
		No-Build	**A1**	**A2-BH**	**A2-LA**	**A1-BH**	**A2-BH-LT**
Ross Island Bridge WB		43%	47%	78%	96%	97%	66%
Ross Island Bridge EB		91%	91%	97%	90%	97%	94%
SW Barbur Blvd NB		92%	94%	100%	70%	100%	96%
SW Barbur Blvd SB		82%	84%	89%	96%	96%	83%

Bold = Demand exceeds volume served by 5% or more

As shown in the simulation results in Section 3.3.4, both the No-Build and all proposed Build Alternatives have significant unserved demand. While the unserved demand system measure is important, there are nuances to why this system measure varies between alternatives, ranging from the difference in coded link storage based on the alternative configuration between gateways to variations in gateway and/or system demand between alternatives. Therefore, comparison of unserved demand at key gateways provides better information as to the differing traffic impacts of each alternative. A key example is Alternative A1, which has a slightly lower unserved system demand than No-Build. Alternative A1 has a higher unserved demand on northbound Macadam Avenue than No-Build (8% to 2%). Macadam Avenue is fed by traffic exiting northbound I-5, so increased unserved demand (and increased queuing) would likely cause increased queuing on the off-ramp from I-5, compared to No-Build conditions. As I-5 is outside the model area, this potential impact is not captured in the unserved

system demand. The key issues observed across the Alternatives when compared to the No-Build system measures are summarized as follows:

- Total Vehicles Served, Unserved Demand, and Total Delay
  - Alternative A1 has lower total demand than No-Build, leading to lower total volume served and lower unserved demand
  - All other alternatives significantly improve across all three measures over No-Build conditions
- Key north gateways (SW Market St, SW Broadway, SW 5th Avenue, and SW Naito Parkway)
  - With SW 5th Avenue and SW Broadway combined, and SW Naito Parkway and SW Market Street combined, Alternative A1 performs very similar to No-Build.
  - Alternatives A2-BH and A2-BH-LT perform worse than No-Build on SW 5th Avenue, due to increased demand on SW 5th Avenue south of Harrison as drivers avoid the congestion generated by the southbound lane drop on SW Naito Parkway and the increased volume at the SW 1st Avenue and SW Arthur Street intersection. Naito Parkway degrades under these alternatives due to queue spillback from the lane drop a SW Sheridan Street. All other north gateways improve over No-Build for A2-BH and A2-BH-LT.
  - Alternative A2-LA degrades on SW Naito Parkway due to queuing from the newly signalized SW Naito Parkway and SW Gibbs Street intersection. All other north gateways improve for A2-LA over No-build.
  - Alternative A1-BH degrades on SW Naito Parkway due to the increased volume at the SW 1st Avenue and SW Arthur Street intersection. All other north gateways improve for A1-BH over No-build.
- Key south gateways (SW Terwilliger Boulevard, SW Macadam Avenue, SW Corbett Avenue, and SW Barbur Boulevard/SW Capitol Highway)
  - Alternative A1 degrades at the key south gateway of SW Macadam Avenue, due to added demand caused by the reduction of northbound lanes on SW Barbur Boulevard. Alternative A1 also degrades at SW Terwilliger Boulevard due to queue spillback from SW Sheridan Street, caused by southbound queuing SW Barbur Boulevard from SW Naito Parkway and SW Hooker Street. All other key south gateways improve or stay the same for Alternative A1 compared to No-Build.
  - Alternative A2-BH degrades at SW Terwilliger Boulevard due to increased conflicting volume at SW 6th Avenue/SW Broadway, as more westbound US 26 traffic reaches this intersection with the bridgehead improvements opening up the bottleneck at the west end of the Ross Island Bridge. All other key south gateways improve or stay the same for Alternative A2-BH compared to No-Build.
  - Alternative A2-LA significantly degrades northbound SW Barbur Boulevard over the No-Build Alternative, due mainly the phase time required to maintain a southbound left turn movement at the SW Hamilton Street and SW Barbur Boulevard intersection, as well as heavy volumes on

northbound Barbur Boulevard at SW Caruthers Street, with drivers opting for SW Barbur Boulevard over SW Naito Parkway to avoid the conflicts at SW Gibbs Street. This conflict impacts demand served at the SW Corbett Street, SW Barbur Boulevard, and SW Capitol Highway gateways. All other key south gateways improve or stay the same for Alternative A2-LA compared to No-Build.

- Alternative A1-BH degrades at SW Terwilliger Boulevard due to increased conflicting volume at SW 6th Avenue/SW Broadway, as more westbound US 26 traffic reaches this intersection with the bridgehead improvements opening up the bottleneck at the west end of the Ross Island Bridge. The gateway is further degraded by occasional queue spillback from SW Sheridan Street, caused by southbound queuing on SW Barbur Boulevard from SW Naito Parkway and SW Hooker Street. All other key south gateways improve or stay the same for Alternative A1-BH compared to No-Build.

- Alternative A2-BH-LT degrades at SW Terwilliger Boulevard due to increased conflicting volume at SW 6th Avenue/SW Broadway, as more westbound US 26 traffic reaches this intersection with the bridgehead improvements opening up the bottleneck at the west end of the Ross Island Bridge. The SW Barbur Boulevard/SW Capitol Hwy gateway was also impacted in some simulations, with the decrease in green time for the northbound right turn at SW Woods Avenue and SW Naito Parkway due to the southbound left turn phase occasionally leads to queue spillback that impacts the SW Hamilton Street and SW Barbur Boulevard intersection. All other key south gateways improve or stay the same for Alternative A2-BH-LT compared to No-Build.

- Key east gateways (SE 8th Avenue/Highway 99E northbound off-ramp, SW Milwaukie/SW Powell Boulevard, and SW Water Avenue at SW Kelly Avenue)

  - Alternative A1 overall improves slightly over No-Build for all key gateways east of the river, due to a slight decrease in westbound demand over the Ross Island Bridge. The SW Water Avenue gateway also degrades slightly due to a slight increase in demand.

  - Alternatives A2-BH and A2-BH-LT improve all key gateways east of the river due to the removal of the SW Macadam Avenue/SW Hood Avenue merge conflict caused by the SW Kelly Avenue ramp queue. The bridgehead configuration eliminates this bottleneck and significantly improves westbound Ross Island Bridge operations. The combination of the new signal at SW Kelly Avenue & SW Water Avenue and the southbound lane drop on SW Naito Parkway divert additional demand to the SW Water Avenue gateway for both the A2-BH and A2-BH-LT alternatives. Opening the westbound bottleneck on the Ross Island Bridge leads to westbound US 26 queuing similar to existing conditions, which hinder southbound right turns from the SW Water and SW Kelly Avenue intersection, despite the new signal.

  - Alternative A2-LA improve all key gateways east of the river due to the reduction of the SW Macadam Avenue/SW Hood Avenue merge conflict caused by the SW Kelly Avenue ramp queue. The signal for the SW Kelly Avenue ramp mitigates the queuing and relieves the bottleneck. Opening the westbound bottleneck on the Ross Island Bridge leads to westbound US 26 queuing similar to existing conditions, which hinder southbound right turns from the SW Water and SW Kelly Avenue intersection, increasing the unserved demand at the SW Water Avenue gateway.

- Alternative A1-BH improves impacts all east gateways similar to Alternatives A2-BH and A2-BH-LT, improving everything east of the river and degrading SW Water Avenue with additional demand.

- Key west gateways (I-405 southbound off-ramp, SW Broadway northbound, and SW Hamilton Street eastbound)
  - Alternatives A1, A2-BH, A1-BH, and A2-BH-LT all perform nearly equivalent to or better than No-Build for the key west gateways.
  - Alterative A2-LA performs worse than No-Build for eastbound SW Hamilton Street due to loss of green time to LRT movements. A2-LA performs equivalent or better than No-Build at the other west gateways.

- Throughput at System Bottlenecks (Ross Island Bridge and Barbur at Hamilton)
  - Alternative A1 shows slight improvement for both directions of traffic on SW Barbur Boulevard at SW Hamilton Street due to increased north-south green time from the LRT, and shifting the southbound left turn to SW Bancroft Street. The demand served on the Ross Island Bridge westbound improves slightly due to a reduction in demand, while the eastbound demand served remains the same as No-Build.
  - Alternatives A2-BH and A2-BH-LT both serve more throughput for both directions of the Ross Island Bridge due to the Bridgehead improvements, which also increase throughput on SW Barbur Boulevard (northbound and southbound) at SW Hamilton Street due to more volume reaching this location.
  - Alternative A1-BH provides the most improvement for both directions at both throughput measure locations. As A1-BH does not have LRT on SW Naito Parkway, the phase time for the westbound left turn at SW Woods Street and SW Naito Parkway is more consistent, allowing better westbound flow on the Ross Island Bridge, and higher southbound volumes at SW Barbur Boulevard and SW Naito Parkway.
  - Alternative A2-LA improves westbound traffic on the Ross Island bridge (and by extension the southbound throughput on SW Barbur Boulevard at SW Hamilton Street) due to the reasons laid out in the key east gateways discussion. However, Alternative A2-LA degrades northbound traffic on SW Barbur Boulevard, for the reasons laid out in the key south gateways discussion.

To provide more comprehensive comparison, travel times on key segments were also recorded in the simulation models. While travel time results were recorded for all alternatives and are included in the Vissim reports in Appendix R, the amount of volume excluded from the unmitigated models due to system bottlenecks dilutes the results and provide inaccurate comparisons. Therefore, the travel time results reported in Table 3.4-4 focus on the mitigated alternatives.

Table 3.4-4. Mitigated Alternatives Peak Hour Travel Time Results

Location			Travel Time Results (4:30-5:30 p.m.)					
Segment	**From**	**To**	**No-Build**	**A1**	**A2-BH**	**A2-LA**	**A1-BH**	**A2-BH-LT**
Hwy 26 EB	Broadway	Hwy 99E	11:01	12:48	13:03	5:09	12:58	13:43
Hwy 26 WB	Milwaukie Ave	I-405 NB On-ramp	22:41	21:57	26:14	13:58	18:05	25:34
99W to HWY 26 EB	Hamilton St	Hwy 99E	12:15	8:21	5:14	4:45	5:54	6:20
Hwy 26 WB to 99W	Milwaukie Ave	Hamilton St	16:31	12:13	14:08	9:26	7:36	15:31
I-5 NB to Hwy 26 EB	Curry St	Hwy 99E	20:29	22:26	4:44	6:23	6:00	7:56
Naito to Hwy 26 EB	Harrison St	Hwy 99E	5:54	6:27	11:18	5:55	13:18	7:52
Motor Vehicle NB	Capitol Hwy	College St	16:49	12:29	9:23	22:56	13:15	11:18
LRT NB	*Capitol Hwy*	*College St*	*N/A*	*6:49*	*9:05*	*8:46*	*6:36*	*8:39*
Motor Vehicle SB	College St	Capitol Hwy	17:10	9:08	9:47	7:49	9:12	10:18
LRT SB	*College St*	*Capitol Hwy*	*N/A*	*6:31*	*8:13*	*7:57*	*6:15*	*8:03*

Italicized = LRT Travel Time Segment

To better inform the comparison of travel times between alternatives, the percent demand served for the travel time segments with significant demand (200+ vehicles from 4-6 p.m.) was reported from the models and is included in Table 3.4-5.

Table 3.4-5. Mitigated Alternatives Travel Time Segments Volumes Served

Location			% Demand Served (4-6 p.m.)					
Segment	**From**	**To**	**No-Build**	**A1**	**A2-BH**	**A2-LA**	**A1-BH**	**A2-BH-LT**
Hwy 26 EB	Broadway	Hwy 99E	99%	100%	100%	100%	98%	100%
Hwy 26 WB	Milwaukie Ave	I-405 NB On-ramp	48%	56%	76%	96%	97%	67%
99W to HWY 26 EB	Hamilton St	Hwy 99E	85%	90%	99%	69%	100%	91%
Hwy 26 WB to 99W	Milwaukie Ave	Hamilton St	47%	56%	78%	98%	98%	68%
I-5 NB to Hwy 26 EB	Curry St	Hwy 99E	86%	80%	100%	100%	100%	100%

Overall, the travel time results support the findings outline in the key gateways unserved demand discussion. The key travel time comparison findings are summarized as follows:

- Westbound US 26 travel times increase under most of the build scenarios due to following factors:
  - Increased westbound traffic (Alternatives A2-BH, A1-BH, and A2-BH-LT): In No-Build and all alternatives without bridgehead improvements, westbound volume between Porter Street and the I-405 ramp is much smaller than in the bridgehead options due to the bottleneck for the SW Macadam Avenue/Ross Island Bridge to SW Hood Avenue merge. At the Broadway/Terwilliger/6th Ave intersection and others, this reduced volume assists the conflicting northbound SW Terwilliger movement, limiting the I-405 northbound on-ramp queue spillback issues, and allowing more green time and better progression for the eastbound movements.
  - Heavy southbound left turn movement at SW 1st Avenue and SW Arthur Street (Alternatives A2-BH, A1-BH, and A2-BH-LT) – leads to less green time for eastbound movements.
  - New signal at SW Water Avenue and SW Kelly Avenue (Alternatives A2-BH, A1-BH, and A2-BH-LT) – the southbound right turn issue at this intersection was discussed earlier. With

southbound right turns stuck in queue, the southbound phases always max out, depriving eastbound traffic of green time.

  - Queue spillback from southbound Barbur Boulevard at SW Hooker Street (Alternatives A1 and A1-BH) – The operations at this intersection are complex, with heavy U-turns due to left turn access reduction along SW Barbur Boulevard, and bus entering and exiting the shared transitway. These issues, coupled with occasional queue shockwaves from the SW Barbur Boulevard and SW Naito Parkway intersection cause queues that extend onto Sheridan and up SW 5th Avenue, degrading travel times for eastbound US 26 traffic.

- Westbound US 26 travel times improve for all alternatives except A2-BH and A2-BH-LT because in the Naito Bridgehead alternative, conflicting volumes at SW 4th Avenue increase, leading to travel time losses at this location, along with travel time losses associated with higher volumes at signalized intersections, as under No-Build conditions only 48% of this demand is served, compared to more than 65% for both A2-BH and A2-BH-LT.

- SW Barbur northbound to the east end of the Ross Island Bridge improves in all scenarios, due to either Bridgehead improvements (A2-BH, A2-LA, A1-BH, and A2-BH-LT) or reduced overall demand shifted to SW Macadam Avenue (A1). However, the demand served on this travel time segment for Alternative A2-LA is reduced below No-Build conditions due to the bottleneck at SW Barbur Boulevard and SW Hamilton Street.

- Westbound Powell Boulevard to southbound SW Barbur Boulevard is improved for all alternatives due to improvements to operations for the southbound left turn movement at SW Barbur Boulevard and SW Hamilton Street.

- Northbound SW Macadam Avenue to the east end of the Ross Island Bridge improves in all alternatives with some type of bridgehead improvement (A2-BH, A2-LA, A1-BH, and A2-BH-LT). This segment performs worse for A1 due to increased demand on SW Macadam Avenue, shifted from SW Barbur Boulevard due to northbound lane reduction.

- The southbound SW Naito Parkway to the east end of the Ross Island Bridge segments stays relatively the same as No Build for alternatives A1 and A2-LA, but degrades under alternatives A2-BH, A1-BH, and A2-BH-LT (to a less extent, due to the southbound left turn movement allowed at SW Woods Street and SW Naito Parkway) due to the lane drop on SW Naito Parkway and queuing on SW 1st Avenue.

- The other travel time segments (Capitol to College, College to Capitol) do not serve high volumes, but provide a comparison between motor vehicle and LRT travel times over equivalent segments. The travel time advantage for the LRT (approximately 1.5-2.5 minutes) on the Barbur versus Naito alignments is apparent, due to longer distance, more time on low speed SW Lincoln Street, and an extra station. Also, the LRT travel time generally out-performs the motor vehicle travel times in both directions.

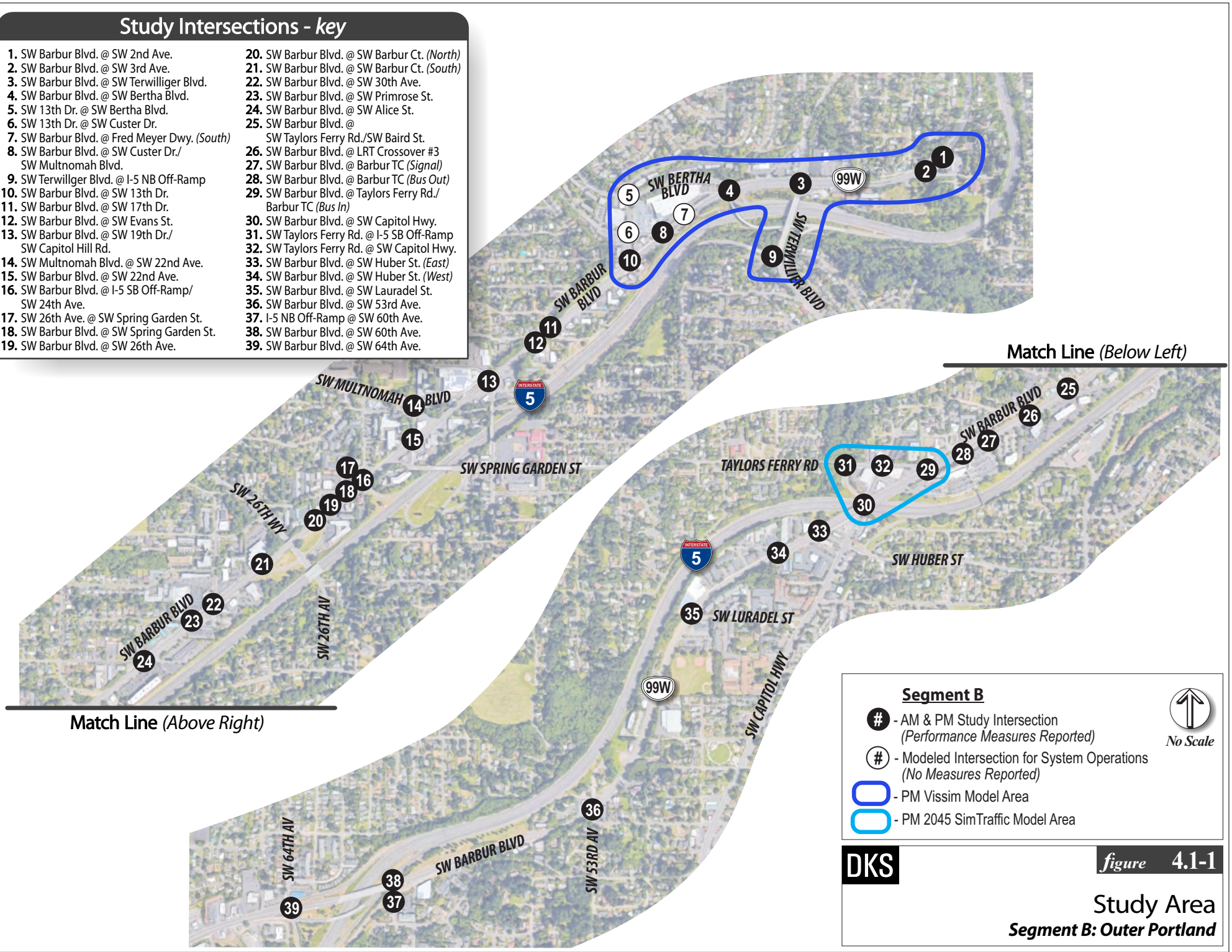
4. SEGMENT B: OUTER PORTLAND

This chapter details the transportation operations for both existing and future conditions within the outer Portland segment (Segment B). The existing operations cover both non-motorized and motorized modes of travel including bicycle, pedestrian, transit and motor vehicle, as well as evaluating parking, freight and collision data. The future operations evaluate the potential impacts to motorized and non-motorized modes, potential mitigation strategies for impacts related to transit alternatives, and possible improvements to be considered by the local jurisdictions within the segment, including the City of Portland and ODOT.

4.1. Study Area Description

Segment B is one of the two segments that falls completely within the City of Portland. In this segment, there are 39 study intersections along SW Barbur Boulevard between SW Brier Place and SW 69th Avenue. It includes major signalized intersections, minor intersections and driveways at key destinations with high traffic volumes. Traffic count data was collected and Synchro (HCM) and SimTraffic and Vissim (simulation) were used to analyze the corridor. For major signalized intersections, the LOS analysis and the V/C ratio were calculated to gauge existing intersection operations.

Figure 4.1-1 below illustrates the study area for Segment B.


Study Intersections - key
1. SW Barbur Blvd. @ SW 2nd Ave.
2. SW Barbur Blvd. @ SW 3rd Ave.
3. SW Barbur Blvd. @ SW Terwilliger Blvd.
4. SW Barbur Blvd. @ SW Bertha Blvd.
5. SW 13th Dr. @ SW Bertha Blvd.
6. SW 13th Dr. @ SW Custer Dr.
7. SW Barbur Blvd. @ Fred Meyer Dwy. (South)
8. SW Barbur Blvd. @ SW Custer Dr./ SW Multnomah Blvd.
9. SW Terwillger Blvd. @ I-5 NB Off-Ramp
10. SW Barbur Blvd. @ SW 13th Dr.
11. SW Barbur Blvd. @ SW 17th Dr.
12. SW Barbur Blvd. @ SW Evans St.
13. SW Barbur Blvd. @ SW 19th Dr./ SW Capitol Hill Rd.
14. SW Multnomah Blvd. @ SW 22nd Ave.
15. SW Barbur Blvd. @ SW 22nd Ave.
16. SW Barbur Blvd. @ I-5 SB Off-Ramp/ SW 24th Ave.
17. SW 26th Ave. @ SW Spring Garden St.
18. SW Barbur Blvd. @ SW Spring Garden St.
19. SW Barbur Blvd. @ SW 26th Ave.
20. SW Barbur Blvd. @ SW Barbur Ct. (North)
21. SW Barbur Blvd. @ SW Barbur Ct. (South)
22. SW Barbur Blvd. @ SW 30th Ave.
23. SW Barbur Blvd. @ SW Primrose St.
24. SW Barbur Blvd. @ SW Alice St.
25. SW Barbur Blvd. @ SW Taylors Ferry Rd./SW Baird St.
26. SW Barbur Blvd. @ LRT Crossover #3
27. SW Barbur Blvd. @ Barbur TC (Signal)
28. SW Barbur Blvd. @ Barbur TC (Bus Out)
29. SW Barbur Blvd. @ Taylors Ferry Rd./ Barbur TC (Bus In)
30. SW Barbur Blvd. @ SW Capitol Hwy.
31. SW Taylors Ferry Rd. @ I-5 SB Off-Ramp
32. SW Taylors Ferry Rd. @ SW Capitol Hwy.
33. SW Barbur Blvd. @ SW Huber St. (East)
34. SW Barbur Blvd. @ SW Huber St. (West)
35. SW Barbur Blvd. @ SW Lauradel St.
36. SW Barbur Blvd. @ SW 53rd Ave.
37. I-5 NB Off-Ramp @ SW 60th Ave.
38. SW Barbur Blvd. @ SW 60th Ave.
39. SW Barbur Blvd. @ SW 64th Ave.
SW BERTHA BLVD
SW TERWILLIGER BLVD
99W
SW BARBUR BLVD
SW MULTNOMAH BLVD
INTERSTATE 5
SW SPRING GARDEN ST
SW 26TH WY
SW 26TH AV
TAYLORS FERRY RD
SW HUBER ST
SW LURADEL ST
SW CAPITOL HWY
SW 64TH AV
SW 53RD AV
Match Line (Below Left)
Match Line (Above Right)
Segment B
- AM & PM Study Intersection (Performance Measures Reported)
- Modeled Intersection for System Operations (No Measures Reported)
- PM Vissim Model Area
- PM 2045 SimTraffic Model Area
No Scale
DKS
figure 4.1-1
Study Area
Segment B: Outer Portland

4.2. Existing Conditions

4.2.1. Segment B Roadway Functional Classification

SW Barbur Boulevard has two to four through travel lanes and posted speeds between 35 and 40 miles per hour (mph). According to the Transportation System Plan (TSP) from the City of Portland, SW Barbur Boulevard is classified as a major city traffic street that is intended to serve as a main route for inter-district traffic.

Table 4.2-1 below summarizes the functional classification for each roadway for Segment B. Most of the roads are owned by the City of Portland.

Table 4.2-1. Roadway Functional Classifications in Segment B

Roadway Name(s)	Jurisdiction	Functional Classification
SW Barbur Blvd. (North of SW Lane St.)	City of Portland	Major City Street
SW Barbur Blvd. (South of SW Lane St.)	ODOT	Principal Arterial (NHS route)
SW 2nd Ave.	City of Portland	Local Service Traffic Street
SW 3rd Ave.	City of Portland	Local Service Traffic Street
SW Terwilliger Blvd.	City of Portland	Neighborhood Collector
SW Bertha Blvd.	City of Portland	District Collector
SW 13th Dr.	City of Portland	Neighborhood Collector
SW Custer Dr.	City of Portland	Local Service Traffic Street
SW Multnomah Blvd.	City of Portland	Local Service Traffic Street
I-5	Federal Highway Administration	Interstate (NHS route)
SW 17th Dr.	City of Portland	Local Service Traffic Street
SW Evans St.	City of Portland	Local Service Traffic Street
SW 19th Dr.	City of Portland	Local Service Traffic Street
SW 22nd Ave.	City of Portland	Local Service Traffic Street
SW 24th Ave.	City of Portland	Local Service Traffic Street
SW Spring Garden St.	City of Portland	Neighborhood Collector
SW Barbur Ct.	City of Portland	Local Service Traffic Street
SW 30th Ave.	City of Portland	Local Service Traffic Street
SW Primrose St.	City of Portland	Local Service Traffic Street
SW Alice St.	City of Portland	Local Service Traffic Street
SW Taylors Ferry Rd.	City of Portland	Local Service Traffic Street
SW Baird St.	City of Portland	Local Service Traffic Street
SW Capitol Hwy.	City of Portland	District Collector
SW Huber St.	City of Portland	Local Service Traffic Street
SW Luradel St.	City of Portland	Local Service Traffic Street
SW 53rd Ave.	City of Portland	Local Service Traffic Street
SW 60th Ave.	City of Portland	Local Service Traffic Street
SW 64th Ave.	City of Portland	Local Service Traffic Street

City of Portland Reference: Comprehensive Plan Maps. https://www.portlandmaps.com/bps/mapapp/

ODOT Reference: Oregon Transportation Map, Showing Functional Classification of Roads, City of Portland (2016 Edition). http://www.oregon.gov/ODOT/Data/Documents/City_Portland.pdf

4.2.2. Segment B Active Transportation

Active transportation refers to people traveling by walking or riding a bicycle. The affected environment for active transportation includes a description of existing sidewalks, pedestrian crossings, bike lanes, multi-use pathways and similar facilities within the corridor. Many of the neighborhoods near Segment B were developed in the 1950s and 1960s, and were not designed to include sidewalks and bike lanes.

Figure 4.2-1 and Figure 4.2-2 show existing bike lane and sidewalk gaps, respectively, in Segment B. These maps focus on collector and arterial streets, because they reflect the locations of greatest need for sidewalks and bicycle facilities. Local streets typically carry less motor vehicle volume, and can still be safely used for walking and bicycling by many people, even without proper facilities.

Figure 4.1-1

Existing Sidewalk Gaps

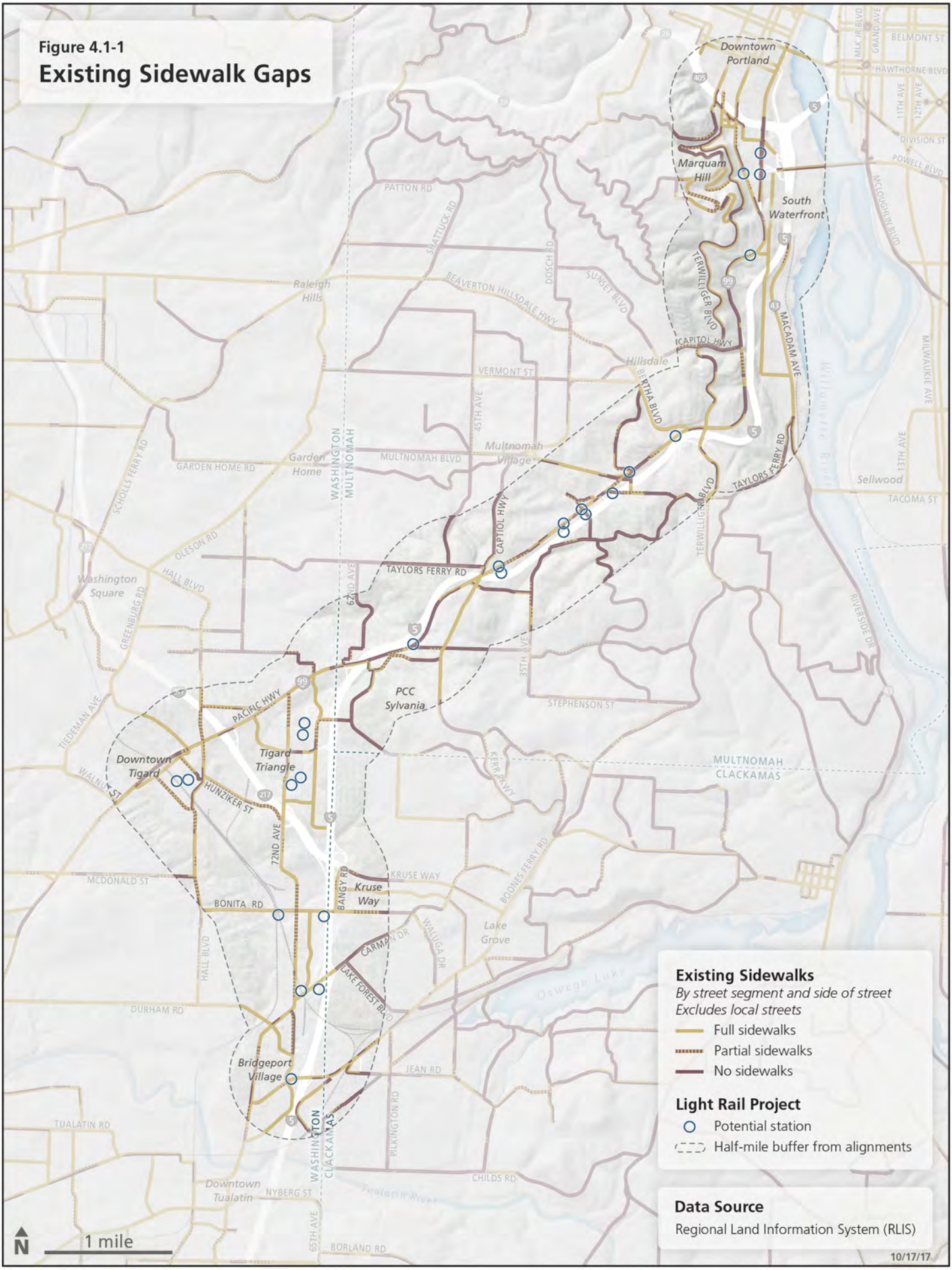
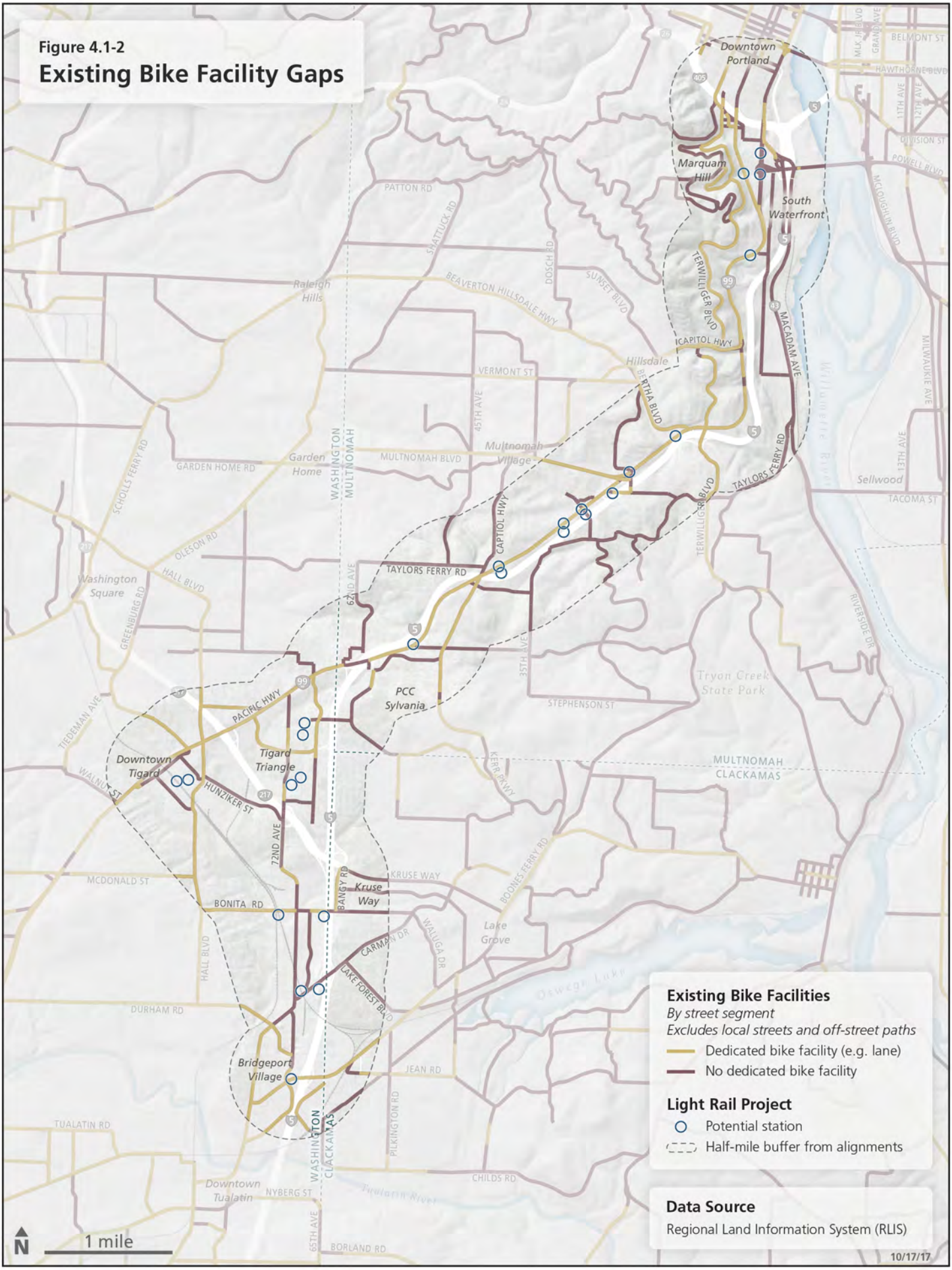


Figure 4.1-2

Existing Bike Facility Gaps



In Segment B, SW Barbur Boulevard includes discontinuous and often substandard sidewalks. SW Barbur Boulevard includes either a designated bike lane or paved shoulder except at the SW Multnomah Boulevard overcrossing, which does not include a bike lane.

4.2.3. Segment B Motor Vehicle Operations

2017 Existing HCM Operations

To accurately model the existing conditions on the roadway network, turning movement counts were conducted in the AM and PM peak hours for all existing study area intersections. The turning movement count data is shown in Appendix B. The count volumes were balanced per the ODOT Analysis Procedures Manual to account for differences in data collected on different dates. The balanced network reflects the typical 2017 weekday AM and PM peak-hour traffic conditions. Additional data, including peaking profiles, pedestrian volumes, bicycle volumes and heavy vehicle percentages, were also input into the Vissim and Synchro models. A Synchro model was developed for all 39 study area intersections, SimTraffic was used to model queuing in the Crossroads vicinity and a Vissim model was developed including the intersections near SW Barbur Boulevard and SW Terwilliger Boulevard.

Table 4.2-2 shows HCM (Synchro) operations analysis results for the existing AM and PM peak hours. Synchro was used to report level of service (LOS), delay and V/C ratio using HCM methodology. As shown in Table 4.2-2, 13 intersections do not meet the mobility target in at least 1 peak hour. One intersection (SW Taylors Ferry Road at SW Capitol Highway) does not meet mobility targets in either peak hour. Five of the intersections are unsignalized. Intersection volumes are shown graphically in Figure 4.2-3 below.

Mobility targets for the appropriate jurisdiction are shown for every intersection in Table 4.2-2. Intersection results that do not meet mobility targets in a peak hour are shaded gray. The worst lane group is listed under the WLANE columns for two-way stop-controlled (TWSC) intersections.

Table 4.2-2. Segment B: Outer Portland 2017 Existing Conditions HCM (Synchro) Analysis

					2017 Existing Conditions								
						AM				PM			
ID	Intersection	Note	Mobility Target		Control	Delay	LOS	V/C	WLANE	Delay	LOS	V/C	WLANE
B1	SW Barbur Blvd./SW 2nd Ave.		ODOT/PBOT 1st HR	0.99	TWSC	0.2 [22.5]	A [C]	0.05	WBLn	0.1 [14.9]	A [B]	0.05	WBLn
B2	SW Barbur Blvd./SW 3rd Ave.		ODOT/PBOT 1st HR	0.99	Signal	**40**	**D**	**1.05**	**-**	21.8	C	0.85	-
B3	SW Barbur Blvd./SW Terwilliger Blvd.		ODOT/PBOT 1st HR	0.99	Signal	**59.2**	**E**	**1.07**	**-**	57.1	E	0.97	-
B4	SW Barbur Blvd./SW Bertha Blvd./I-5 ramps		ODOT Ramp	0.85	Signal	**38.6**	**D**	**0.94**	**-**	28.6	C	0.83	-
B9	SW Terwilliger Blvd./I-5 NB off-ramp		ODOT Ramp	0.85	Signal	16.2	B	0.67	-	**43.7**	**D**	**0.92**	**-**
B10	SW Barbur Blvd./SW 13th Dr./ped. crossing /LRT Crossover #1		ODOT/PBOT 1st HR	0.99	TWSC	1.8 [13]	A [B]	0.31	EBLn1	5.5 [61.3]	A [F]	0.83	EBLn1
B13	SW Barbur Blvd./SW 19th Dr./SW Capitol Hill Rd.	1	ODOT/PBOT 1st HR	0.99	Signal	49.2	D	0.95	-	33.2	C	0.86	-
B15	SW Barbur Blvd./SW 22nd Ave.	1	ODOT/PBOT 1st HR	0.99	TWSC	**256.2 [>300]**	**F [F]**	**>2.0**	**WBLn1**	2.5 [>300]	A [F]	0.12	NBL

ID	Intersection	Note	Mobility Target		2017 Existing Conditions								
						AM				PM			
					Control	Delay	LOS	V/C	WLANE	Delay	LOS	V/C	WLANE
B16	SW Barbur Blvd./I-5 SB off-ramp/SW 24th Ave.	1	ODOT Ramp	0.85	Signal	**15.8**	**B**	**0.87**	**-**	19.4	B	0.66	-
B20	SW Barbur Blvd./SW Barbur Ct. (North)	1	ODOT/PBOT 1st HR	0.99	TWSC	**10.9 [119.9]**	**B [F]**	**1.08**	**WBLn1**	2.3 [22.9]	A [C]	0.60	WBLn1
B22	SW Barbur Blvd./SW 30th Ave.	1	ODOT/PBOT 1st HR	0.99	Signal	18.4	B	0.74	-	13.4	B	0.66	-
B24	SW Barbur Blvd./SW Alice St./ped. crossing	1,2	ODOT/PBOT 1st HR	0.99	TWSC	0.8 [136.3]	A [F]	0.36	EBLn1	1.8 [95.6]	A [F]	0.41	WBLn1
B25	SW Barbur Blvd./SW Taylors Ferry Rd./SW Baird St.	1,2	ODOT/PBOT 1st HR	0.99	TWSC	**8.2 [>300]**	**A [F]**	**1.20**	**WBLn1**	4.1 [194.7]	A [F]	0.78	EBLn1
B27	SW Barbur Blvd./Barbur Transit Center (Signal)	1,2	ODOT/PBOT 1st HR	0.99	Signal	5.8	A	0.64	-	6.4	A	0.57	-
B29	SW Barbur Blvd./SW Taylors Ferry Rd./Barbur Transit Center (Bus In)	1,2	ODOT/PBOT 1st HR	0.99	Signal	34	C	0.81	-	**60.8**	**E**	**1.00**	**-**
B30	SW Barbur Blvd./SW Capitol Hwy. (Crossroads)	1,2	ODOT/PBOT 1st HR	0.99	Signal	**48.9**	**D**	**1.01**	**-**	33	C	0.81	-
B31	SW Taylors Ferry Rd./I-5 SB off-ramp	2	ODOT Ramp	0.85	TWSC	3.5 [40.1]	A [E]	0.53	NBLn1	**56.7 [272.1]**	**F [F]**	**1.46**	**NBLn1**
B32	SW Taylors Ferry Rd./SW Capitol Hwy.	2	PBOT 1st HR	0.99	AWSC	**124.8**	**F**	**1.41**	**-**	**138.4**	**F**	**1.47**	**-**
B34	SW Barbur Blvd./SW Huber St. (West)	1,2	ODOT/PBOT 1st HR	0.99	TWSC	0.1 [16.2]	A [C]	0.00	EBLn1	0.2 [14.6]	A [B]	0.06	EBLn1
B35	SW Barbur Blvd./SW Luradel St.	1,2	ODOT/PBOT 1st HR	0.99	TWSC	0.6 [34.9]	A [D]	0.20	WBLn1	0.7 [30.6]	A [D]	0.19	WBLn1
B36	SW Barbur Blvd./SW 53rd Ave.	1,2	ODOT/PBOT 1st HR	0.99	Signal	37.8	D	0.98	-	11.2	B	0.73	-
B37	I-5 NB off-ramp/SW 60th Ave.	1	ODOT Ramp	0.85	Signal	49.4	D	0.49	-	46.9	D	0.51	-
B38	SW Barbur Blvd./SW 60th Ave.	1	ODOT/PBOT 1st HR	0.99	Signal	31	C	0.57	-	35.1	D	0.63	-
B39	SW Barbur Blvd./SW 64th Ave.	1	ODOT Ramp	0.85	Signal	40.9	D	0.70	-	**56.5**	**E**	**0.96**	**-**

Notes:

ID = Intersection ID #

Key: Worst Major [Worst stop-controlled delay] for TWSC intersections.

V/C represents intersection average for signals and worst movement for stop control intersections.

HR = hour; Ln = lane; PBOT = Portland Bureau of Transportation; EB = eastbound; NB = northbound; WB = westbound.

Delay, LOS, and V/C ratio reported for average and worst approach for two-way stop control and worst lane for all-way stop control.

1. Intersection analysis completed as part of 2016 Southwest Corridor study with review by ODOT, PBOT and Metro.
2. Intersection part of Town Center designation with 2nd hour mobility target. To maintain consistency with 2016 Southwest Corridor analysis, proximity to ramps and peak-hour park and ride trip generation rates, 1st hour analysis was performed. Intersections meeting 1st hour target also meet 2nd hour.

As shown in Table 4.2-2, HCM operations analysis indicates that the following intersections fail to meet mobility targets.

AM peak hour:

- **SW Barbur Boulevard and SW 3rd Avenue.** This signalized intersection experiences very high northbound through volumes during the AM peak hour.
- **SW Barbur Boulevard and SW Terwilliger Boulevard.** This eight-phase signalized intersection experiences very high northbound Barbur through volumes during the AM peak hour along with high northbound Terwilliger volumes.
- **SW Barbur Boulevard and SW Bertha Boulevard/I-5 ramps.** This intersection experiences high northbound Barbur volumes coupled with high southbound Bertha volumes accessing I-5 in the AM peak hour.
- **SW Barbur Boulevard and SW 22nd Avenue.** This two-way stop control intersection performs better than indicated by the HCM analysis because of more aggressive driving behavior from vehicles on the side street. Field observations did not indicate significant queuing issues at this location.
- **SW Barbur Boulevard and I-5 southbound off-ramp/SW 24th Avenue.** This signalized intersection is located at a freeway off-ramp. It operates just slightly above the mobility target. No excessive queuing occurs at the intersection.
- **SW Barbur Boulevard and SW Barbur Court (North).** This two-way stop control intersection performs better than indicated by the HCM analysis because of more aggressive driving behavior from vehicles on the side street. Field observations did not indicate significant queuing issues at this location.
- **SW Barbur Boulevard and SW Taylors Ferry Road/SW Baird Street.** This two-way stop control intersection performs better than indicated by the HCM analysis because of more aggressive driving behavior from vehicles on the side street. Field observations did not indicate significant queuing issues at this location.
- **SW Barbur Boulevard and SW Capitol Highway ("Crossroads").** This signalized intersection is located at an I-5 southbound freeway on-ramp. The intersection has a considerable skew that creates a significantly wide intersection (approximately 220 feet) across SW Barbur Boulevard. The northbound Barbur through volumes, along with north/south Capitol through volumes, have a significant effect on intersection operations.
- **SW Taylors Ferry Road and SW Capitol Highway.** This all-way stop control intersection experiences significant delays and queuing during the AM peak-hour period because of heavy volumes from the nearby I-5 northbound off-ramp that are traveling through the intersection and across SW Barbur Boulevard.

PM peak hour:

- **SW Terwilliger Boulevard/I-5 northbound off-ramp.** This signalized intersection is located at a freeway off-ramp. The critical movement is the left turn from the ramp.

- **SW Barbur Boulevard and SW Taylors Ferry Road/Barbur Transit Center (Bus In).** This intersection experiences a high southbound through volume and a high northbound left volume due to the northbound left prohibition at SW Capitol Hwy and SW Barbur Blvd.

- **SW Taylors Ferry Road/I-5 southbound off-ramp.** This T-intersection is stop sign controlled on the side street, which is a freeway off-ramp. Vehicle queues extend back towards the freeway gore, and there is a slow-moving queue of vehicles that extends along SW Capitol Highway from SW Barbur Boulevard, and then down SW Taylors Ferry Road to the I-5 off-ramp.

- **SW Taylors Ferry Road and SW Capitol Hwy.** Similar to the AM peak-hour period operation, this all-way stop control intersection experiences significant delays and queuing during the PM peak-hour period because of heavy volumes from the nearby I-5 northbound off-ramp that are traveling through the intersection and across SW Barbur Boulevard.

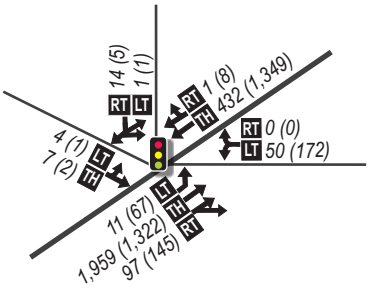
- **SW Barbur Boulevard and SW 64th Avenue.** This signalized intersection is located at a freeway on- and off-ramp. It has several critical movements.

2017 Existing Simulation Analysis

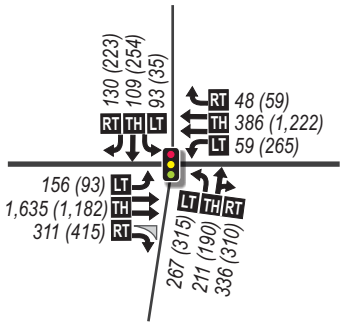
An existing conditions simulation model (Vissim) focused around the I-5 southbound off-ramp at SW Barbur Boulevard and the SW Barbur Boulevard and SW Terwilliger Boulevard intersection was developed. The area analyzed by the Vissim model is shown in Figure 4.1-1. The model was calibrated over a two-hour peak traffic time interval: 7 to 9 a.m. for the AM models and 4 to 6 p.m. for the PM model. Model calibration included comparison of modeled queues to field-observed queues and queues estimated from Google traffic maps captured during field observations. Other calibration measures included intersection traffic volumes. A complete summary of the existing conditions model network development and calibration can be found in the Terwilliger Calibration Report found in Appendix G.

B1. *SW Barbur Blvd. @ SW 2nd Ave.*

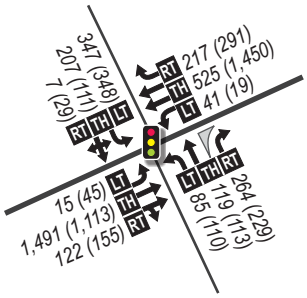
B2. *SW Barbur Blvd. @ SW 3rd Ave.*



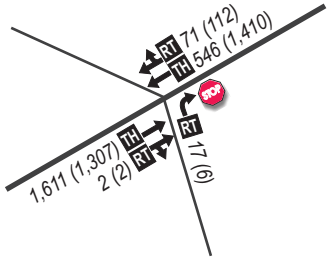
B3. *SW Barbur Blvd. @ SW Terwilliger Blvd.*



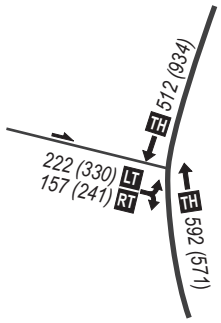
B4. *SW Barbur Blvd. @ SW Bertha Blvd.*



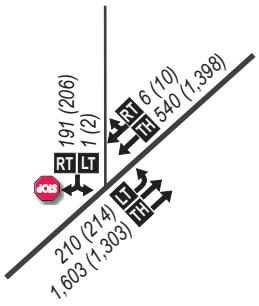
B8. *SW Barbur Blvd. @ SW Custer Dr./ SW Multnomah Blvd.*



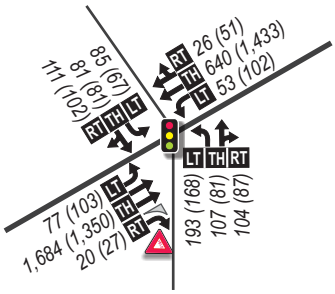
B9. *SW Terwillger Blvd. @ I-5 NB Off-Ramp*



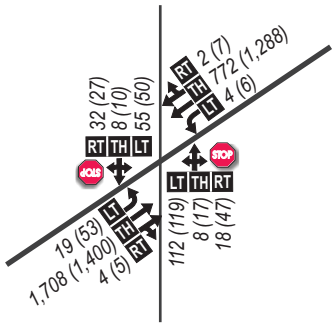
B10. *SW Barbur Blvd. @ SW 13th Dr.*



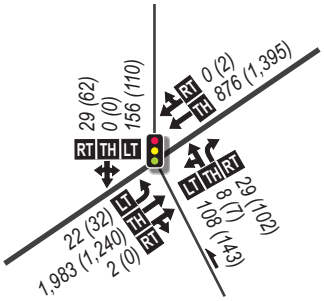
B13. *SW Barbur Blvd. @ SW 19th Dr./ SW Capitol Hill Rd.*



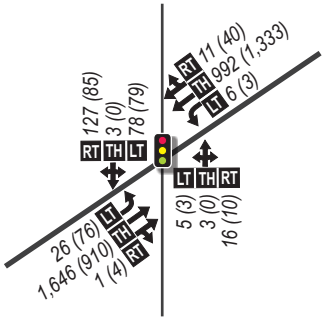
B15. *SW Barbur Blvd. @ SW 22nd Ave.*



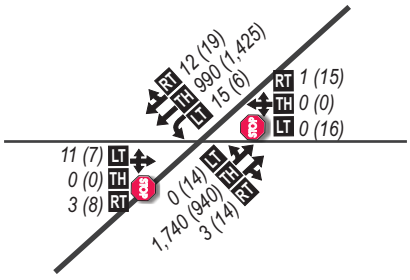
B16. *SW Barbur Blvd. @ I-5 SB Off-Ramp/ SW 24th Ave.*



B22. *SW Barbur Blvd. @ SW 30th Ave.*



B24. *SW Barbur Blvd. @ SW Alice St.*



LEGEND

00. - Study Intersection No.
STOP - Stop Sign
- Yield Sign
- Traffic Signal
← - Lane Configuration
AM (PM) - Peak Hour Traffic Volumes
LT TH RT - Volume Turn Movement
Left•Thru•Right

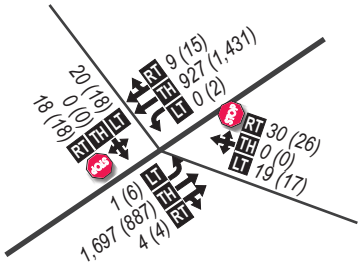
DKS

No Scale

figure **4.2-3a**

2017 Existing Conditions
AM/PM Peak Hour
Segment B: Outer Portland

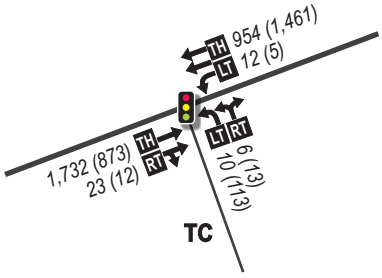
B25. *SW Barbur Blvd. @ SW Taylors Ferry Rd./SW Baird St.*



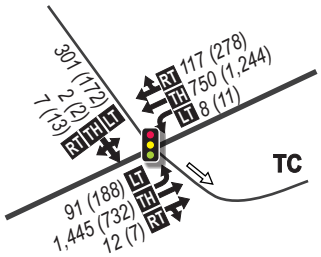
B26. *SW Barbur Blvd. @ LRT Crossover #3*

Future
LRT Crossover
(No volumes for this scenario)

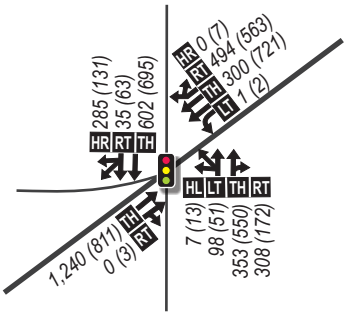
B27. *SW Barbur Blvd. @ Barbur TC (Signal)*



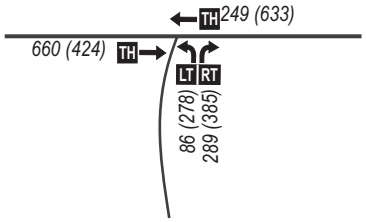
B29. *SW Barbur Blvd. @ Taylors Ferry Rd./ Barbur TC (Bus In)*



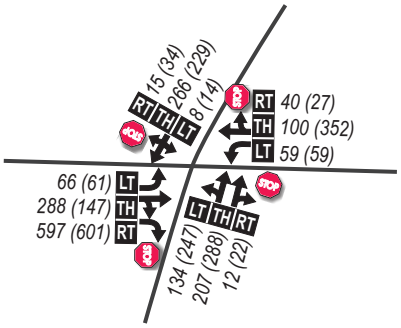
B30. *SW Barbur Blvd. @ SW Capitol Hwy.*



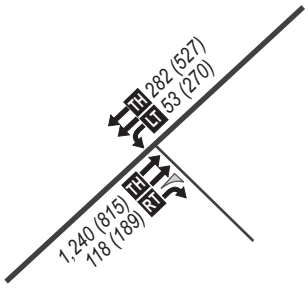
B31. *Taylors Ferry Rd. @ I-5 SB Off-Ramp*



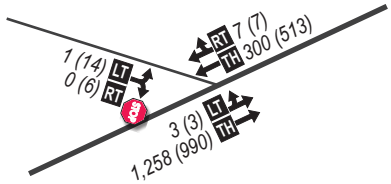
B32. *SW Taylors Ferry Rd. @ SW Capitol Hwy.*



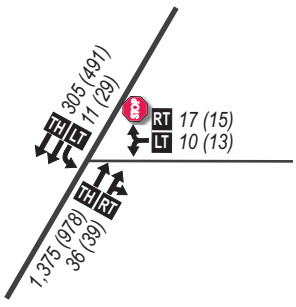
B33. *SW Barbur Blvd. @ SW Huber St. (East)*



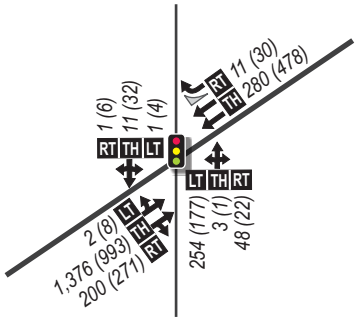
B34. *SW Barbur Blvd. @ SW Huber St. (West)*



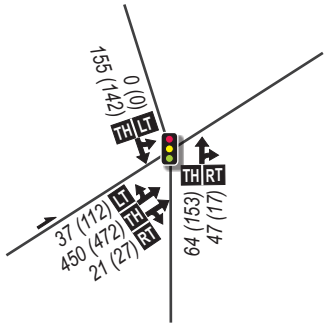
B35. *SW Barbur Blvd. @ SW Luradel St.*



B36. *SW Barbur Blvd. @ SW 53rd Ave.*



B37. *I-5 NB Off-Ramp @ SW 60th Ave.*



LEGEND

00. - Study Intersection No.
STOP - Stop Sign
- Yield Sign
- Traffic Signal
- Lane Configuration
- Bus Only Lane
AM (PM) - Peak Hour Traffic Volumes
LT TH RT - Volume Turn Movement
Left•Thru•Right

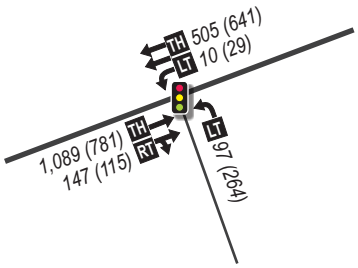
DKS

No Scale

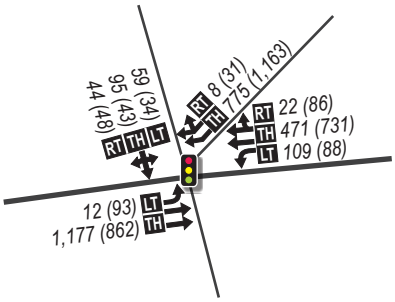
figure **4.2-3b**

2017 Existing Conditions
AM/PM Peak Hour
Segment B: Outer Portland

B38. *SW Barbur Blvd. @ SW 60th Ave.*



B39. *SW Barbur Blvd. @ SW 64th Ave.*



LEGEND

00. - Study Intersection No.
STOP - Stop Sign
- Yield Sign
- Traffic Signal
- Lane Configuration
AM (PM) - Peak Hour Traffic Volumes
HL Hard Left | LT TH RT Left•Thru•Right | HR Hard Right - Volume Turn Movement

DKS

No Scale

figure **4.2-3c**

2017 Existing Conditions
AM/PM Peak Hour
Segment B: Outer Portland

Preliminary Signal Warrant Analysis

A preliminary signal warrant analysis was completed for study area intersections where new signals or significant changes to existing signals could be included as part of a light rail alignment alternative. Analysis for both existing year and future year 2035 are presented in Section 4.3.6, Segment B Preliminary Signal Warrant Analysis. All signal warrant analysis presented in this report is based on available turning movement counts and 24-hour counts. Because 24-hour counts were not available near all study area intersections, in such cases the closest available 24-hour count was used to estimate 8-hour and 4-hour volumes. A complete warrant analysis will be completed in a later phase of the project following selection of a Locally Preferred Alternative. No currently unsignalized study area intersections meet signal warrant criteria under existing conditions.

Section 4.3.6 discusses the analysis for future year 2035 conditions of intersections that do not meet traffic signal warrants under the existing conditions.

4.2.4. Segment B Freight Operations

Federal, state and local jurisdictions designate freight routes to ensure that those roadways are maintained in a manner that allows for the effective operation of freight trucks. Freight designations of major facilities within the study corridor include:

- The **National Highway System**, or NHS, is a network of highways serving strategic economic, defense and transportation facilities such as ports, terminals and railway stations. States are encouraged to focus federal highway funding on maintaining the NHS in a state of good repair.
- The ***Oregon Highway Plan***, or OHP, **State Highway Freight System** has implications for roadway design and mobility standards to accommodate trucks, and may override exceptions granted from other designations.
- **ORS 366.215** specifies a series of **Reduction Review Routes**, which are designated for the movement of oversized freight trucks. These routes require review during planning, project development review and maintenance to examine any "hole in the air" capacity, to ensure freight movement is not restricted.
- **Regional Freight Routes** are designated by Metro and are intended to prioritize areas for investment in freight mobility.
- Portland and Tigard designate **City Freight Routes**. Portland's Major Truck Street designation indicates that all truck types should be accommodated on that street, where practicable. The City of Tigard's freight network designates the most desirable routes for trucks and is intended to ensure that the system is designed to accommodate necessary freight movement.

In Segment B, SW Barbur Boulevard is designated as part of the NHS and is designated as a Major Truck Street by the City of Portland. I-5 is designated as part of the NHS and the State Highway Freight System.

4.2.5. Segment B On-Street Parking

The supply and utilization of on-street parking within the footprint of the proposed light rail alignments was determined by measuring the currently available and legal parking within the public right of way using 22.5 feet[4] to define a parking space. In some locations, there is privately owned land that is used for parking adjacent to the proposed light rail alignments, and these locations were not included in the inventory. The utilization survey was conducted on weekdays in May and August 2017.

In Segment B: Outer Portland there are four locations with existing on-street parking within the proposed alignment alternative footprints:

- on SW Multnomah Boulevard southeast of SW Barbur Boulevard (Alternative B4)
- on SW Barbur Boulevard between SW 13th Avenue and SW 26th Way (Alternatives B1, B2 and B3)
- on SW Barbur Boulevard between SW 26th Avenue and SW Taylors Ferry Road (Alternatives B1 and B2)
- on SW Barbur Boulevard near SW 53rd Avenue (Alternative B1).

In several locations in Segment B, there are no curbs or signs defining where legal on-street parking exists. The inventory process included judgments based on available information to estimate the number of legal parking spaces in these locations. Table 4.2-3 summarizes the results of the parking inventory and utilization survey.

Table 4.2-3. Segment B On-Street Parking Supply and Utilization

Parking Location	Alignment Alternatives	On-Street Parking Supply	AM Utilization	AM Percent Utilization	PM Utilization	PM Percent Utilization	Parking Restrictions
SW Multnomah Blvd.: SE of SW Barbur Blvd.	B4: I-5 Custer-60th	12	11	92%	3	25%	Assumed no legal parking adjacent to existing guardrail
SW Barbur Blvd.: SW 13th Ave. to SW 26th Ave.	B1: Barbur B2: I-5 Barbur TC-60th B3: I-5 26th-60th	27	7	26%	2	7%	5 spaces near the Original Pancake House have 2-hour limit
SW Barbur Blvd.: SW 26th Ave. to SW Taylors Ferry Rd.	B1: Barbur B2: I-5 Barbur TC-60th	61	12	20%	0	0%	
SW Barbur Blvd.: near SW 53rd Ave.	B1: Barbur	25	2	8%	1	4%	2-hour parking for 5 spaces near SW 55th Ave.

There are also local streets perpendicular to the LRT alignment where the project would modify the streetscape for a small portion of the street immediately adjacent to the LRT alignment, often adding

[4] City of Portland Bureau of Development Services, Permanent Administrative Rules, Streets, Alleys, Shared Courts, Common Greens and Pedestrian Connections, July 19, 2010.

curbs, water quality facilities, sidewalks and bike lanes. These streetscape modifications have not been defined in detail and may or may not include on-street parking impacts.

4.2.6. Segment B Safety Analysis

The following safety analysis uses the same methodology and datasets as described in Section 3.2.6, Segment A Safety Analysis. The crash history maps are included in Appendix BB.

In Segment B, there are two identified clusters of fatal and serious injury collisions along SW Barbur Boulevard:

- SW Barbur Boulevard curves near Fulton Community Garden
- SW Barbur Boulevard between SW Multnomah Boulevard and SW Capitol Highway (Crossroads)

In the study area, there were a total of 13 fatal and serious injury collisions between 2011 and 2015. Of the two cluster areas, the SW Barbur Boulevard curves had a higher fatality collision rate. The two most common collision types were fixed object and turning. A summary of the fatal and serious injury crashes in the two clusters are shown in Table 4.2-4 and Table 4.2-5.

Table 4.2-5Table 4.2-4. Fatal and Serious Injury Collisions (2011–2015), Segment B

Location	Fatal	Serious Injury	Total
Study Area Corridor	**5**	**8**	**13**
SW Barbur Boulevard Curves near Fulton Community Garden	4	3	7
SW Barbur Boulevard between SW Multnomah Boulevard and SW Capitol Highway (Crossroads)	1	5	6

Table 4.2-5. Fatal and Serious Injury Collision Type (2011–2015), Segment B

Location	Pedestrian	Bicycle	Rear-End	Fixed Object	Turning	Other[1]	Total
Study Corridor	**0**	**2**	**2**	**4**	**3**	**2**	**13**
SW Barbur Boulevard Curves near Fulton Community Garden	0	0	2	3	1	1	7
SW Barbur Boulevard between SW Multnomah Boulevard and SW Capitol Highway (Crossroads)	0	2	0	1	2	1	6

[1] Other collision types include head-on, sideswipe and non-collision.

SW Barbur Boulevard Curves near Fulton Community Garden

Along SW Barbur Boulevard there were a total of seven collisions (four fatal and three that resulted in serious injuries) during the period of 2011 to 2015. Of the total collisions, three were fixed-object collisions, two were rear-end, one was head-on and one was a turning-related collision.

Three of the four fatal crashes were fixed-object collisions where speeding or reckless driving was the primary cause and which occurred between 10 p.m. and 4 a.m. when visibility is decreased. The fourth fatality was a head-on collision that resulted in one of the vehicles catching fire.

The two rear-end collisions were caused by either following too closely or failing to avoid a stopped vehicle at a signalized intersection, and the turning-related collision was caused by careless driving when the road was wet at a stop sign.

Recommended improvements include installing a combination of chevron signs, curve warning signs and/or sequential flashing beacons (including advance curve warning flashers; oversized, doubled up and/or fluorescent yellow sheeting advance curve warning signs; and dynamic curve speed warning systems) and improving traffic signal hardware (including lenses, reflectorized back plates, size and number of signal heads).

SW Barbur Boulevard at SW Capitol Highway (Crossroads)

The All Roads Transportation Safety Program (ARTS) is designed to address safety needs on all public roads in Oregon. The program is data-driven to achieve the greatest benefits in crash reduction and is a jurisdictionally blind implementation of the federal Highway Safety Improvement Program (HSIP).

One component of ARTS was a hotspot analysis to find specific locations throughout the state that would benefit the most from safety improvements. A draft list of potential hotspot projects was developed for ODOT Region 1, not all of which have so far become funded projects.

There are two locations along the study corridor that are identified as part of ARTS. The first location is the SW Capitol Highway/SW Barbur Boulevard intersection (referred to in this document as intersection B30), where there were 93 total crashes, 1 of which resulted in a fatality and 2 in serious injury. The recommended countermeasures at this location include:

- Improve Signal Hardware: Lenses, Reflectorized Back Plates, Size, and Number
- Install Pedestrian Countdown Timer(s)
- Provide Intersection Illumination (Bike and Pedestrian)
- Install Urban Traffic Signal
- Install Pedestrian Signal
- Install Any Type of Median Barrier

4.3. Future Conditions

This section identifies potential impacts to non-motorized and motorized modes of travel associated with the No-Build Alternative and the light rail alternative alignments within Segment B in 2035 and in 2045 for freeway ramp terminals. In addition, potential improvements outside of this project are developed to address the potential deficiencies in the transportation network.

4.3.1. Segment B Alternatives Description

No-Build Alternative

The No-Build Alternative includes all the projects identified in the Metro Regional Transportation Plan Financially Constrained 2035 project list and does not include the proposed project. Link volumes from the Metro model were refined within the study area and forecasted using National Cooperative Highway Research Program (NCHRP) 765 future forecasting methodology to convert the model link

volumes to forecast turn volumes. General purpose traffic volumes are adjusted to include forecasts for future year 2035 (and 2045 for freeway ramp terminals).

Light Rail Alternatives

A full description of the different alignment alternatives is included in Chapter 2 of the Draft EIS.

In Segment B, there are four light rail alignment alternatives.

With Alternative B1, LRT would operate in the median of SW Barbur Boulevard between SW Brier Place and SW 60th Avenue. SW Barbur Boulevard would have two general purpose lanes for each travel direction.

With Alternative B2, LRT would operate in the median of SW Barbur Boulevard between SW Brier Place and SW Plum Street near Barbur Transit Center and adjacent to I-5 south of Barbur Transit Center to SW 60th Avenue. SW Barbur Boulevard would have two general purpose lanes for each travel direction.

With Alternative B3, LRT would operate in the median SW Barbur Boulevard between SW Brier Place and SW 26th Way, and adjacent to I-5 south of SW 26th Way to SW 60th Avenue. SW Barbur Boulevard would have two general purpose lanes for each travel direction.

With Alternative B4, LRT would operate in the median SW Barbur Boulevard between SW Brier Place and SW 13th Avenue, and adjacent to I-5 south of SW 13th Avenue to SW 60th Avenue. SW Barbur Boulevard would have two general purpose lanes for each travel direction.

4.3.2. Segment B System-wide Analysis

The light rail alternatives in Segment B would result in minor changes to the roadway network and maintain roadway capacity and motor vehicle traffic patterns. From a system-wide perspective, all the light rail alternatives are expected to perform similarly for motor vehicle traffic (see Figure 4.3-1).

With the light rail alternatives, total north-south motor vehicle volume at screenlines would be reduced as follows:

- "The Woods" (SW Vermont Street/SW Sunset Boulevard) screenline: reduced by 1 percent (AM and PM)
- "Mid-Barbur" (Taylors Ferry Road) screenline: reduced by 1 percent (AM and PM)

As shown in Table 4.3-1, SW Barbur Boulevard throughout Segment B would see a reduction in motor vehicle volume, varying between less than 1 percent at Crossroads (SW Capitol Highway) and 6 percent/5 percent (AM/PM) east of SW Terwilliger Boulevard. The segment of SW Capitol Highway between SW Barbur Boulevard/Crossroads and SW 49th Avenue would see a reduction of 9 percent/ 8 percent (AM/PM). No other significant impacts were observed.

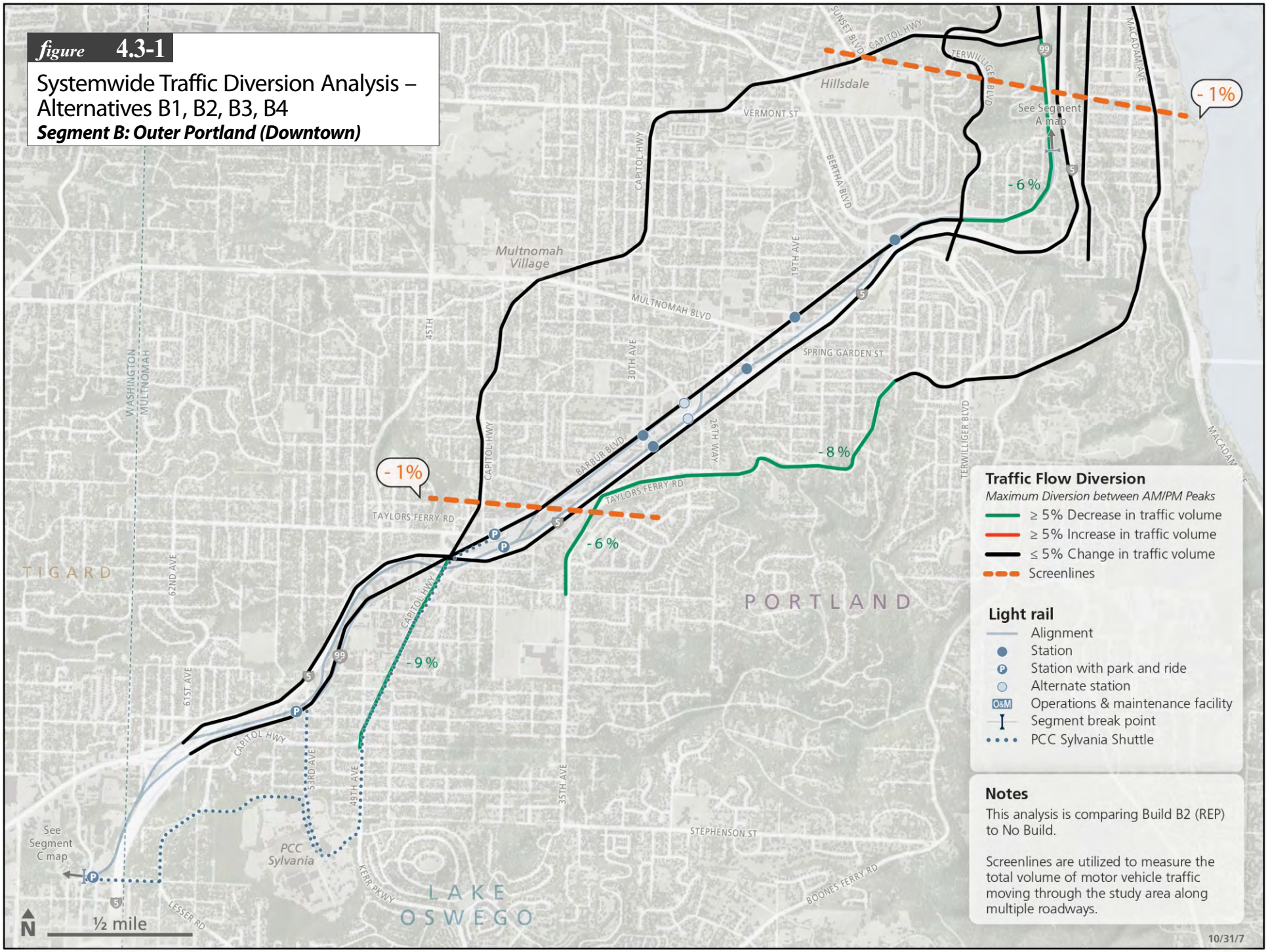
Table 4.3-1. Peak 2-hour Motor Vehicle Volumes in Segment B

			2035 No-Build		2035 Light Rail (all Segment B alternatives)	
			2-hour, 2-way volume		Change from No-Build	
	From	To	AM	PM	AM	PM
A	**Barbur**					
1	60th	Crossroads	5,223	5,591	-0.5%	-0.9%
2	Crossroads	Multnomah	5,872	5,924	-0.6%	-0.3%
3	Multnomah	Terwilliger	4,987	5,427	-3.1%	-2.0%
4	Terwilliger	Capitol (Woods)	4,122	4,149	-6.4%	-5.0%
5	Capitol (Woods)	Rasmussen	8,005	8,345	-2.7%	-2.5%
B	**I-5**					
1	60th	Crossroads	22,684	23,360	-0.9%	-0.2%
2	Crossroads	Multnomah	21,807	22,469	-0.9%	-0.6%
3	Multnomah	Terwilliger	23,690	23,733	-1.0%	-0.4%
4	Terwilliger	Richardson	24,031	24,187	-0.6%	-0.2%
C	**Capitol**					
1	49th	Crossroads	2,709	3,105	-9.2%	-7.5%
2	Crossroads	Multnomah	1,492	1,809	-1.9%	+0.7%
3	Multnomah	Bertha	1,834	2,035	-3.0%	-0.7%
4	Bertha	Terwilliger	3,577	4,036	-0.8%	-1.6%
5	Terwilliger	Barbur	3,922	4,220	-0.1%	-1.0%
D	**Corbett**					
1	Miles	Richardson	2,478	2,808	+1.6%	-1.3%
E	**35th/Taylors Ferry**					
1	Huber	35th/Taylors Ferry	351	426	-6.3%	-8.7%
2	35th/Taylors Ferry	Spring Garden	819	1,470	-7.7%	-5.6%
3	Spring Garden	Terwilliger	2,450	2,660	-0.5%	-1.1%
4	Terwilliger	Macadam	4,246	4,256	-0.4%	-0.0%
F	**Macadam**					
1	Taylors Ferry	Richardson	4,398	4,761	-1.5%	+0.0%
G	**Terwilliger**					
1	Barbur	Capitol	1,688	1,942	-1.8%	-1.6%
2	Capitol	Hamilton	2,249	2,449	-0.6%	-0.5%
North-South Screenlines						
Measured at Vermont/Sunset (Capitol, Terwilliger, Barbur, I-5, Corbett, Macadam			40,294	41,883	-1.2%	-0.9%
Measured at Taylors Ferry (Capitol, Barbur, I-5, 35th)			29,522	30,628	-1.0%	-0.5%

figure **4.3-1**

Systemwide Traffic Diversion Analysis – Alternatives B1, B2, B3, B4

Segment B: Outer Portland (Downtown)



4.3.3. Segment B Active Transportation

With the No-Build Alternative, pedestrian and bicycle activity would remain similar to the existing activity, with some increased activity because of the forecasted residential and employment growth in the corridor, and planned improvements to bicycle and pedestrian facilities. Previous planning in the corridor identified a series of station access improvements that would improve and facilitate bicycle and pedestrian access to the planned light rail stations. These projects are not included as project elements, but the potential impacts of these planned improvements are referenced in the discussion of active transportation impacts.

Impacts on Pedestrian and Bicycle Facilities

The light rail alternatives would include new or improved pedestrian and bicycle facilities on all in-street segments of the light rail alignments. These new and improved facilities would fill in existing gaps in the sidewalk and bicycle network, and attract increased pedestrian and bicycle activity in the transportation system. Areas near light rail stations would see increased pedestrian activity with transit riders accessing the stations.

In Segment B: Outer Portland, with Alternatives B1, B2, B3 and B4, SW Barbur Boulevard would include new or reconditioned sidewalks between SW Brier Place and SW 60th Avenue. With Alternative B4, SW Multnomah Boulevard would be closed as a through street for motor vehicles, bicycles and pedestrians between SW 13th Avenue and immediately east of SW 19th Avenue. Pedestrian access to homes and businesses southeast of SW Barbur Boulevard in this area would be via improved sidewalks on SW Barbur Boulevard, SW Moss Street, SW Evans Street, SW 17th Avenue and a small segment of SW Multnomah Boulevard just north of SW 19th Avenue. With Alternatives B1, B2 and B3, there would be 21 to 35 designated pedestrian crossings of SW Barbur Boulevard, and with Alternative B4, there would be 18 designated pedestrian crossings of SW Barbur Boulevard.

In Segment B, with the No-Build Alternative, the sidewalks on SW Barbur Boulevard would be intermittent and substandard, and there would be bike lane gaps on the street. The No-Build Alternative includes 14 designated pedestrian crossings of SW Barbur Boulevard.

Alternative B1 would include an 8-foot-wide bike lane in both directions between SW Brier Place and SW 60th Avenue. Alternative B2 would include an 8-foot-wide bike lane in both directions between SW Brier Place and SW Capitol Highway. Between SW Capitol Highway and SW 60th Avenue, Alternative B2 would include widening and improvements to SW Barbur Boulevard to fill in bike lane gaps. Alternative B3 would include an 8-foot-wide bike lane between SW Brier Place and SW 26th Way. Between SW 26th Way and SW 60th Avenue, Alternative B3 would include widening and improvements to SW Barbur Boulevard to fill in bike lane gaps. Alternative B4 would include an 8-foot-wide bike lane between SW Brier Place and SW 13th Avenue, and west of SW 13th Avenue on SW Barbur Boulevard would include shoulder improvements to fill in bike lane gaps.

Two analysis methods were used to evaluate the impact of the alignment alternatives on SW Barbur in Boulevard Segment B: MMLOS and a pedestrian crossing spacing assessment using the City of Portland's proposed pedestrian crossing spacing standards.

Multimodal Level of Service (MMLOS)

MMLOS is included in the 2010 HCM and provides a methodology to evaluate the comfort of the walking and bicycling environment along roadways based on their design and traffic characteristics. MMLOS assigns a letter grade between A and F to the quality of the environment along each roadway segment for each mode of travel. In Segment B, the MMLOS method provides pedestrian level of service, or PLOS, and bicycle level of service, or BLOS, along SW Barbur Boulevard with the No-Build Alternative and the light rail alternatives. The PLOS and BLOS findings in Segment B are summarized below.

Pedestrian Level of Service (PLOS)

Along SW Barbur Boulevard, segment-level PLOS was calculated for each side of the street. Segment-level LOS is a planning-level approach that captures the influence of both the roadway cross-section, including pedestrian environment and motor vehicle traffic characteristics, but does not consider intersection quality or crossing frequency. The worse PLOS of the two sides of the roadway, according to its grade between A and F, is reported and shown for each portion of Segment B in Table 4.3-2.

Table 4.3-2. Segment B Pedestrian Level of Service (PLOS) along SW Barbur Boulevard

To/From (Segment B)	No-Build	B1	B2	B3	B4
SW 3rd Ave.–SW Terwilliger Blvd.	D	C	C	C	C
SW Terwilliger Blvd.–SW Bertha Blvd.	E	D	D	D	D
SW Bertha Blvd.–SW 24th Ave.	E	C	C	C	E
SW 24th Ave.–SW Taylors Ferry Rd.	D	D	D	D	D
SW Taylors Ferry Rd.–SW Capitol Hwy. (Crossroads)	D	C	D	D	D
SW Capitol Hwy. (Crossroads)–SW 60th Ave.	D	C	D	D	D

Bicycle Level of Service (BLOS)

Along SW Barbur Boulevard, segment-level BLOS was calculated for each side of the street. Segment-level BLOS is a planning-level approach that captures the influence of both the roadway cross-section, including bicycling environment and motor vehicle traffic characteristics, but does not consider intersection quality or crossing frequency. The worse BLOS of the two sides is reported and shown for each portion of Segment B in Table 4.3-3.

Table 4.3-3. Segment B Bicycle Level of Service (BLOS) along SW Barbur Boulevard

To/From (Segment B)	No-Build	B1	B2	B3	B4
SW 3rd Ave.–SW Terwilliger Blvd.	C	A	A	A	A
SW Terwilliger Blvd.–SW Bertha Blvd.	C	A	A	A	A
SW Bertha Blvd.–SW 24th Ave.	C	A	A	A	C
SW 24th Ave.–SW Taylors Ferry Rd.	C	A	A	C	C
SW Taylors Ferry Rd.–SW Capitol Hwy. (Crossroads)	B	A	B	B	B
SW Capitol Hwy. (Crossroads)–SW 60th Ave.	B	A	B	B	B

Pedestrian Crossing Spacing

The ability to safely cross the street at regular intervals is an essential part of creating an attractive walking and bicycling environment, but it is not measured in the evaluation of presence of facilities or the MMLOS analysis. To evaluate the effect of the project on this aspect of the transportation network, a review of pedestrian crossing spacing in the corridor was performed for the project in the areas where the project would alter the crossing patterns significantly.

The City of Portland has developed a proposed spacing standard for marked crossings that would apply to SW Barbur Boulevard in Segment B. The proposed standard is 530 feet maximum spacing within pedestrian districts and designated main streets, and 795 feet maximum spacing along city walkways and at every transit stop. SW Barbur Boulevard would be designated as city walkways (795-foot standard) except in the following area, where the main street designation (530-foot standard) would apply:

- SW Barbur Boulevard: SW 5th Avenue to SW 13th Avenue, SW Evans Street to SW Spring Garden Street, SW 24th Avenue to SW Primrose Street, SW Plum Street to SW Huber Street

In Segment B, SW Barbur Boulevard was evaluated for compliance with the spacing requirements between SW Brier Place and SW 64th Avenue under the No-Build Alternative and the four alignment alternatives. Where the spacing would exceed the maximum, the degree of excess was documented and the portion of street within 150 percent of the standard was documented to quantify the degree to which crossing spacing would exceed the proposed standard. The percentage of the length of roadways that would meet the standard, fail to meet the standard but be close to it, and fail to meet the standard but not be close are summarized in the following table and in Figure 4.3-2 through 4.3-6.

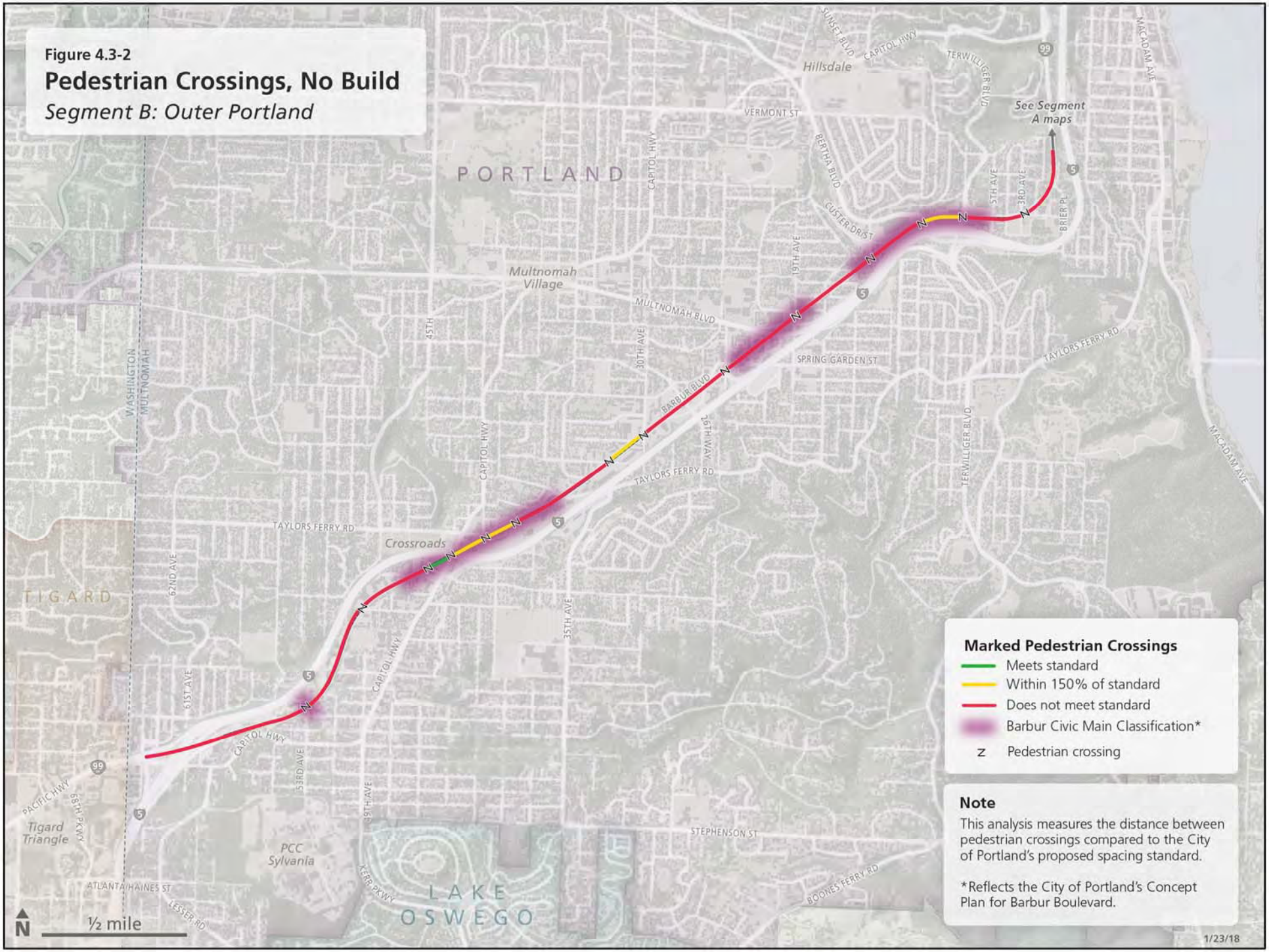
Table 4.3-4. Segment B Percent of SW Barbur Boulevard Meeting Proposed Standard: SW Brier Place to SW 64th Avenue

Location	Meets standard?	No-Build	B1	B2	B3	B4
Overall: Barbur Boulevard within Segment B	Yes, meets standard	2%	30%	26%	18%	5%
	No; close to standard (≤150%)	17%	29%	24%	28%	14%
	No; not close to standard (>150%)	81%	41%	50%	55%	81%
Barbur Boulevard Civic Main Street within Segment B	Yes, meets standard	6%	36%	36%	31%	20%
	No; close to standard (≤150%)	24%	34%	34%	45%	26%
	No; not close to standard (>150%)	70%	30%	30%	24%	54%

Figure 4.3-2

Pedestrian Crossings, No Build

Segment B: Outer Portland



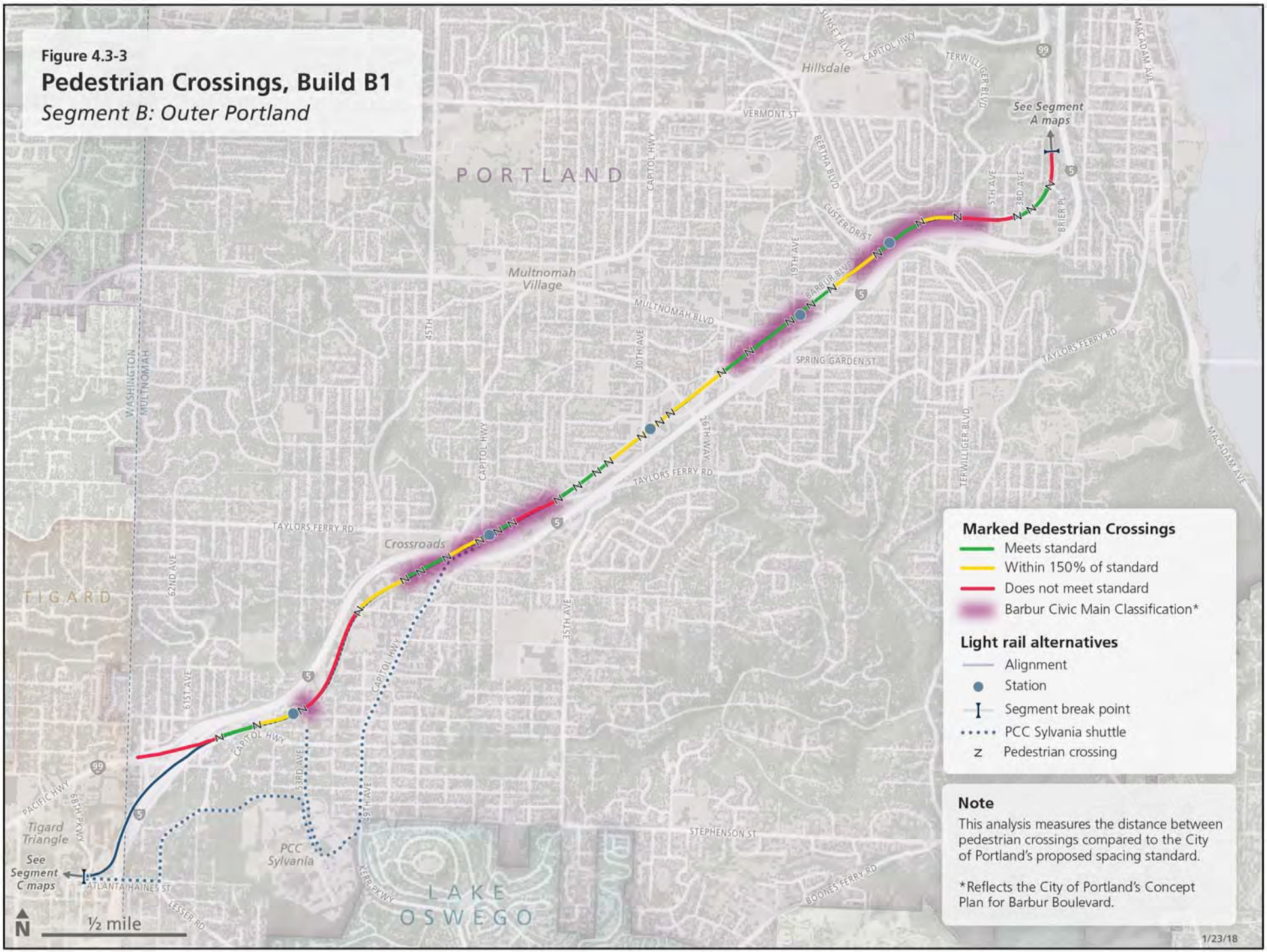
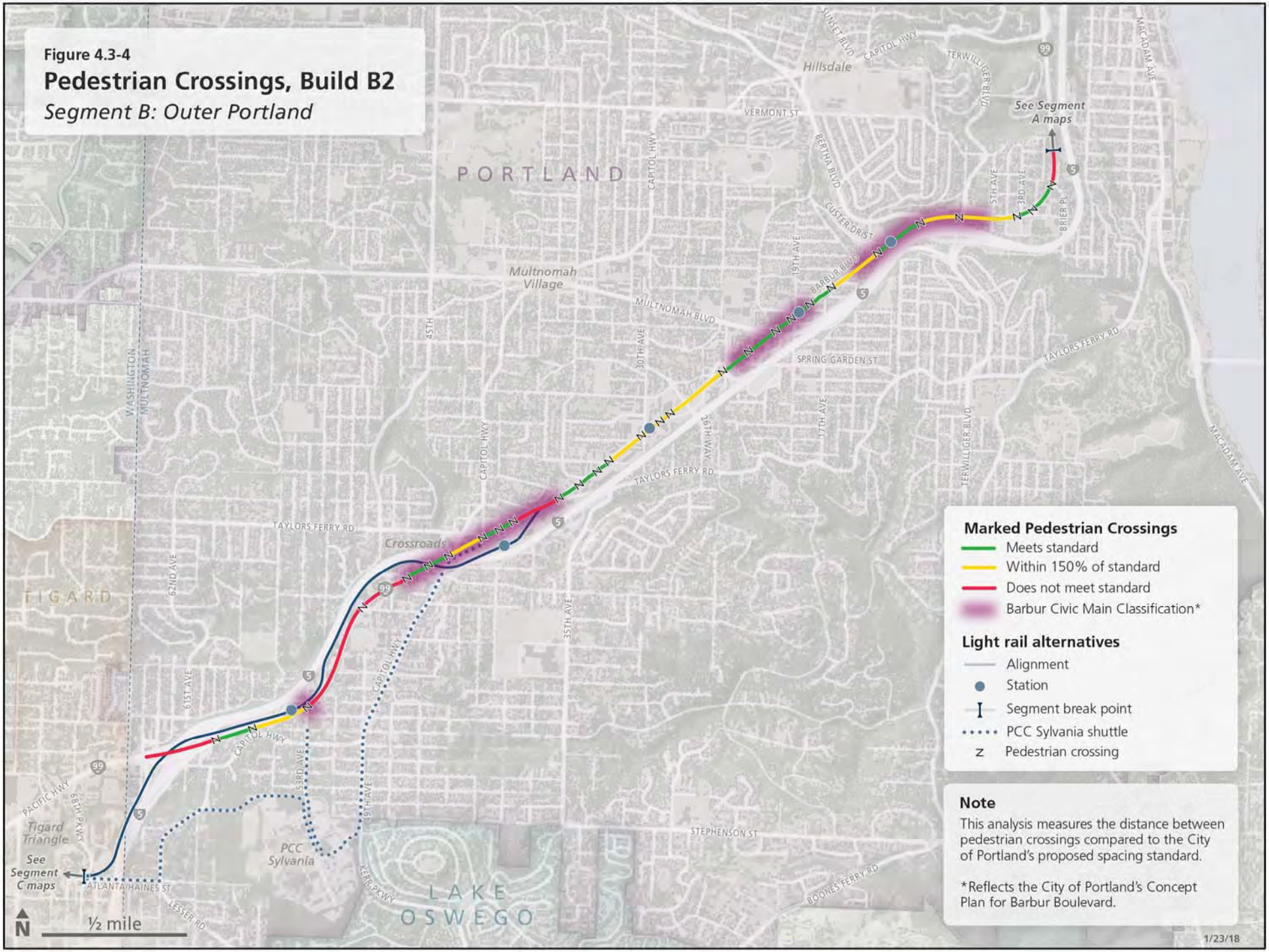


Figure 4.3-3
Pedestrian Crossings, Build B1
Segment B: Outer Portland
PORTLAND
Hillsdale
Multnomah Village
Crossroads
TIGARD
LAKE OSWEGO
Tigard Triangle
PCC Sylvania
See Segment A maps
See Segment C maps
Marked Pedestrian Crossings
Meets standard
Within 150% of standard
Does not meet standard
Barbur Civic Main Classification*
Light rail alternatives
Alignment
Station
Segment break point
PCC Sylvania shuttle
Pedestrian crossing
Note
This analysis measures the distance between pedestrian crossings compared to the City of Portland's proposed spacing standard.
*Reflects the City of Portland's Concept Plan for Barbur Boulevard.
½ mile
1/23/18

Figure 4.3-4

Pedestrian Crossings, Build B2

Segment B: Outer Portland



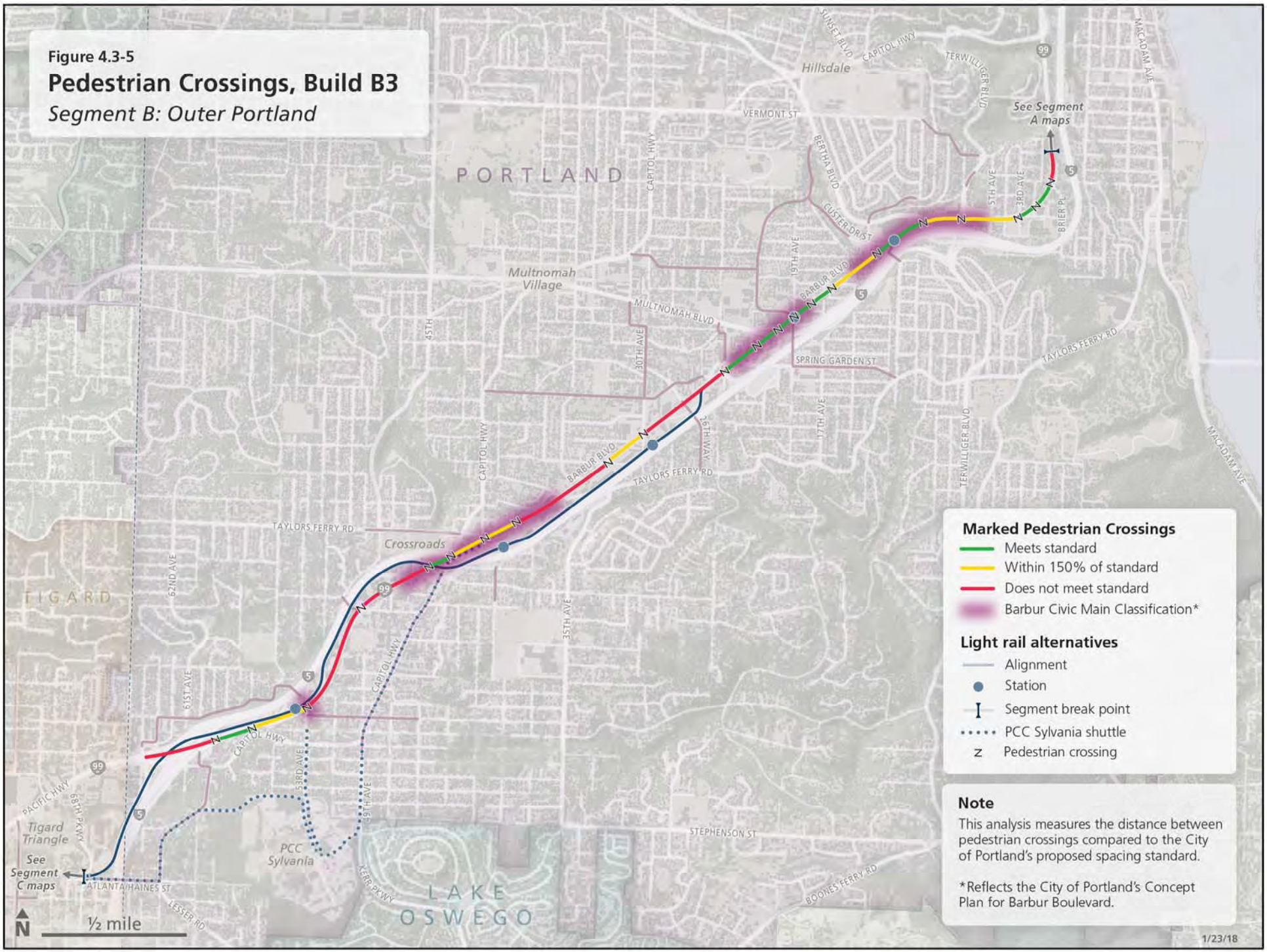
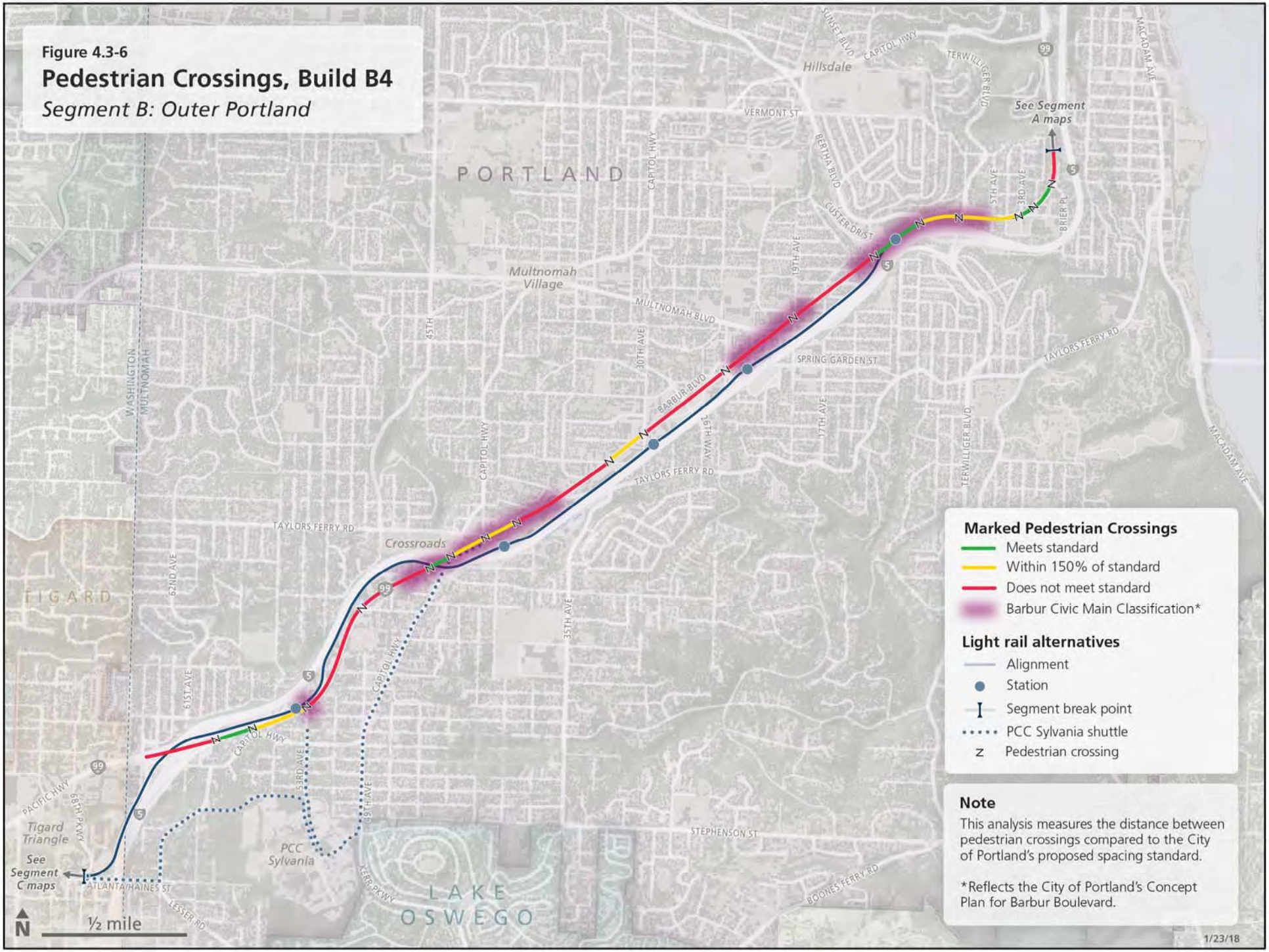


Figure 4.3-5
Pedestrian Crossings, Build B3
Segment B: Outer Portland
PORTLAND
Hillsdale
Multnomah Village
Crossroads
TIGARD
LAKE OSWEGO
Tigard Triangle
PCC Sylvania
See Segment A maps
See Segment C maps
SUNSET BLVD
CAPITOL HWY
TERWILLIGER BLVD
MACADAM AVE
VERMONT ST
BERTHA BLVD
CUSTER DR ST
5TH AVE
3RD AVE
BRIER PL
19TH AVE
BARBUR BLVD
MULTNOMAH BLVD
45TH
30TH AVE
SPRING GARDEN ST
TAYLORS FERRY RD
17TH AVE
26TH WAY
35TH AVE
62ND AVE
61ST AVE
53RD AVE
49TH AVE
PACIFIC HWY
68TH PKWY
ATLANTA/HAINES ST
LESSER RD
KERR PKWY
STEPHENSON ST
BOONES FERRY RD
Marked Pedestrian Crossings
Meets standard
Within 150% of standard
Does not meet standard
Barbur Civic Main Classification*
Light rail alternatives
Alignment
Station
Segment break point
PCC Sylvania shuttle
Pedestrian crossing
Note
This analysis measures the distance between pedestrian crossings compared to the City of Portland's proposed spacing standard.
*Reflects the City of Portland's Concept Plan for Barbur Boulevard.
N
½ mile
1/23/18

Figure 4.3-6

Pedestrian Crossings, Build B4

Segment B: Outer Portland



Station Access Improvements

In addition to the walking and bicycle facility improvements included along SW Barbur Boulevard as part of the alignment alternatives, the project includes 19 station access improvement options in Segment B (see Figure 2.3-10 of the Draft EIS). The station access improvements include a mix of bike lanes, sidewalks and sharrows (arrows painted on low-volume streets to indicate a shared-use bicycle route). Table 4.3-5 summarizes these Segment B station access improvements.

Table 4.3-5. Segment B: Outer Portland Station Access Improvements

Station Access Improvement	Major Design Elements	Potential Impacts	Notes
SA04: Terwilliger Bikeway	Bike lane, curb, landscape strip, Americans with Disabilities Act (ADA) ramps	None	
SA05: Chestnut Bikeway	Westbound bike lane, eastbound sharrows	On-street parking removal	
SA06: 13th Sidewalks and Bikeway	Sidewalks, bike lane	On-street parking removal, possible property impacts	
SA07: Custer Sidewalks	Sidewalks, bike lane	On-street parking removal, possible property impacts	Sidewalk added on north side only
SA08: Custer Walk/Bike Bridge	New 14-foot-wide pedestrian/bike bridge over I-5 with access ramps	Possible property impacts, parking removal, traffic impacts during construction	Approvals from ODOT and FHWA would be required, and traffic management on I-5 during construction could result in partial lane closures or full closures during nighttime construction
SA09: Capitol Hill Sidewalks and Bikeway	Sidewalk, water quality, retaining walls, bike lane, sharrows	Possible property impacts, parking impacts, construction impacts	Bike lane on east side only
SA10: 19th Bikeway	Modify existing striping to provide 5-foot bike lanes and 10-foot motor vehicle lanes, sharrows	Possible parking impacts	
SA11: Troy Bikeway	Bike lane and sharrows	On-street parking removal	Bike lane in on north side only, sharrows for downhill travel
SA12: Spring Garden and Dolph Sidewalks and Bikeway	Sidewalk, bike lane, water quality	Possible property impacts, parking impacts, construction impacts	
SA13: 24th Sidewalks and Bikeway	Sidewalk, bike lanes, sharrows, new intersection	Possible property impacts, parking impacts, construction impacts	New intersection with crosswalks at SW 24th Avenue and SW Multnomah Blvd.
SA14: 26th Sidewalks and Bikeway	Sidewalk, bike lane, lighting, water quality, retaining walls	On-street parking impacts	
SA15: 30th Sidewalks	Sidewalks, water quality	Possible property impacts	
SA16: Taylors Ferry Sidewalks and Bikeway	Sidewalks, bike lanes, retaining walls, water quality, culvert extension	Possible property impacts, traffic impacts during construction	
SA17: 40th Sidewalks and Crossing	Sidewalk, flashing beacon crosswalk	Possible property impacts	Sidewalk on west side only
SA18: Capitol Sidewalks and Crossings	Sidewalks, crosswalk, signals, ADA ramps, bus shelter, median	Possible property impacts, traffic impacts during construction	

Station Access Improvement	Major Design Elements	Potential Impacts	Notes
SA19: Luradel Walk/Bike Bridge	Bike/ped. crossing of I-5, retaining walls, water quality	Possible property impacts, traffic impacts during construction	Either SA19 or SA20 could be constructed – not both
SA20: 53rd Walk/Bike Bridge	Bike/ped. crossing of I-5, retaining walls, water quality	Possible property impacts, traffic impacts during construction	Either SA19 or SA20 could be constructed – not both
SA21: Pomona Sidewalks and Bikeway	Sidewalk, bike lane	Possible property impacts, on-street parking impacts	
SA22: Pasadena Sidewalks and Bikeway	Sidewalk, bike lane	Possible property impacts, on-street parking impacts	
SA23: Barbur/PCC to Triangle Connection	Either on-street improvements or separated multi-use pathway. Could cross freeway at Haines Road (with bike/ped improvements) or on separate bike/ped only bridge	No specific project description – not possible to determine potential impacts	

4.3.4. Segment B Motor Vehicle Operations

No-Build Alternative in 2035

The No-Build Alternative assumes that the project is not constructed and allows the analysis to directly compare the future scenarios with and without the project, instead of comparing to the existing conditions only.

Table 4.3-6 shows the Synchro analysis results for the 2035 No-Build Alternative. Intersection volumes are shown graphically in Figure 4.3-7. As shown, ten intersections do not meet the mobility target in at least one peak period. Of these ten, three do not meet the mobility target in either peak period.

Comparison to the existing conditions analysis reveals that the intersection of SW Taylors Ferry Road and SW Capitol Highway would meet mobility standards because of a planned signal improvement in the future year.

Table 4.3-6. Segment B 2035 No-Build Alternative HCM (Synchro) Analysis

					2035 No-Build								
						AM				PM			
ID	Intersection	Note	Mobility Target		Control	Delay	LOS	V/C	WLANE	Delay	LOS	V/C	WLANE
B1	SW Barbur Blvd./SW 2nd Ave.		ODOT/PBOT 1st HR	0.99	TWSC	0.2 [22.5]	A [C]	0.05	WBLn	0.2 [15.2]	A [C]	0.04	WBLn
B2	SW Barbur Blvd./SW 3rd Ave.		ODOT/PBOT 1st HR	0.99	Signal	**16.6**	**B**	**1.05**	-	18.9	B	0.82	-
B3	SW Barbur Blvd./SW Terwilliger Blvd.		ODOT/PBOT 1st HR	0.99	Signal	**61.4**	**E**	**1.09**	-	**58.9**	**E**	**1.08**	-
B4	SW Barbur Blvd./SW Bertha Blvd./I-5 ramps		ODOT Ramp	0.85	Signal	**33.8**	**C**	**0.91**	-	24.2	C	0.83	-
B9	SW Terwilliger Blvd./I-5 NB off-ramp		ODOT Ramp	0.85	Signal	16.1	B	0.67	-	**39.1**	**D**	**0.89**	-

ID	Intersection	Note	Mobility Target		2035 No-Build								
						AM				PM			
					Control	Delay	LOS	V/C	WLANE	Delay	LOS	V/C	WLANE
B10	SW Barbur Blvd./SW 13th Ave./ped. crossing/ LRT Crossover #1		ODOT/PBOT 1st HR	0.99	TWSC	2.1 [18.1]	A [C]	0.44	EBLn1	3.1 [29.4]	A [D]	0.60	EBLn1
B13	SW Barbur Blvd./SW 19th Ave./SW Capitol Hill Rd.	1	ODOT/PBOT 1st HR	0.99	Signal	33.7	C	0.89	-	28.4	C	0.86	-
B15	SW Barbur Blvd./SW 22nd Ave.	1	ODOT/PBOT 1st HR	0.99	TWSC	**3.1 [>300]**	**F [F]**	**>2.0**	**EBLn1**	3.6 [>300]	A [F]	0.14	NBLn
B16	SW Barbur Blvd./I-5 SB off-ramp/SW 24th Ave.	1	ODOT Ramp	0.85	Signal	14.6	B	0.85	-	15.7	B	0.67	-
B20	SW Barbur Blvd./SW Barbur Ct. (North)	1	ODOT/PBOT 1st HR	0.99	TWSC	**10.5 [110.2]**	**B [F]**	**1.06**	**WBLn1**	4 [36.2]	A [E]	0.77	WBLn1
B22	SW Barbur Blvd./SW 30th Ave.	1	ODOT/PBOT 1st HR	0.99	Signal	11.5	B	0.73	-	10.0	B	0.58	-
B24	SW Barbur Blvd./SW Alice St./ped. crossing	1, 2	ODOT/PBOT 1st HR	0.99	TWSC	3.4 [>300]	A [F]	0.88	EBLn1	**14 [>300]**	**B [F]**	**1.21**	**WBLn1**
B25	SW Barbur Blvd./SW Taylors Ferry Rd./SW Baird St.	1, 2	ODOT/PBOT 1st HR	0.99	TWSC	**29.1 [>300]**	**D [F]**	**>2.0**	**WBLn1**	**30.1 [>300]**	**D [F]**	**>2.0**	**EBLn1**
B27	SW Barbur Blvd./Barbur Transit Center (Signal)	1, 2	ODOT/PBOT 1st HR	0.99	Signal	2.7	A	0.59	-	5.3	A	0.54	-
B29	SW Barbur Blvd./SW Taylors Ferry Rd./Barbur Transit Center (Bus In)	1, 2	ODOT/PBOT 1st HR	0.99	Signal	19.1	B	0.71	-	28.8	C	0.91	-
B30	SW Barbur Blvd./SW Capitol Hwy. (Crossroads)	1, 2	ODOT/PBOT 1st HR	0.99	Signal	29.7	C	0.79	-	28.1	C	0.83	-
B31	SW Taylors Ferry Rd./I-5 SB off-ramp	2	ODOT Ramp	0.85	TWSC	2 [24.1]	A [C]	0.33	NBLn1	**43.2 [226]**	**E [F]**	**1.34**	**NBLn1**
B32	SW Taylors Ferry Rd./SW Capitol Hwy.	2	PBOT 1st HR	0.99	Signal	32.4	C	0.72	-	32.7	C	0.78	-
B33	SW Barbur Blvd./SW Huber St. (East)	2	ODOT/PBOT 1st HR	0.99	free	-	-	-	-	-	-	-	-
B34	SW Barbur Blvd./SW Huber St. (West)	1,2	ODOT/PBOT 1st HR	0.99	TWSC	0.2 [16.3]	A [C]	0.03	EBLn1	0.4 [14.8]	A [B]	0.08	-
B35	SW Barbur Blvd./SW Luradel St.	1,2	ODOT/PBOT 1st HR	0.99	TWSC	0.8 [32.8]	A [D]	0.24	WBLn1	0.8 [30.6]	A [D]	0.20	WBLn1
B36	SW Barbur Blvd./SW 53rd Ave.	1, 2	ODOT/PBOT 1st HR	0.99	Signal	18.5	B	0.86	-	10.7	B	0.72	-
B37	I-5 NB off-ramp/SW 60th Ave.	1	ODOT Ramp	0.85	Signal	46.8	D	0.40	-	49.3	D	0.43	-
B38	SW Barbur Blvd./SW 60th Ave.	1	ODOT/PBOT 1st HR	0.99	Signal	15.5	B	0.53	-	20.1	C	0.61	-
B39	SW Barbur Blvd./SW 64th Ave.	1	ODOT Ramp	0.85	Signal	36.3	D	0.77	-	**43.8**	**D**	**0.89**	**-**

Key: Average Intersection [Worst stop-controlled movement] delay and LOS for TWSC intersections.

V/C represents intersection average for signals and worst movement for stop-controlled intersections.

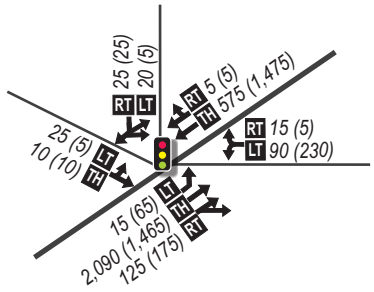
HR = hour; Ln = lane; PBOT = Portland Bureau of Transportation; EB = eastbound; NB = northbound; WB = westbound.

Notes:

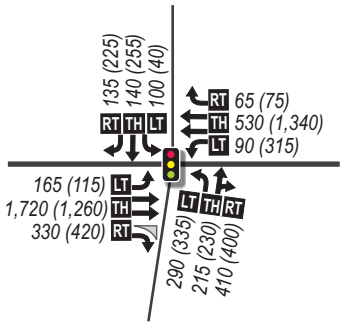
1. Intersection analysis completed as part of 2016 Southwest Corridor study with review by ODOT, PBOT and Metro.
2. Intersection part of Town Center designation with 2nd hour mobility target. To maintain consistency with 2016 Southwest Corridor analysis, proximity to ramps, and peak-hour park and ride trip generation rates, 1st hour analysis was performed. Intersections meeting 1st hour target also meet 2nd hour target.

B1. *SW Barbur Blvd. @ SW 2nd Ave.*

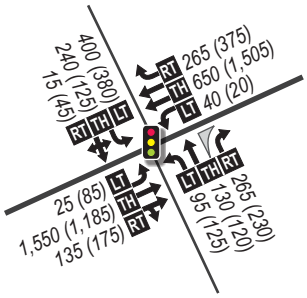
B2. *SW Barbur Blvd. @ SW 3rd Ave.*



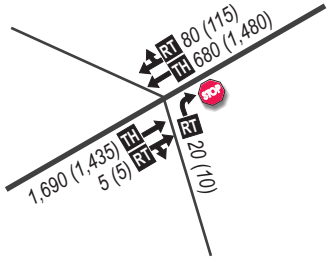
B3. *SW Barbur Blvd. @ SW Terwilliger Blvd.*



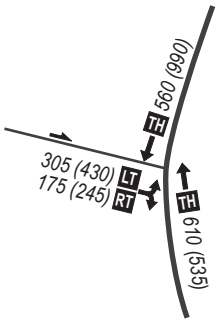
B4. *SW Barbur Blvd. @ SW Bertha Blvd.*



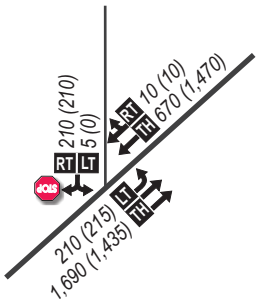
B8. *SW Barbur Blvd. @ SW Custer Dr./ SW Multnomah Blvd.*



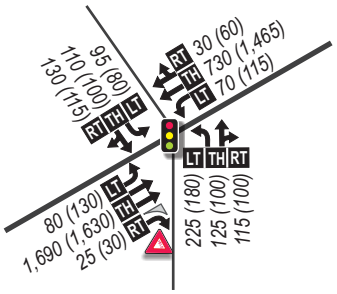
B9. *SW Terwillger Blvd. @ I-5 NB Off-Ramp*



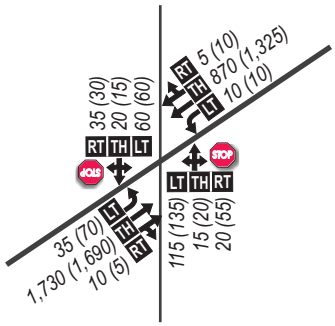
B10. *SW Barbur Blvd. @ SW 13th Dr.*



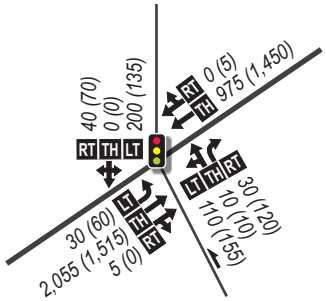
B13. *SW Barbur Blvd. @ SW 19th Dr./ SW Capitol Hill Rd.*



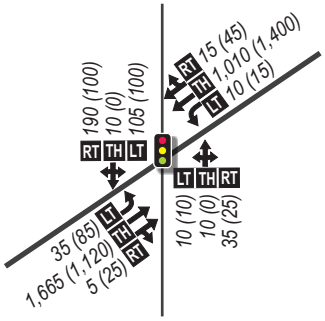
B15. *SW Barbur Blvd. @ SW 22nd Ave.*



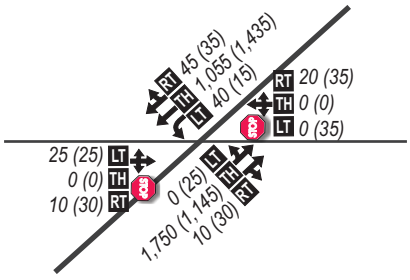
B16. *SW Barbur Blvd. @ I-5 SB Off-Ramp/ SW 24th Ave.*



B22. *SW Barbur Blvd. @ SW 30th Ave.*



B24. *SW Barbur Blvd. @ SW Alice St.*



LEGEND

00. - Study Intersection No.
STOP - Stop Sign
- Yield Sign
- Traffic Signal
- Lane Configuration
AM (PM) - Peak Hour Traffic Volumes
LT TH RT - Volume Turn Movement
Left•Thru•Right

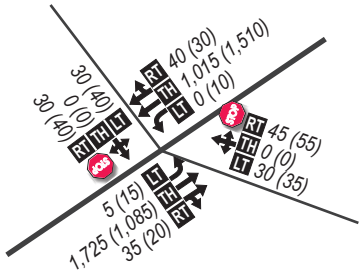
DKS

No Scale

figure **4.3-7a**

2035 No Build Alternative
AM/PM Peak Hour
Segment B: Outer Portland

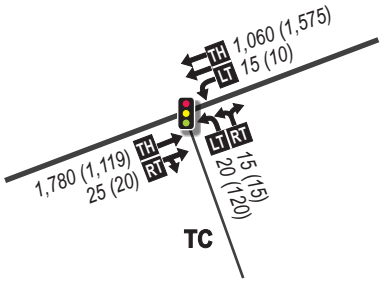
B25. *SW Barbur Blvd. @ SW Taylors Ferry Rd./SW Baird St.*



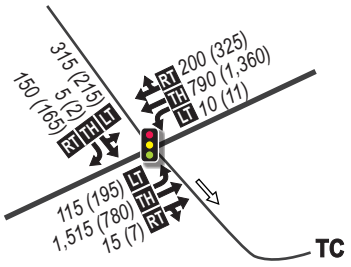
B26. *SW Barbur Blvd. @ LRT Crossover #3*

Future
LRT Crossover
(No volumes for this scenario)

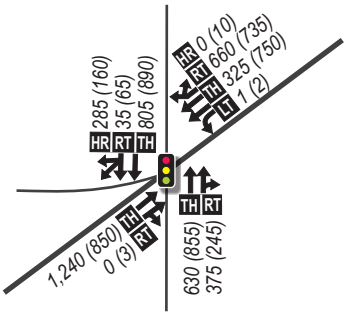
B27. *SW Barbur Blvd. @ Barbur TC (Signal)*



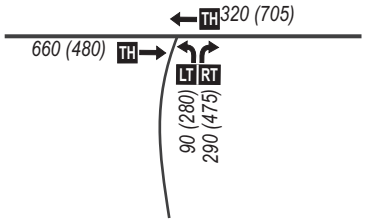
B29. *SW Barbur Blvd. @ Taylors Ferry Rd./ Barbur TC (Bus In)*



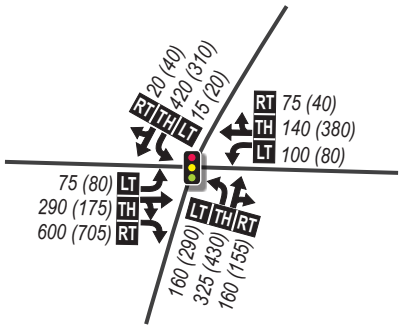
B30. *SW Barbur Blvd. @ SW Capitol Hwy.*



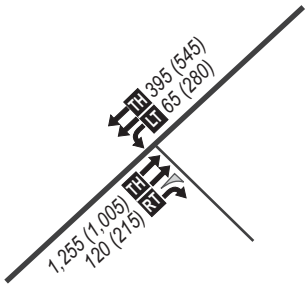
B31. *Taylors Ferry Rd. @ I-5 SB Off-Ramp*



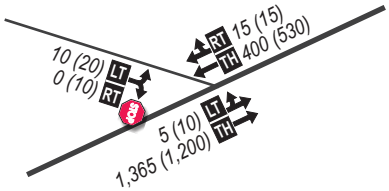
B32. *SW Taylors Ferry Rd. @ SW Capitol Hwy.*



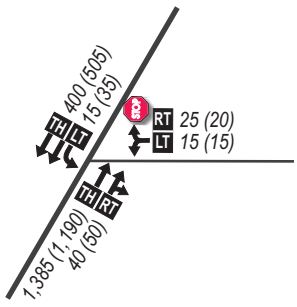
B33. *SW Barbur Blvd. @ SW Huber St. (East)*



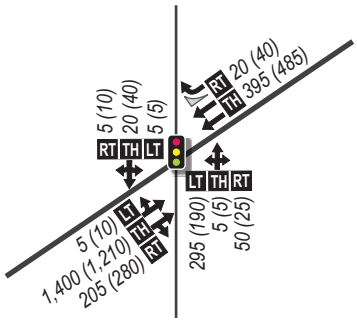
B34. *SW Barbur Blvd. @ SW Huber St. (West)*



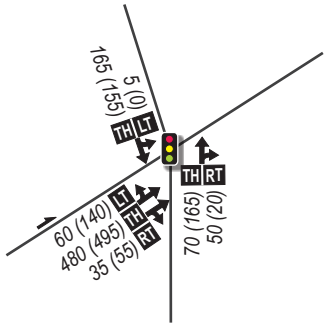
B35. *SW Barbur Blvd. @ SW Luradel St.*



B36. *SW Barbur Blvd. @ SW 53rd Ave.*



B37. *I-5 NB Off-Ramp @ SW 60th Ave.*



LEGEND

00. - Study Intersection No.
STOP - Stop Sign
- Yield Sign
- Traffic Signal
- Lane Configuration
- Bus Only Lane
AM (PM) - Peak Hour Traffic Volumes
LT TH RT - Volume Turn Movement
Left•Thru•Right

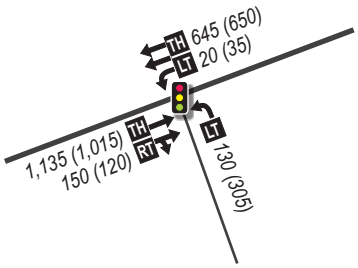
DKS

No Scale

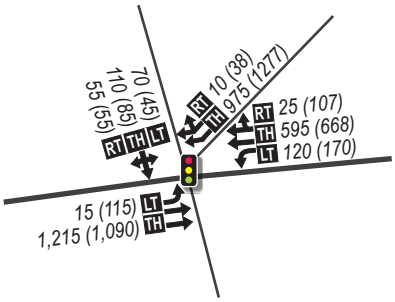
figure **4.3-7b**

2035 No Build Alternative
AM/PM Peak Hour
Segment B: Outer Portland

B38. *SW Barbur Blvd. @ SW 60th Ave.*



B39. *SW Barbur Blvd. @ SW 64th Ave.*



LEGEND

00. - Study Intersection No.
STOP - Stop Sign
- Yield Sign
- Traffic Signal
← - Lane Configuration
AM (PM) - Peak Hour Traffic Volumes
HL Hard Left LT TH RT Left•Thru•Right HR Hard Right - Volume Turn Movement

DKS

No Scale

figure **4.3-7c**

2035 No Build Alternative
AM/PM Peak Hour
Segment B: Outer Portland

2045 No-Build Alternative Ramp Terminal Analysis

The following analysis evaluates the ramp terminal intersections for the SW Terwilliger Boulevard interchange and the Crossroads area in Segment B under the 2045 No-Build Alternative peak-hour conditions. Table 4.3-7 shows the Synchro analysis results for the 2045 No-Build Alternative. As shown, the V/C ratio under the No-Build Alternative fails to meet mobility targets for all intersections.

Table 4.3-7. Segment B 2045 No-Build Alternative HCM (Synchro) Analysis

ID	Intersection	Mobility Target		2045 No-Build				
					PM			
				Control	Delay	LOS	V/C	WLANE
B4	SW Barbur Blvd./SW Bertha Blvd./I-5 ramps	ODOT Ramp	0.85	Signal	**35.7**	**C**	**0.87**	-
B9	SW Terwilliger Blvd./I-5 northbound off-ramp	ODOT Ramp	0.85	Signal	**53.4**	**D**	**0.98**	-
B31	SW Taylors Ferry Rd./I-5 southbound off-ramp	ODOT Ramp	0.85	TWSC	**103.8 [>300]**	**F [F]**	**>2.0**	**NBLn1**

2045 No-Build Alternative Simulation Queuing and Operations Analysis – SW Terwilliger Boulevard Interchange

A future 2045 No-Build Alternative Vissim simulation model was developed from the calibrated existing conditions model. The 2045 PM analysis of the SW Terwilliger Boulevard interchange area requested by ODOT and the Federal Highway Administration evaluates traffic and transit performance based on a longer horizon period than that required by the Federal Transit Administration for the Draft EIS analysis. No changes were made to the modeling assumptions, but volumes and vehicle routing patterns were updated based on the Metro regional travel demand model. There are no Regional Transportation Model projects included in this model area for 2045.

As with the existing model, performance metrics such as delay, travel times and 95th percentile queues were pulled from the model. These metrics are included in Appendix M. The No-Build Alternative model exhibits significant congestion. Most of the congestion stems from capacity constraints at the SW Terwilliger Boulevard/SW Barbur Boulevard intersection. The congestion leads to significant queues on eastbound and westbound SW Barbur Boulevard approaches and the northbound SW Terwilliger Boulevard approach. These queues perpetuate past the extents of the model and prevent the model from serving the full demand volumes. The No-Build Alternative model serves only about 85 percent of the demand volume.

Light Rail Alternatives in 2035

As shown in Table 4.3-8 and Table 4.3-9, under the light rail alignment alternatives in Segment B, there are a total of nine intersections that would not meet the mobility target in at least one peak hour. Two intersections would not meet the mobility target in either peak hour. The greatest overall intersection delay would occur at the intersection of SW Barbur Boulevard and SW 53rd Avenue.

Table 4.3-8. Segment B 2035 Light Rail Alternatives HCM (Synchro) AM Analysis

ID	Intersection	Note	Mobility Target		Alignment Alternatives[3]				2045 Light Rail			
										AM		
					B1	B2	B3	B4	Control	Delay	LOS	V/C
B1	SW Barbur Blvd. (OR 99W) & SW 2nd Ave.		ODOT/PBOT 1st HR	0.99	X	X	X	X	Signal	9.4	A	0.78
B2	SW Barbur Blvd. (OR 99W) & SW 3rd Ave.		ODOT/PBOT 1st HR	0.99	X	X	X	X	Signal	7.1	A	0.71
B3	SW Barbur Blvd. (OR 99W) & SW Terwilliger Blvd.		ODOT/PBOT 1st HR	0.99	X	X	X	X	**Signal**	**91.5**	**F**	**1.05**
B4	SW Barbur Blvd. (OR 99W) & SW Bertha Blvd./I-5 ramps		ODOT Ramp	0.85	X	X	X	X	**Signal**	**48.7**	**D**	**0.94**
B9	SW Terwilliger Blvd. & I-5 northbound off-ramp		ODOT Ramp	0.85	X	X	X	X	Signal	14.8	B	0.66
B10	SW Barbur Blvd. (OR 99W) & SW 13th Ave.		ODOT/PBOT 1st HR	0.99	X	X	X	-	Signal	11.9	B	0.58
	SW Barbur Blvd. (OR 99W) & SW 13th Ave Crossover.		ODOT/PBOT 1st HR	0.99	-	-	-	X	Signal	34.6	C	0.70
B13	SW Barbur Blvd. (OR 99W) & SW Capitol Hill Rd./SW 19th Ave.	1	ODOT/PBOT 1st HR	0.99	X	X	X		Signal	70.4	E	0.94
B15	SW Barbur Blvd. (OR 99W) & SW 22nd Ave.	1	ODOT/PBOT 1st HR	0.99	X	X	X		Signal	10.3	B	0.70
B16	SW Barbur Blvd. (OR 99W) & SW 24th Ave./I-5 southbound off-ramp	1	ODOT Ramp	0.85	X	X	X		**Signal**	**15.4**	**B**	**0.91**
B20	SW Barbur Blvd. & SW Barbur Court (North) LRT crossover		ODOT/PBOT 1st HR	0.99			X		Signal	6.2	A	0.68
B22	SW Barbur Blvd. (OR 99W) & SW 30th Ave.		ODOT/PBOT 1st HR	0.99	X	X			Signal	20.5	C	0.72
B24	SW Barbur Blvd. (OR 99W) & SW Alice St.	2	ODOT/PBOT 1st HR	0.99	X	X			Signal	6.4	A	0.62
B25	SW Barbur Blvd. (OR 99W) & SW Taylors Ferry Rd. (SW Baird St.)/SW Taylors Ferry Rd.	2	ODOT/PBOT 1st HR	0.99	X	X			Signal	9.4	A	0.58
B26	SW Barbur Blvd. (OR 99W) & LRT crossover/SW Plum St.	2	ODOT/PBOT 1st HR	0.99		X			Signal	3.6	A	0.55
B27	SW Barbur Blvd. (OR 99W) & Transit Center (signalized)	2	ODOT/PBOT 1st HR	0.99	X	X			Signal	15.9	B	0.67
B29	SW Barbur Blvd. (OR 99W) & SW Taylors Ferry Rd./Barbur Transit Center (Bus in)	2	ODOT/PBOT 1st HR	0.99	X	X			Signal	36.3	C	0.95
B30	SW Barbur Blvd. (OR 99W) & SW Capitol Hwy.	2	ODOT/PBOT 1st HR	0.99	X				Signal	22.1	C	0.86
B31	I-5 southbound off-ramp & SW Taylors Ferry Rd.	2	ODOT Ramp	0.85	X	X	X	X	TWSC	2.4 [29.5]	A [D]	0.40
B32	SW Capitol Hwy. & SW Taylors Ferry Rd.	2	PBOT 1st Hour	0.99	X	X	X	X	Signal	34.7	C	0.74
B33	SW Barbur Blvd. (OR 99W) & SW Huber St. (east leg)	2	ODOT/PBOT 1st HR	0.99	X				Signal	2.4	A	0.47
B34	SW Barbur Blvd. (OR 99W) & SW Huber St. (west leg)	2	ODOT/PBOT 1st HR	0.99	X				Signal	1.9	A	0.44
B35	SW Barbur Blvd. (OR 99W) & SW Luradel St.	2	ODOT/PBOT 1st HR	0.99	X				Signal	9.6	A	0.48
B36	SW Barbur Blvd. (OR 99W) & SW 53rd Ave.	2	ODOT/PBOT 1st HR	0.99	X	X	X	X	**Signal**	**>300**	**F**	**1.24**
B37	SW 60th Ave. & I-5 off-ramp/SW Barbur Blvd.	1	ODOT Ramp	0.85	X				Signal	54.0	D	0.50
B38	SW Barbur Blvd. (OR 99W) & SW 60th Ave.	1	ODOT/PBOT 1st HR	0.99	X				Signal	40.4	D	0.56
B39	SW Barbur Blvd. (OR 99W) & SW 64th Ave. & I-5 southbound off-ramp	1	ODOT Ramp	0.85	X	X	X	X	Signal	38.5	D	0.75

Key: [Worst stop-controlled delay] for TWSC intersections.

Scenario represents worst case conditions. Unlisted scenarios perform better.

V/C represents intersection average for signals and worst movement for stop-controlled intersections.

HR = hour; Ln = lane; PBOT = Portland Bureau of Transportation.

Table Notes:

1. Intersection analysis completed as part of 2016 Southwest Corridor study with review by ODOT, PBOT and Metro.
2. Intersection part of Town Center designation with 2nd hour mobility target. To maintain consistency with 2016 Southwest Corridor analysis, proximity to ramps, and peak hour park and ride trip generation rates, 1st hour analysis is being performed. Intersections meeting 1st hour target also meet 2nd hour target.
3. Intersections without an 'X' for a given alternative operate similar to No Build for that alternative.

Table 4.3-9. Segment B 2035 Light Rail Alternatives HCM (Synchro) PM Analysis

ID	Intersection	Note	Mobility Target		Alignment Alternatives				2045 Light Rail			
										PM		
					B1	B2	B3	B4	Control	Delay	LOS	V/C
B1	SW Barbur Blvd. (OR 99W) & SW 2nd Ave.		ODOT/PBOT 1st HR	0.99	X	X	X	X	Signal	10.5	B	0.70
B2	SW Barbur Blvd. (OR 99W) & SW 3rd Ave.		ODOT/PBOT 1st HR	0.99	X	X	X	X	Signal	14.2	B	0.59
B3	SW Barbur Blvd. (OR 99W) & SW Terwilliger Blvd.		ODOT/PBOT 1st HR	0.99	X	X	X	X	**Signal**	**107.3**	**F**	**1.10**
B4	SW Barbur Blvd. (OR 99W) & SW Bertha Blvd./I-5 ramps		ODOT Ramp	0.85	X	X	X	X	Signal	21.7	C	0.80
B9	SW Terwilliger Blvd. & I-5 northbound off-ramp		ODOT Ramp	0.85	X	X	X	X	**Signal**	**35.9**	**D**	**0.89**
B10	SW Barbur Blvd. (OR 99W) & SW 13th Ave.		ODOT/PBOT 1st HR	0.99	X	X	X	-	Signal	16.2	B	0.73
	SW Barbur Blvd. (OR 99W) & SW 13th Ave. Crossover		ODOT/PBOT 1st HR	0.99	-	-	-	X	Signal	39.2	D	0.69
B13	SW Barbur Blvd. (OR 99W) & SW Capitol Hill Rd./SW 19th Ave.	1	ODOT/PBOT 1st HR	0.99	X	X	X		Signal	67.1	E	0.91
B15	SW Barbur Blvd. (OR 99W) & SW 22nd Ave.	1	ODOT/PBOT 1st HR	0.99	X	X	X		Signal	11.2	B	0.80
B16	SW Barbur Blvd. (OR 99W) & SW 24th Ave./I-5 southbound off-ramp	1	ODOT Ramp	0.85	X	X	X		Signal	16.7	B	0.76
B20	SW Barbur Blvd. & SW Barbur Ct. (north) LRT crossover		ODOT/PBOT 1st HR	0.99			X		Signal	3.3	A	0.55
B22	SW Barbur Blvd. (OR 99W) & SW 30th Ave.		ODOT/PBOT 1st HR	0.99	X	X			Signal	28.7	C	0.68
B24	SW Barbur Blvd. (OR 99W) & SW Alice St.	2	ODOT/PBOT 1st HR	0.99	X	X			Signal	9.1	A	0.57
B25	SW Barbur Blvd. (OR 99W) & SW Taylors Ferry Rd. (SW Baird St.)/SW Taylors Ferry Rd.	2	ODOT/PBOT 1st HR	0.99	X	X			Signal	10.0	A	0.56
B26	SW Barbur Blvd. (OR 99W) & LRT crossover/SW Plum St.	2	ODOT/PBOT 1st HR	0.99		X			Signal	0.6	A	0.46
B27	SW Barbur Blvd. (OR 99W) & Transit Center (Signalized)	2	ODOT/PBOT 1st HR	0.99	X	X			Signal	8.9	A	0.49
B29	SW Barbur Blvd. (OR 99W) & SW Taylors Ferry Rd./Barbur Transit Center (Bus in)	2	ODOT/PBOT 1st HR	0.99	X	X			**Signal**	**97.6**	**F**	**1.14**
B30	SW Barbur Blvd. (OR 99W) & SW Capitol Hwy.	2	ODOT/PBOT 1st HR	0.99	X				Signal	24.4	C	0.94
B31	I-5 southbound off-ramp & SW Taylors Ferry Rd.	2	ODOT Ramp	0.85	X	X	X	X	**TWSC**	**56 [>300]**	**F [F]**	**1.57**
B32	SW Capitol Hwy. & SW Taylors Ferry Rd.	2	PBOT 1st Hour	0.99	X	X	X	X	Signal	36.2	D	0.82
B33	SW Barbur Blvd. (OR 99W) & SW Huber St. (east Leg)	2	ODOT/PBOT 1st HR	0.99	X				Signal	9.1	A	0.54
B34	SW Barbur Blvd. (OR 99W) & SW Huber St. (west leg)	2	ODOT/PBOT 1st HR	0.99	X				Signal	2.1	A	0.38
B35	SW Barbur Blvd. (OR 99W) & SW Luradel St.	2	ODOT/PBOT 1st HR	0.99	X				Signal	12.1	B	0.45
B36	SW Barbur Blvd. (OR 99W) & SW 53rd Ave.	2	ODOT/PBOT 1st HR	0.99	X	X	X	X	**Signal**	**>300**	**F**	**1.06**

ID	Intersection	Note	Mobility Target		Alignment Alternatives				2045 Light Rail			
										PM		
					B1	B2	B3	B4	Control	Delay	LOS	V/C
B37	SW 60th Ave. & I-5 off-ramp/SW Barbur Blvd.	1	ODOT Ramp	0.85	X				Signal	55.5	E	0.48
B38	SW Barbur Blvd. (OR 99W) & SW 60th Ave.	1	ODOT/PBOT 1st HR	0.99	X				Signal	25.3	C	0.66
B39	SW Barbur Blvd. (OR 99W) & SW 64th Ave. & I-5 southbound off-ramp	1	ODOT Ramp	0.85	X	X	X	X	**Signal**	**47.3**	**D**	**0.91**

Key: [Worst stop-controlled delay] for TWSC intersections.

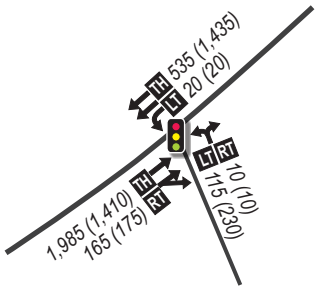
V/C represents intersection average for signals and worst movement for stop control intersections.

HR = hour; Ln = lane; PBOT = Portland Bureau of Transportation.

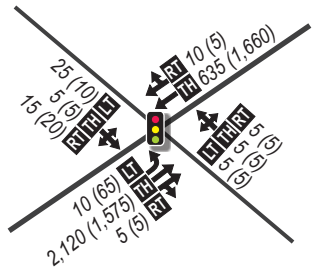
Notes:

1. Intersection analysis completed as part of 2016 SWC study with review by ODOT, PBOT and Metro.
2. Intersection part of Town Center designation with 2nd hour mobility target. To maintain consistency with 2016 SWC analysis, proximity to ramps, and peak hour park-and-ride trip generation rates, 1st hour analysis is being performed. Intersections meeting 1st hour target also meet 2nd hour.

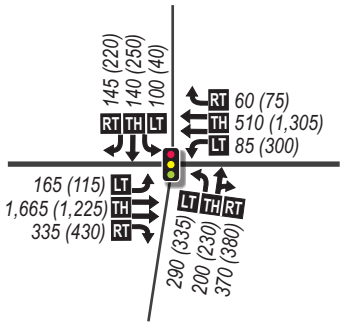
B1. *SW Barbur Blvd. @ SW 2nd Ave.*



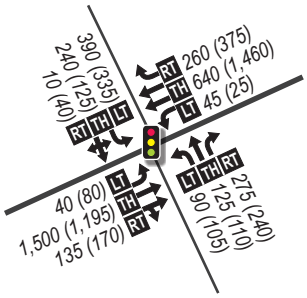
B2. *SW Barbur Blvd. @ SW 3rd Ave.*



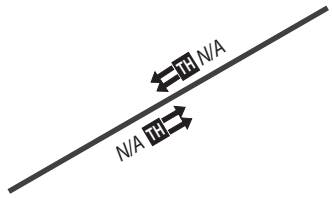
B3. *SW Barbur Blvd. @ SW Terwilliger Blvd.*



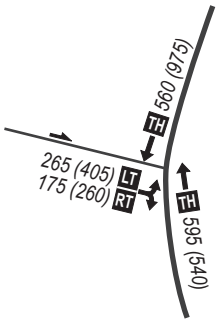
B4. *SW Barbur Blvd. @ SW Bertha Blvd.*



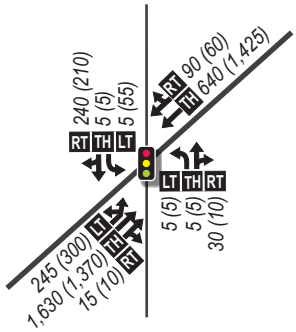
B8. *SW Barbur Blvd. @ SW Custer Dr./ SW Multnomah Blvd.*



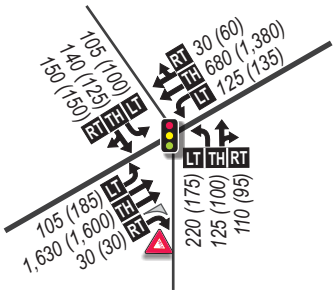
B9. *SW Terwillger Blvd. @ I-5 NB Off-Ramp*



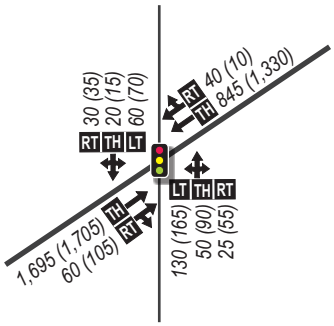
B10. *SW Barbur Blvd. @ SW 13th Dr.*



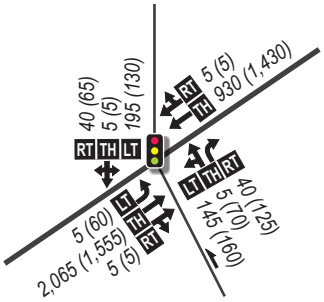
B13. *SW Barbur Blvd. @ SW 19th Dr./ SW Capitol Hill Rd.*



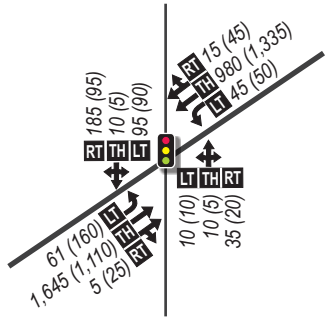
B15. *SW Barbur Blvd. @ SW 22nd Ave.*



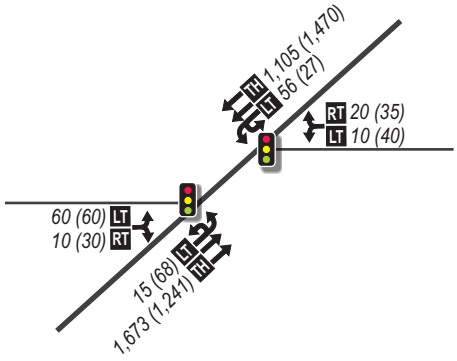
B16. *SW Barbur Blvd. @ I-5 SB Off-Ramp/ SW 24th Ave.*



B22. *SW Barbur Blvd. @ SW 30th Ave.*



B24. *SW Barbur Blvd. @ SW Alice St.*



LEGEND

00. - Study Intersection No.
- Stop Sign
- Yield Sign
- Traffic Signal
- Lane Configuration
AM (PM) - Peak Hour Traffic Volumes
LT TH RT - Volume Turn Movement (Left•Thru•Right)

DKS

No Scale

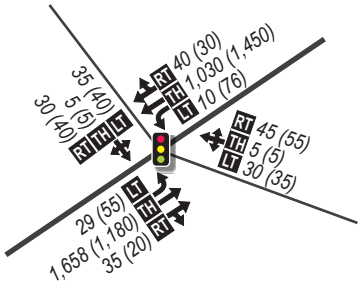
figure **4.3-8a**

2035 Light Rail Alternative AM/PM Peak Hour

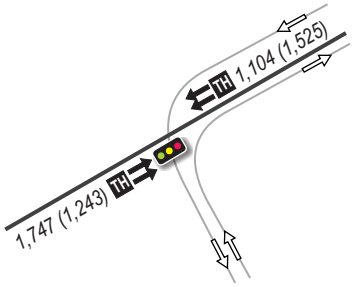
B2: I-5 Barbur Transit Center (TC) to 60th *(B1-B24)*

Segment B: Outer Portland

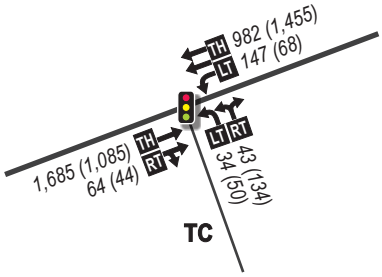
B25. *SW Barbur Blvd. @ SW Taylors Ferry Rd./SW Baird St.*



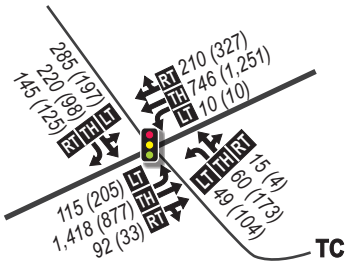
B26. *SW Barbur Blvd. @ LRT Crossover #3*



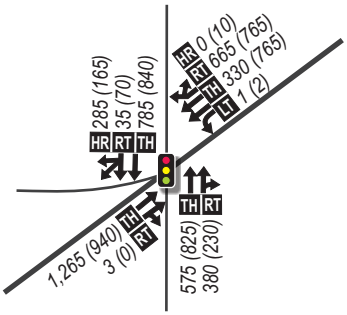
B27. *SW Barbur Blvd. @ Barbur TC (Signal)*



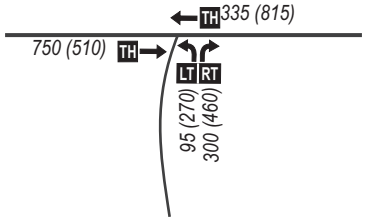
B29. *SW Barbur Blvd. @ Taylors Ferry Rd./ Barbur TC (Bus In)*



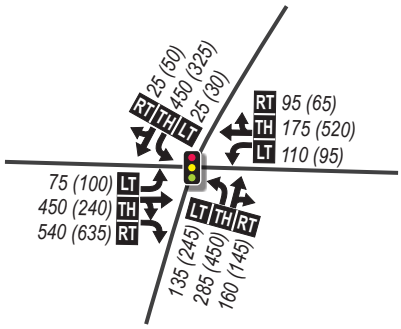
B30. *SW Barbur Blvd. @ SW Capitol Hwy.*



B31. *Taylors Ferry Rd. @ I-5 SB Off-Ramp*



B32. *SW Taylors Ferry Rd. @ SW Capitol Hwy.*



LEGEND

00. - Study Intersection No.
- Stop Sign
- Yield Sign
- Traffic Signal
- Lane Configuration
- Bus Only Lane
AM (PM) - Peak Hour Traffic Volumes
LT TH RT - Volume Turn Movement
Left•Thru•Right

DKS

No Scale

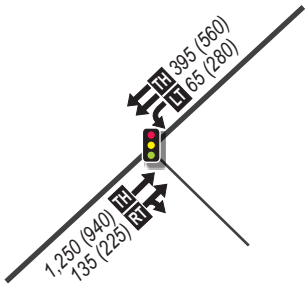
figure **4.3-8b**

2035 Light Rail Alternative AM/PM Peak Hour

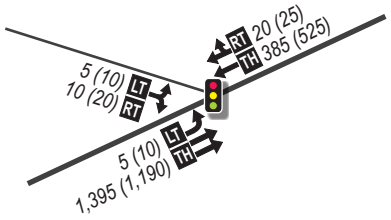
B2: I-5 Barbur Transit Center (TC) to 60th *(B25-B32)*

Segment B: Outer Portland

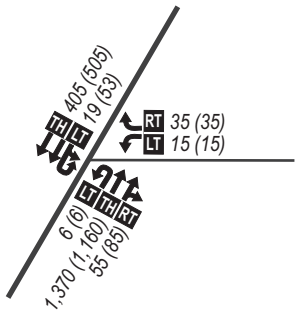
B33. *SW Barbur Blvd. @ SW Huber St. (East)*



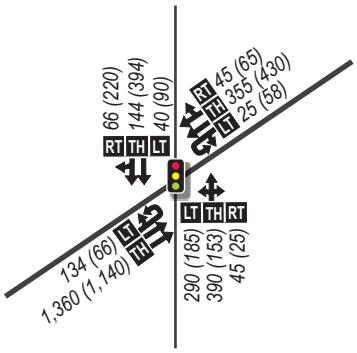
B34. *SW Barbur Blvd. @ SW Huber St. (West)*



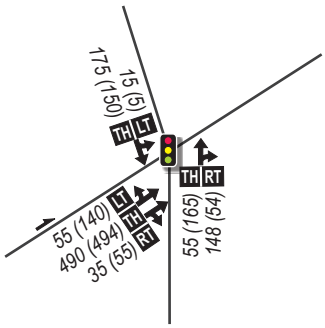
B35. *SW Barbur Blvd. @ SW Luradel St.*



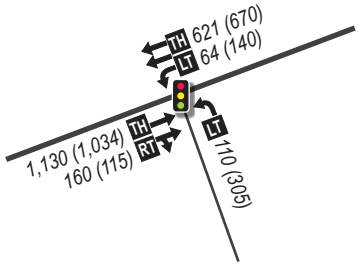
B36. *SW Barbur Blvd. @ SW 53rd Ave.*



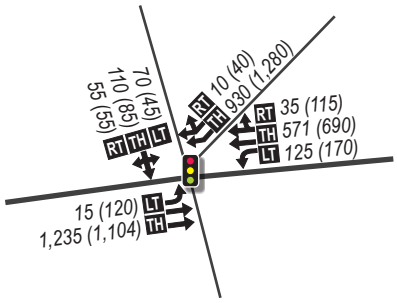
B37. *I-5 NB Off-Ramp @ SW 60th Ave.*



B38. *SW Barbur Blvd. @ SW 60th Ave.*

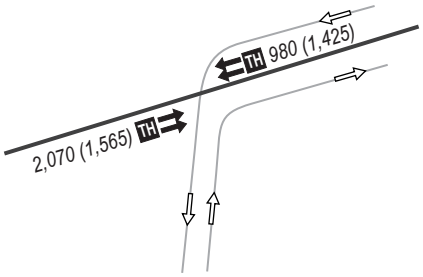


B39. *SW Barbur Blvd. @ SW 64th Ave.*



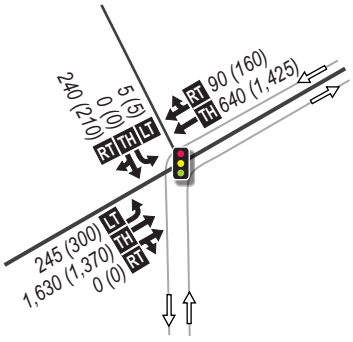
B3: I-5 26th to 60th

B3 426 *Crossover #2*



B4: I-5 Custer to 60th

B4 413 *Crossover #1*



LEGEND

00. - Study Intersection No.
- Stop Sign
- Yield Sign
- Traffic Signal

- Lane Configuration
- Bus Only Lane
AM (PM) - Peak Hour Traffic Volumes
LT TH RT - Volume Turn Movement
Left•Thru•Right

DKS

figure **4.3-8c**

2035 Light Rail Alternative AM/PM Peak Hour
B1: Barbur *(B33-B39)*
B4: I-5 Custer to 60th *(B4 413)*
B3: I-5 26th to 60th *(B3 426)*
Segment B: Outer Portland

No Scale

2045 Light Rail Alternatives Ramp Terminal Analysis

The following analysis evaluates the ramp terminal intersections for the SW Terwilliger Boulevard interchange and the Crossroads area under 2045 PM peak-hour conditions for the light rail alternatives. Table 4.3-10 shows Synchro analysis results for the light rail alternatives in 2045. The V/C ratio in the light rail alternatives for the intersections either meets the mobility target or is within 0.03 of the V/C ratio in 2045 for the No-Build Alternative. There is a significant drop in the intersection V/C ratio at SW Taylors Ferry Road/I-5 southbound because of 50 fewer vehicles per hour turning northbound left from the off-ramp. This reduction is a result of the regional model shifting southbound I-5 traffic from exiting at SW Taylors Ferry Road to exiting at the next exit, OR 99W.

Table 4.3-10. Segment B 2045 Light Rail Alternatives HCM (Synchro) PM Analysis

				2045 Light Rail				
					PM			
ID	Intersection	Mobility Target		Control	Delay	LOS	V/C	WLANE
B4	SW Barbur Blvd./SW Bertha Blvd./I-5 ramps	ODOT Ramp	0.85	Signal	**38.3**	**C**	**0.89**	**-**
B9	SW Terwilliger Blvd./I-5 northbound off-ramp	ODOT Ramp	0.85	Signal	**51.9**	**D**	**0.98**	**-**
B31	SW Taylors Ferry Rd./I-5 southbound off-ramp	ODOT Ramp	0.85	TWSC	**77.8 [>300]**	**F [F]**	**1.94**	**NBLn1**

2045 Light Rail Alternatives Vissim Simulation Queuing and Operations Analysis – SW Terwilliger Boulevard Interchange

Both the No-Build Alternative and the Light Rail Alternatives Vissim models exhibit significant congestion at the SW Terwilliger Boulevard interchange. Most of the congestion stems from capacity constraints at the SW Terwilliger Boulevard/SW Barbur Boulevard intersection. The congestion leads to significant queues on eastbound and westbound SW Barbur Boulevard approaches and the northbound SW Terwilliger Boulevard approach. These queues perpetuate past the extents of the model and prevent the model from serving the full demand volumes. The light rail alternatives model serves approximately 77 percent of the demand volume.

The primary difference between the light rail alternatives model and the No-Build Alternative model is the removal of the auxiliary lane between the southbound I-5 ramp turning right at SW Bertha Boulevard and continuing to a yield-controlled right-turn movement to southbound SW Terwilliger Boulevard. Under the light rail alternatives model, this traffic must turn right at a signalized movement, joining the northbound SW Barbur Boulevard traffic before turning right at the Terwilliger/Barbur traffic signal. This reduction in vehicle capacity results in the I-5 southbound off-ramp 95th percentile queue extending to 900 feet, which would no longer allow for adequate safe stopping distance on the ramp.

The I-5 northbound off-ramp 95th percentile queue at SW Terwilliger Boulevard would decrease by 75 feet under the light rail alternatives condition due to reduced volumes. Regardless of this slight reduction in queue, the queue length in both the light rail alternatives model and the No-Build Alternative model is approximately 2,600 feet, which extends back to the gore.

2045 Queuing Analysis for Crossroads Area in PM Peak – No-Build Alternative and Light Rail Alternatives

Under the 2045 No-Build Alternative and light rail alternatives, SimTraffic analysis shows a high level of queuing and delay at the I-5 southbound off-ramp to SW Taylors Ferry Road as well as at the adjacent intersections of SW Taylors Ferry Road and SW Capitol Highway, SW Taylors Ferry Road and SW Barbur Boulevard, and SW Capitol Highway and SW Barbur Boulevard. This queuing can be largely attributed to three factors: growth in regional volumes, extension of SW Taylors Ferry Road to connect with SW Oleson Road (a project included in the financially constrained planned network between 2035 and 2045) and the lack of planned projects in the Regional Transportation Plan for this interchange. Observation of the simulation runs shows that these intersections will have demand that exceeds capacity, resulting in queues backing up throughout the adjacent network. Table 4.3-11 summarizes the queue under the 2045 No-Build Alternative and light rail alternatives that would develop from the signal at SW Barbur Boulevard and SW Capitol Highway, through the stop controlled intersection at SW Taylors Ferry Road and SW Capitol Highway and onto the I-5 southbound off-ramp.

Under the No-Build Alternative, the queue on the I-5 southbound off-ramp would extend onto the mainline. The upstream block time shown in Table 4.3-11 indicates the percentage of the time additional vehicles were prevented from entering the simulation network because of the queue reaching the edge of the simulation network, meaning that the queue shown theoretically would be longer than reported. The storage block time and associated queuing penalty show the amount of time the right-turn lane would be blocked by queue spillback from the left-turn lane and the effect of the blockage as a number of additional vehicles in the queue. Queues in the light rail alternatives are less severe because of changes in turning movement patterns and demand at the four-way stop controlled intersection at SW Taylors Ferry Road and SW Capitol Highway. The key differences are increased through volume on SW Taylors Ferry Road coming to and from the Barbur Transit Center park and ride facility, and approximately 50 northbound left-turn vehicles per hour shifting from the SW Taylors Ferry Road southbound exit to the OR 99W exit from the No-Build Alternative to the light rail alternatives in the regional model.

After completion of this simulation analysis, ODOT provided information of a future funded safety project that could signalize the intersection of SW Taylors Ferry Road and SW Capitol Highway, and redistribute some traffic in the Crossroads area. The HCM analysis in this report reflects this future safety project; however, the SimTraffic queue analysis was not updated, because the two-way stop controlled intersection at the I-5 southbound ramp and SW Taylors Ferry Road is a controlling factor that fails both with and without the Southwest Corridor Light Rail Project.

Table 4.3-11. Queuing Results for No-Build Alternative and Light Rail Alternatives at I-5 Southbound Off-ramp and SW Taylors Ferry Road

	No-Build	Light Rail
I-5 southbound off-ramp & SW Taylors Ferry Rd.	**Northbound Right**	**Northbound Right**
Ramp Length (feet*)	1,050	1,050
Ramp Length (Simulation) (feet)	2,200	2,200
95th Percentile Queue (feet)	3,000	2,075
Upstream Block Time (%)	40%	7%
Storage Block Time (%)	10%	22%
Queuing Penalty (vehicles)	33	62
SW Capitol Hwy. & SW Taylors Ferry Rd.	**Eastbound Right**	**Eastbound Right**

Link Distance (feet)	225	225
Link Distance (Simulation) (feet)	225	225
95th Percentile Queue (feet)	400	350
Upstream Block Time (%)	22%	32%
Queuing Penalty (vehicles)	128	180
SW Barbur Blvd. & SW Capitol Hwy.	**Southbound Through Right**	**Southbound Through Right**
Link Distance (feet)	225	225
Link Distance (Simulation) (feet)	200	200
95th Percentile Queue (feet)	300	300
Upstream Block Time (%)	24%	27%
Queuing Penalty (vehicles)	158	173

*Distances throughout rounded to nearest 25 feet.

4.3.5. Segment B Preliminary Progression Analysis

A preliminary progression analysis was performed to evaluate the impact of the light rail alternatives on the progression of traffic along SW Barbur Boulevard. Reviewing the preliminary progression of traffic on SW Barbur Boulevard for the 2035 No-Build Alternative and light rail alternatives shown in Table 4.3-12 reveals no significant differences. There is some queue spillback in the AM models. Under the No-Build Alternative, this queue spillback occurs between the SW Terwilliger Boulevard and SW Bertha Boulevard intersections. Under the light rail alternatives, this occurs between the SW Baird Street and Transit Center intersections. In general, most of the bands between intersections under the light rail alternatives are greater than the bands between intersections under the No-Build Alternative, but these are achieved at the cost of operations to side street traffic. Under both the No-Build Alternative and light rail alternatives, there are intersections that do not meet the minimum band based on the traffic flow calculations. Appendix C contains the Time-Space Diagrams used for this analysis.

Table 4.3-12. Segment B Preliminary Progression Analysis

		2035 No-Build						2035 Light Rail					
		Northbound			Southbound			Northbound			Southbound		
Period	Intersection	Band (S)	Queue Spillback	Starvation	Band (S)	Queue Spillback	Starvation	Band (S)	Queue Spillback	Starvation	Band (S)	Queue Spillback	Starvation
AM	**Minimum Progression Band**	65			54			65			43		
	SW Barbur Blvd./SW 3rd Ave.	46			N/A			56			87		
	SW Barbur Blvd./SW Terwilliger Blvd.	56			37			53			25		
	SW Barbur Blvd./SW Bertha Blvd./I-5 ramps	44	X		17			56			31		
	SW Barbur Blvd./SW 13th Ave./ped. crossing/LRT Crossover #1							56			42		
	SW Barbur Blvd./SW 19th Ave./SW Capitol Hill Rd.	44			44			56			45		
	SW Barbur Blvd./SW 22nd Ave.							86			45		
	SW Barbur Blvd./I-5 southbound off-ramp/ SW 24th Ave.	59			12			65			62		
	SW Barbur Blvd./SW 30th Ave.	64			57			65			22		
	SW Barbur Blvd./SW Alice St./ped. crossing							77			51		
	SW Barbur Blvd./SW Taylors Ferry Rd./SW Baird St.							90			61		
	SW Barbur Blvd. / Barbur Transit Center (signal)	35			87			55	X		71		
	SW Barbur Blvd./SW Taylors Ferry Rd./ Barbur Transit Center (bus In)	31		X	56			40			N/A		
	SW Barbur Blvd./SW Capitol Hwy. (Crossroads)	N/A			17			N/A			N/A		
PM	**Minimum Progression Band**	34			85			48			58		

	SW Barbur Blvd./SW 3rd Ave.	46			N/A			32			81			
	SW Barbur Blvd./SW Terwilliger Blvd.	56			31			40			47			
	SW Barbur Blvd./SW Bertha Blvd./I-5 ramps	44			22			55			48			
	SW Barbur Blvd./SW 13th Ave./ped. crossing/LRT Crossover #1							59			49			
	SW Barbur Blvd./SW 19th Dr./SW Capitol Hill Rd.	44			44			59			52			
	SW Barbur Blvd./SW 22nd Ave.							77			52			
	SW Barbur Blvd./I-5 southbound off-ramp/ SW 24th Ave.	59			12			64			74			
	SW Barbur Blvd./SW 30th Ave.	64			57			40			38			
	SW Barbur Blvd./SW Alice St./ped. crossing							76			56			
	SW Barbur Blvd./SW Taylors Ferry Rd./SW Baird St.							76			45			
	SW Barbur Blvd./Barbur Transit Center (signal)	35			87			48			71			
	SW Barbur Blvd./SW Taylors Ferry Rd./ Barbur Transit Center (bus In)	35			56		X	N/A			60			
	SW Barbur Blvd./SW Capitol Hwy. (Crossroads)	N/A			17			N/A			N/A			

*Minimum band based on a representative intersection in the corridor.

**Queue spillback and starvation observations based on Synchro results for 90th percentile traffic.

***Intersections at end of corridor do not have applicable band.

4.3.6. Segment B Preliminary Signal Warrant Analysis

Signal warrant analysis was completed for study area intersections in Segment B where new signals or significant changes to the signal were proposed. The analysis was completed for both the existing year 2015 and future year 2035. Intersections that would meet peak-hour, 4-hour volume or 8-hour volume warrants for future year 2035 are:

- B15: SW Barbur Boulevard/SW 22nd Avenue
- B20: SW Barbur Boulevard/SW Barbur Court
- B25: SW Barbur Boulevard/SW Taylors Ferry Road /SW Baird Street

4.3.7. Segment B Access Spacing

Segment B is entirely within Portland city limits. However, many study intersections are on SW Barbur Boulevard (OR 99 West), which is part of the OHS and is classified as a District Highway by ODOT.

Table 4.3-13 shows the ODOT spacing standards for intersections in Segment B that have a newly proposed signal under the denoted alignment alternatives.

Table 4.3-13. Segment B – Access Spacing, ODOT Standards

Int.	Name	Alignment Alternative(s)	Dist. To Nearest Ramp or Int. (feet)	Along Road	Class/Area	Speed Limit (mph)	Spacing Standard (feet)	Standard Met?
B1	SW Barbur Blvd./SW 2nd Ave.	All	280	SW Barbur Blvd.	District Highway	35	350	No
B2	SW Barbur Blvd./SW 3rd Ave.	All	280	SW Barbur Blvd.	District Highway	35	350	No
B8	SW Barbur Blvd./SW Custer Dr./SW Multnomah Blvd.	B1, B2, B3	100	SW Barbur Blvd.	District Highway	35	350	No
		B4	200	SW Barbur Blvd.	District Highway	35	350	No
B15	SW Barbur Blvd./SW 22nd Ave.	B1, B2, B3	235	SW Barbur Blvd.	District Highway	35	350	No
B20	SW Barbur Blvd./SW Barbur Ct.	B3	85	SW Barbur Blvd.	District Highway	40	500	No

Int.	Name	Alignment Alternative(s)	Dist. To Nearest Ramp or Int. (feet)	Along Road	Class/Area	Speed Limit (mph)	Spacing Standard (feet)	Standard Met?
B24	SW Barbur Blvd./SW Alice St.	B1, B2	75	SW Barbur Blvd.	District Highway	40	500	No
B25	SW Barbur Blvd./SW Taylors Ferry Rd./SW Baird St.	B1	100	SW Barbur Blvd.	District Highway	40	500	No
		B2	50	SW Barbur Blvd.	District Highway	40	500	No
B26	SW Barbur Blvd./LRT Crossover #3	B2	75	SW Barbur Blvd.	District Highway	40	500	No
B27	SW Barbur Blvd./Barbur Transit Center (signal)	B1	210	SW Barbur Blvd.	District Highway	40	500	No
		B2	130	SW Barbur Blvd.	District Highway	40	500	No
B28	SW Barbur Blvd./Barbur Transit Center (bus out)	B1	200	SW Barbur Blvd.	District Highway	40	500	No
		B2, B3, B4	420	SW Barbur Blvd.	District Highway	40	500	No
B33	SW Barbur Blvd./SW Huber St. (east)	B1	105	SW Barbur Blvd.	District Highway	40	500	No
B34	SW Barbur Blvd./SW Huber St. (west)	B1	75	SW Barbur Blvd.	District Highway	40	500	No
B35	SW Barbur Blvd./SW Luradel St.	B1	785	SW Barbur Blvd.	District Highway	40	500	Yes

The relevant spacing standards for OHS district highways is found in OAR 734-051-4020, in Table 6. The text regarding Table 6 states: "The spacing standards in Tables 3 through 6 apply to the distance measured along the highway from the center of an existing or proposed private approach to the center of the nearest existing private connection, proposed approach, or public approach on the same side of the highway in both directions."

Additionally, OAR 734-051-4020 (8) (c) allows spacing exceptions to be made if the approach was originally constructed before January 1, 2012. Some conditions apply, most importantly subsection (C), which prescribes increasing spacing when a highway project occurs, given that doing so would improve spacing or safety.

Exceptions to the ODOT spacing requirements can be submitted through a General Design Exception Request Form. However, if the City of Portland successfully acquires OR 99W (SW Barbur Boulevard, SW Naito Parkway), then a design exception would not be necessary. At the time of writing of this report, negotiations for this jurisdictional transfer are ongoing.

The City of Portland has no spacing standards, but the City Traffic Engineer will review all the spacing on city-owned streets on a case-by-case basis.

4.3.8. Segment B Freight Impacts

In Segment B, the primary impact would be restricting of access to driveways along SW Barbur Boulevard to right-in/right-out. Full access, including the ability for some vehicles to make U-turns, would be provided at traffic signals. Alternatives B1 and B2 would alter but maintain truck access to two gas stations. All the alignment alternatives would alter truck access to the Fred Meyer grocery store at SW Barbur Boulevard and SW Bertha Boulevard.

With Alternative B1, businesses along SW Barbur Boulevard from SW 13th Avenue to SW Taylors Ferry Road would not have left-turn access for delivery trucks. Delivery trucks would need to access these businesses via right turns. Smaller trucks might be able to navigate U-turns at traffic signals, or utilize intersecting streets to access their destinations via a right turn. Larger trucks would need to select a

route to access their destination via right turns, which is a typical strategy of many delivery companies where medians or heavy conflicting traffic volumes are present.

With Alternative B4, the small businesses and residences on SW Multnomah Boulevard (between SW 13th and SW 19th Avenues) would access via SW Barbur Boulevard instead, with a reduction in local street connections. Large trucks are not typical of the land uses along this section of SW Multnomah Boulevard.

A detailed review was made at businesses with designated loading areas and docks using large trucks for deliveries, and is summarized below.

- **Fred Meyer grocery store, 7555 SW Barbur Boulevard (access affected with Alternatives B1, B2, B3 and B4)**

    1. The existing median on SW Barbur Boulevard directs truck access to the Fred Meyer loading dock via SW Custer Street. LRT in the median on SW Barbur Boulevard will not add any access restrictions. Trucks currently access the loading dock from SW Barbur Boulevard and SW Custer Street via right turns. Truck egress to southbound SW Barbur Boulevard requires a right turn on SW Custer Street and a left turn on SW 13th Avenue.
    2. LRT designs for the light rail alternatives propose the possible consolidation and realignment of SW 13th Avenue and SW Custer Street at their intersection with SW Barbur Boulevard. Access to and egress from the Fred Meyer loading dock on SW Custer Street and on-site truck circulation would need to be addressed by the project design.

- **Safeway grocery store, 8145 SW Barbur Boulevard (access affected with Alternatives B1, B2 and B3)**

    1. Trucks currently access the Safeway loading dock from SW Capitol Hill Road, with trucks backing into the loading dock on-site. Entering trucks can access SW Capitol Hill Road from either direction of SW Barbur Boulevard using the traffic signal, although the curvature of SW Capitol Hill Road limits the size of truck that can turn left from SW Barbur Boulevard. Truck egress is to westbound SW Multnomah Boulevard, a narrow one-way street with no direct access to SW Barbur Boulevard.
    2. LRT designs for the light rail alternatives do not alter the circulation pattern at this site. However, egress from the Safeway loading dock could be enhanced by signalizing the intersection at SW Multnomah Boulevard and SW 22nd Avenue to allow trucks and customers from Safeway to turn southbound onto SW 22nd Avenue to more directly reach SW Barbur Boulevard.

- **Fred Meyer Fuel Center, 8420 SW 24th Avenue (access affected with Alternatives B1, B2 and B3)**

    1. Fuel trucks currently can access the site from either direction of SW Barbur Boulevard or from the I-5 off-ramp that intersects opposite SW 24th Avenue. Truck egress is to the signal at SW Barbur Boulevard and SW 24th Avenue.
    2. LRT designs for the light rail alternatives do not alter the circulation pattern at this site. Intersection design at SW 24th Avenue and SW Barbur Boulevard needs to continue to accommodate fuel trucks.

- **Chevron gas station, 9025 SW Barbur Boulevard (access affected with Alternatives B1 and B2)**

    1. This gas station is an older site design, with gas pumps close to the street. The site has little space for tanker trucks, and refueling the pumps blocks other vehicles. Fuel truck access to the site is via southbound SW Barbur Boulevard or via SW 30th Avenue. The driveway on SW 30th Avenue is very close to the intersection at SW Barbur Boulevard, and vehicles queued at the traffic signal frequently block it. The northbound left turn into the site from SW Barbur Boulevard is not currently prohibited, but is not ideal given the volume of southbound traffic and proximity to the signal.
    2. LRT designs would prevent the northbound left turn access to the site on Barbur, but allow northbound left-turn access at the signal via 30th Avenue. Truck access to the site would continue to be available via southbound Barbur or via 30th Avenue.

- **Barbur World Foods grocery store, 9845 SW Barbur Boulevard (access affected with Alternative B1)**

    1. The World Foods store does not have a loading dock. Deliveries occur using the parking area or adjacent streets. LRT designs for the light rail alternatives do not alter the circulation pattern at this site.

4.3.9. Segment B On-Street Parking Impacts

With Alternative B1: Barbur, the cross section of SW Barbur Boulevard between SW 13th Avenue and SW 60th Avenue would include light rail in the center, two motor vehicle travel lanes in each direction, bike lanes and sidewalks. With this alternative, 113 on-street parking spaces would be eliminated along SW Barbur Boulevard. The utilization survey found that the existing on-street parking spaces are lightly used, and the spaces are typically adjacent to businesses or multifamily residences with off-street parking available.

Alternative B2 would leave the median of SW Barbur Boulevard near the Barbur Transit Center. This alternative would eliminate 88 on-street parking spaces between SW 13th Avenue and the Barbur Transit Center. The utilization survey found that the spaces were lightly used and are typically adjacent to businesses with off-street parking available.

Alternative B3 would leave the median of SW Barbur Boulevard at SW 26th Way. This alternative would eliminate 27 on-street parking spaces. The utilization survey found that the spaces were lightly used and are typically adjacent to businesses with off-street parking available.

Alternative B4: I-5 Custer to 60th would close SW Multnomah Boulevard southeast of SW Barbur Boulevard to vehicular traffic and convert the roadway to exclusive right of way for transit operations. Twelve legal on-street spaces would be eliminated with this alternative. These spaces are primarily used as unofficial park and ride parking, and would be replaced by the added park and ride capacity at the Barbur Transit Center.

Indirect parking impacts could also result if demand for parking exceeds the available park and ride supply or if transit riders opt to “hide and ride” on neighborhood streets. See Table 4.3-14 below.

Table 4.3-14. Segment B "Hide and Ride" Assessment

Station	Alternative	Notes
Custer	All	Limited nearby on-street parking, but some existing informal park and ride activity within a few blocks.
19th	B1, B2, B3	Some limited on-street parking on SW Evans St. and SW 19th Ave. west of SW Barbur Blvd. Very limited on-street parking east of SW Barbur Blvd. East of I-5 is longer walk and very limited on-street spaces.
Spring Garden	B4	Same as 19th.
30th (Barbur or I-5)	All	Available on-street parking near multifamily dwellings west of SW Barbur Blvd. Some parking potential on unimproved streets east of SW Barbur Blvd.
Barbur Transit Center (Barbur or I-5)	All	Increased park and ride capacity. Some potential overflow parking west of SW Barbur Blvd. on SW Taylors Ferry Rd. Likely a high overall parking demand location because this would be the closest park and ride to downtown Portland.
53rd (Barbur or I-5)	All	New park and ride capacity provided. Limited on-street parking available east of SW Barbur Blvd. on SW 53rd Ave. or SW Pomona St.

4.3.10. Segment B Light Rail Station Vehicular Access

The local circulation to neighborhood streets surrounding the station areas was evaluated to determine the impact of transit-related trips. There may be some redistribution of trips near light rail stations because of pick-ups and drop-offs, but this impact would be minor. The analysis of local streets near Barbur Transit Center and the proposed 53rd Park-and-Ride shows that those trips can be accommodated.

High capacity transit systems have traditionally been accessed by some passengers being picked up and dropped off, and this trend has expanded in recent years thanks to commercial mobility services such as Lyft and Uber. Shared mobility is expected to expand significantly in the future, including ride-hailing, car-sharing, bike-sharing, micro-transit and other services. By the 2035 model year, a significant percentage of vehicles will likely operate autonomously, potentially reducing the demand for parking but increasing the need for curb space for passenger pick-up and drop-off. To address this change, transit stations should be full-service mobility hubs that facilitate shared-mobility including ample convenient and accessible pick-up and drop-off zones for cars, shuttles and busses, car and bike share, and other shared mobility infrastructure designed to expedite passenger transfer and facilitate traffic flow.

Segment B Park and Ride Lots

Barbur Transit Center

Barbur Transit Center is an existing park and ride facility located off SW Barbur Boulevard and SW Taylors Ferry Road near SW Capitol Highway in the Crossroads area. It currently provides 382 parking stalls, and expansion is planned under the light rail alternatives. Under Alternatives B2, B3 and B4, the number of parking stalls will be 725. Under Alternative B1, the number of stalls will be 825. Demand volumes for analysis are based on the higher capacity facility. Approximately 50 percent of demand is expected to come from the area to the northwest of the park and ride via SW Capitol Highway and SW Taylors Ferry Road. Around 30 percent of the demand is expected to access via southbound SW Barbur

Boulevard and the remaining 20 percent from northbound SW Barbur Boulevard via SW Capitol Highway.

53rd Park and Ride

This park and ride facility is planned for the site north of the intersection of SW Barbur Boulevard and SW 53rd Avenue between SW Barbur Boulevard and I-5 under all Build alternatives. It will provide 950 parking stalls and secure bike parking. All the demand for this park and ride is expected to come from the area to the southeast that contains the Portland Community College (PCC) Sylvania campus. Of the trips to this park and ride 75 percent will travel via SW 53rd Avenue and approximately 25 percent will come from northbound SW Barbur Boulevard via SW 60th Avenue. Less than 5 percent of demand is expected to access this facility via I-5.

4.3.11. Segment B Construction Impacts

In Segment B, there are locations that would have construction impacts to the transportation system with an approximate time frame of one to two years.

Table 4.3-15 summarizes these construction impacts.

Table 4.3-15. Construction Impacts Summary – Segment B: Outer Portland

Location	Alignment Alternative(s)	Issue	Major Assumption	Approximate Time Frame
SW Barbur Blvd./SW Multnomah Blvd. structure	B1: Barbur B2: I-5 Barbur TC-60th B3: I-5 26th-60th	Structure needs to be replaced to accommodate LRT and/or ped/bike	SW Barbur Blvd.: one lane each direction SW Multnomah Blvd.: weekend closures	1 year
SW Barbur Blvd./SW 26th Ave. structure	B1: Barbur B2: I-5 Barbur TC-60th	Structure needs to be replaced to accommodate LRT and/or ped/bike	SW Barbur Blvd.: one lane each direction SW 26th Ave.: weekend closures	1 year
SW Barbur Blvd./SW Capitol Hwy. (Crossroads) structure over I-5	B1: Barbur	Existing structure needs to be replaced to accommodate LRT	SW Capitol Hwy.: closed SW Taylors Ferry Rd. to SW Huber St. SW Barbur Blvd.: closed SW Taylors Ferry Rd. to SW Huber St. Northbound SW Barbur Blvd. to northbound I-5: remain open Southbound SW Barbur Blvd. to southbound I-5: temporarily relocate on-ramp to Taylors Ferry Rd. (temporarily close southbound off-ramp) Southbound I-5 off-ramp: closed to accommodate temporary southbound on-ramp	2 years
New LRT-only structure over I-5 (Crossroads)	B2: I-5 Barbur TC-60th B3: I-5 26th-60th B4: I-5 Custer-60th	New structure to accommodate LRT	Intermittent weekend closures and/or night closures of SW Capitol Hwy. and SW Barbur Blvd.	1 year

Location	Alignment Alternative(s)	Issue	Major Assumption	Approximate Time Frame
Structure crossing, I-5, OR 99, and ramps and continuing along west side of I-5 to near SW Atlanta St.	All	New structure over I-5; widen I-5 for future widening project	I-5: lane shifts and intermittent temporary lane closures SW Barbur Blvd. and I-5 on-ramps: maintain one lane in each direction; multiple weekend closures; night closures	2 years

4.4. Segment B Mitigation

The following section addresses potential improvement measures based on the previously outlined impacts for the light rail alternatives within the study area by mode.

Potential Project-related Mitigation

Five locations were identified that would require mitigation to meet mobility targets in Segment B. The first would reconfigure the Barbur Transit Center to allow ingress access only from the SW Barbur Boulevard/SW Taylors Ferry Road intersection and egress only from the SW Barbur Boulevard/Barbur Transit Center intersection. A southbound right-turn lane from SW Barbur Boulevard to SW Taylors Ferry Road would also be added. In both AM and PM periods, the SW Barbur Boulevard/SW Taylors Ferry Road intersection would meet mobility targets with this mitigation.

The second mitigation would reconfigure access to the 53rd Park and Ride. The mitigation includes not building the access directly at SW 53rd Avenue and building a new intersection south of SW 53rd Avenue between SW 53rd Avenue and SW 64th Avenue. The new traffic signal would have right- and left-turn lanes to SW Barbur Boulevard. The intersection at SW 53rd Avenue would become a T-intersection with left-turn and shared left-right turn lanes on the SW 53rd Avenue approach. In both AM and PM periods, SW Barbur Boulevard/SW 53rd Avenue would meet mobility targets with this mitigation.

Table 4.4-1. Segment B AM Mitigation Results

ID	Intersection	Mobility Target		Control	Delay	LOS	V/C
B16	SW Barbur Blvd./SW 24th Ave/ I-5 southbound off-ramp	ODOT Ramp	0.85	Signal	22.2	C	0.87
B27	SW Barbur Blvd./Barbur Transit Center	ODOT/PBOT 1st HR	0.99	Signal	14.1	B	0.57
B29	SW Barbur Blvd./SW Taylors Ferry Rd. (near SW 41st Ave.)	ODOT/PBOT 1st HR	0.99	Signal	35.9	D	0.90
B31	SW Taylors Ferry Rd./I-5 off ramp	ODOT Ramp	0.85	Signal	11.9	B	0.72
B36	SW Barbur Blvd. (OR 99W)/SW 53rd Ave.	ODOT/PBOT 1st HR	0.99	Signal	35.7	D	0.89
New	SW Barbur Blvd. (OR 99W) & SW 53rd Park and Ride	ODOT/PBOT 1st HR	0.99	Signal	11.9	B	0.61

Table 4.4-2. Segment B PM Mitigation Results

ID	Intersection	Mobility Target		Control	Delay	LOS	V/C
B27	SW Barbur Blvd./Barbur Transit Center	ODOT/PBOT 1st HR	0.99	Signal	15.4	B	0.61
B29	SW Barbur Blvd./SW Taylors Ferry Rd.	ODOT/PBOT 1st HR	0.99	Signal	28.7	C	0.78
B31	SW Taylors Ferry Rd./I-5 southbound off-ramp	ODOT Ramp	0.85	Signal	22.7	C	0.80
B36	SW Barbur Blvd. (OR 99W) /SW 53rd Ave.	ODOT/PBOT 1st HR	0.99	Signal	40.5	D	0.84
New	SW Barbur Blvd. (OR 99W) & 53rd Park and Ride	ODOT/PBOT 1st HR	0.99	Signal	21.8	C	0.73

The third Segment B location needing mitigation to address project impacts associated with vehicle queuing is the intersection of SW Barbur Boulevard/SW Bertha Boulevard/I-5 southbound. There are two potential options to mitigate the impacts at the I-5 off-ramp. One option is to provide queue detection to flush the off-ramp signal phase and clear the queue. A queue dump operation was tested using the Vissim model with the queue detection placed at 500 feet upstream of the signal head. The results indicated that on average approximately one queue dump occurred during the PM peak hour and lasted an average of approximately 60 seconds with a maximum of 90 seconds. During the queue dump event, southbound SW Barbur Boulevard traffic queued back through SW Terwilliger Boulevard and 2 percent of LRT vehicles were impacted. For trains that were impacted, the average delay was 23 seconds.

An alternative mitigation for SW Barbur Boulevard/SW Bertha Boulevard/I-5 southbound is to add an auxiliary lane connecting the right lane from the off-ramp to a yield controlled movement at SW Terwilliger Boulevard, similar to the configuration under existing conditions. This mitigation strategy needs further evaluation for consideration of bicycle and pedestrian facilities.

The fourth mitigation closes the northbound left at SW Barbur Boulevard/SW 24th St/I-5 Southbound off-ramp during the AM peak. This movement has a low AM volume that can shift to another signal and the increased time for the other signal phases reduces the V/C ratio to an acceptable value.

The fifth mitigation is to signalize the I-5 southbound off-ramp/SW Taylor's Ferry Road. This intersection becomes extremely congested during the PM peak hour due to the proximity of the intersection of SW Capitol Highway and SW Taylor's Ferry Road. Signalization of this intersection will meet the mobility target for a freeway off-ramp

5. SEGMENT C: TIGARD AND TUALATIN

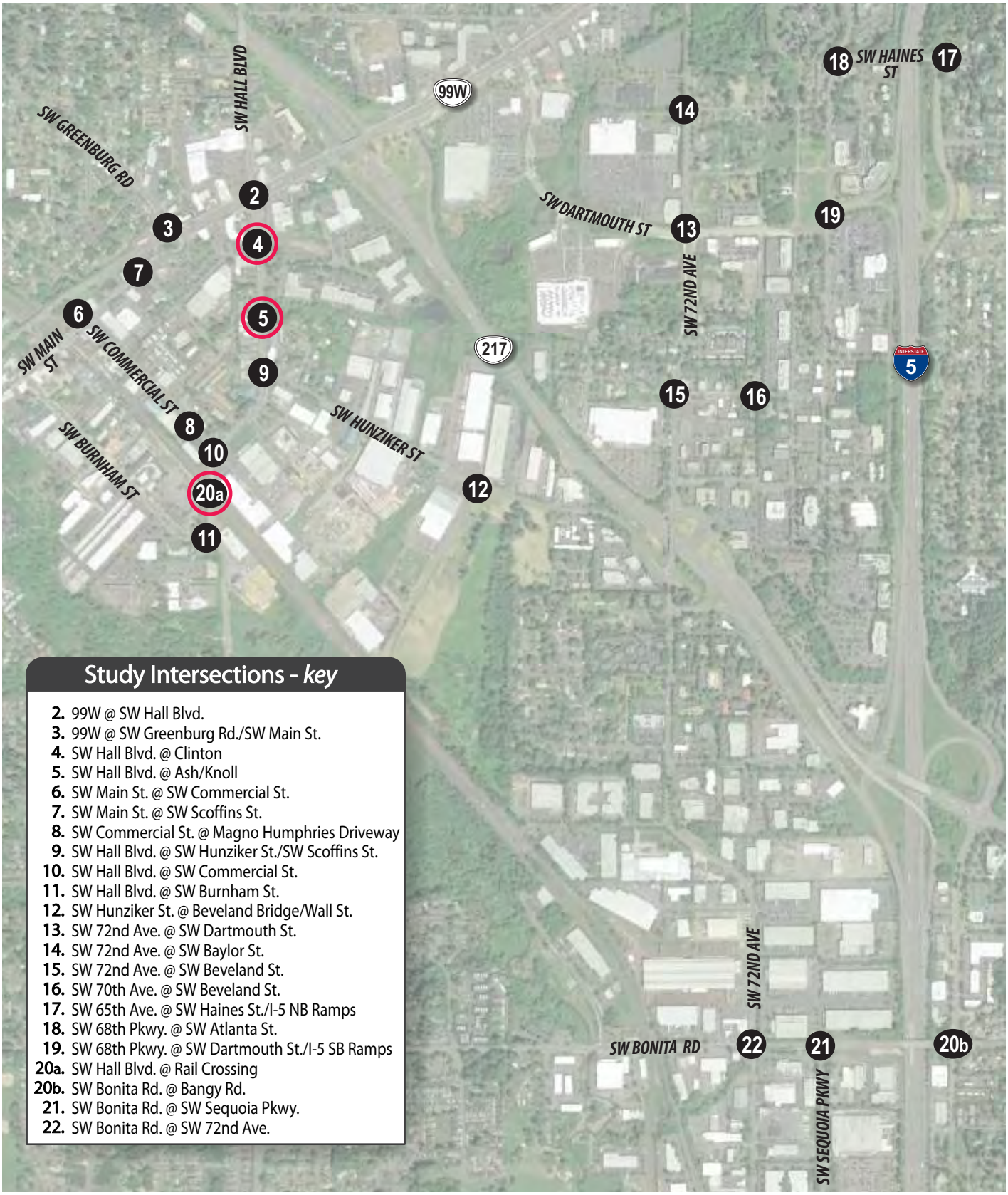
This chapter details the transportation operations for both existing and future conditions within Segment C: Tigard and Tualatin. The existing operations cover both non-motorized and motorized modes of travel including bicycle, pedestrian, transit and motor vehicle, as well as evaluating parking, freight and collision data. The future operations evaluate the potential impacts to motorized and non-motorized modes, potential mitigation strategies for impacts related to the light rail alternatives, and possible improvements to be considered by the local jurisdictions within the segment.

5.1. Segment C Study Area Descriptions

Segment C is defined as the section from just west of SW 68th Parkway to Tigard and the Bridgeport Village terminus, station and park and ride facility. Within Segment C, there are three unique subareas: Tigard, SW Carman Drive/SW Upper Boones Ferry Road and Bridgeport. The Segment C study area includes a total of 40 intersections, as depicted in Figures 5.1-1, 5.1-2 and 5.1-3 below. Three of the 40 intersections do not currently exist and are analyzed under future conditions.

5.1.1. Tigard Subarea

The Tigard subarea of Segment C has 22 study area intersections that fall mostly within the City of Tigard near areas known as the Tigard Triangle and downtown Tigard and along SW Bonita Road. One intersection falls in the City of Lake Oswego. Traffic count data was collected, and Synchro was used to analyze the area for the PM peak period only. The LOS analysis and the V/C ratio were calculated to evaluate intersection operations. For study area intersections related to freeway ramp terminals or railroad crossings, Synchro was used to determine approximate 95th percentile queue lengths. Figure 5.1-1 below illustrates the Tigard subarea of Segment C.



Study Intersections - *key*

2. 99W @ SW Hall Blvd.
3. 99W @ SW Greenburg Rd./SW Main St.
4. SW Hall Blvd. @ Clinton
5. SW Hall Blvd. @ Ash/Knoll
6. SW Main St. @ SW Commercial St.
7. SW Main St. @ SW Scoffins St.
8. SW Commercial St. @ Magno Humphries Driveway
9. SW Hall Blvd. @ SW Hunziker St./SW Scoffins St.
10. SW Hall Blvd. @ SW Commercial St.
11. SW Hall Blvd. @ SW Burnham St.
12. SW Hunziker St. @ Beveland Bridge/Wall St.
13. SW 72nd Ave. @ SW Dartmouth St.
14. SW 72nd Ave. @ SW Baylor St.
15. SW 72nd Ave. @ SW Beveland St.
16. SW 70th Ave. @ SW Beveland St.
17. SW 65th Ave. @ SW Haines St./I-5 NB Ramps
18. SW 68th Pkwy. @ SW Atlanta St.
19. SW 68th Pkwy. @ SW Dartmouth St./I-5 SB Ramps
20a. SW Hall Blvd. @ Rail Crossing
20b. SW Bonita Rd. @ Bangy Rd.
21. SW Bonita Rd. @ SW Sequoia Pkwy.
22. SW Bonita Rd. @ SW 72nd Ave.

Segment C

(#) - PM Study Intersection *(Performance Measures Reported)*

(#) - Modeled Intersection for System Operations *(No Measures Reported)*

○ - PM HCM Queue Analysis

No Scale

DKS

figure **5.1-1**

Study Area

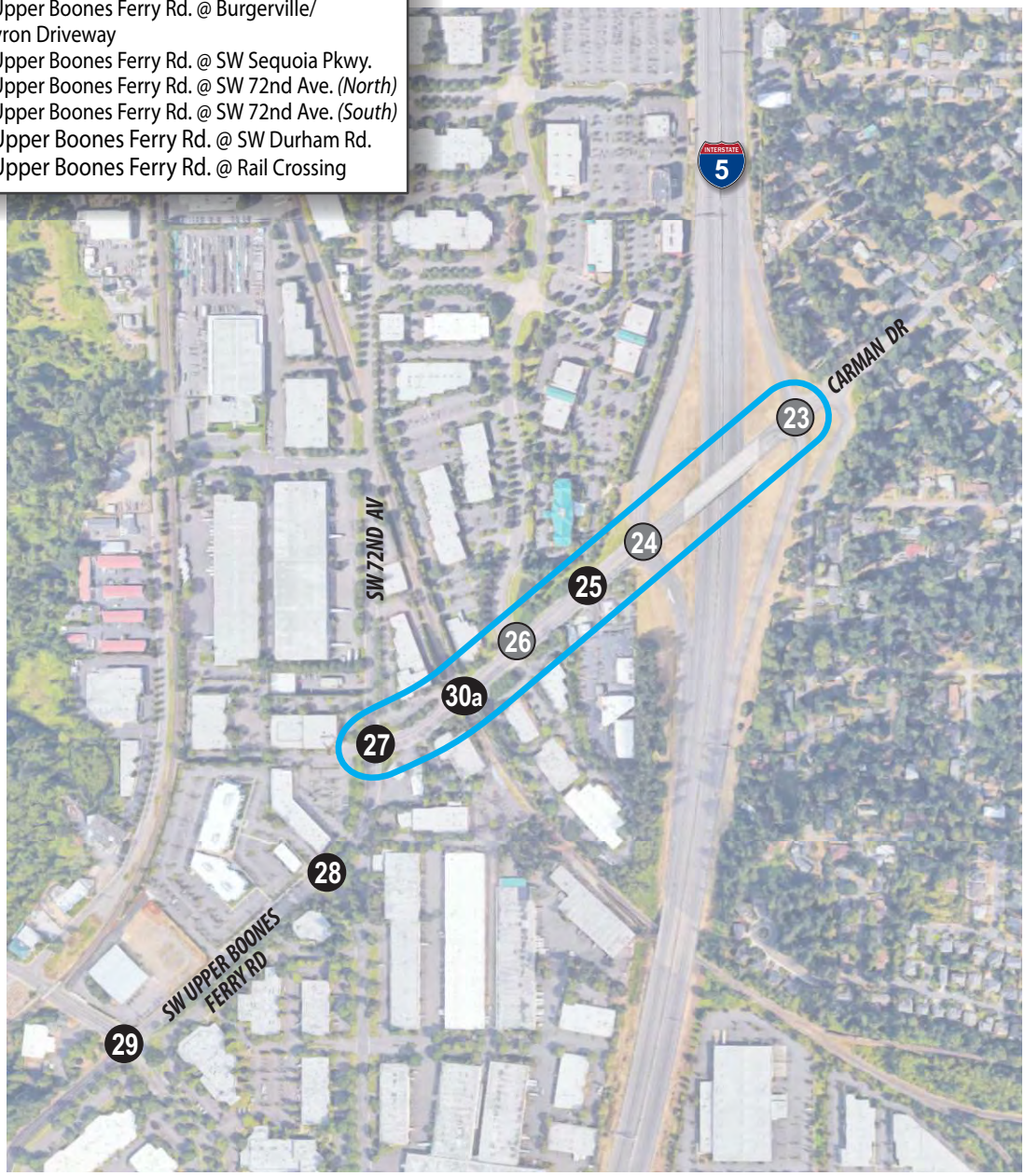
Segment C: Tigard

5.1.2. SW Carman Drive/SW Upper Boones Ferry Road Subarea

The SW Carman Drive/SW Upper Boones Ferry Road subarea of Segment C has eight study intersections along SW Carman Drive/SW Upper Boones Ferry Road, between SW Durham Road and the I-5 ramp terminals, all within the city of Tigard. It includes seven major signalized intersections and one stop controlled access with high traffic volumes. Traffic count data was collected, and Synchro and SimTraffic were used to determine the LOS analysis, V/C ratio and selective queuing results to evaluate intersection operations. Figure 5.1-2 below illustrates the SW Carman Drive/SW Upper Boones Ferry Road subarea of Segment C.

Study Intersections - *key*

23. SW Upper Boones Ferry Rd. @ I-5 NB Ramps
24. SW Upper Boones Ferry Rd. @ I-5 SB Ramps
25. SW Upper Boones Ferry Rd. @ Burgerville/ Chevron Driveway
26. SW Upper Boones Ferry Rd. @ SW Sequoia Pkwy.
27. SW Upper Boones Ferry Rd. @ SW 72nd Ave. *(North)*
28. SW Upper Boones Ferry Rd. @ SW 72nd Ave. *(South)*
29. SW Upper Boones Ferry Rd. @ SW Durham Rd.
30a. SW Upper Boones Ferry Rd. @ Rail Crossing



Segment C

- PM Study Intersection *(Performance Measures Reported)*

- AM & PM Study Intersection *(Performance Measures Reported)*

- Modeled Intersection for System Operations *(No Measures Reported)*

- AM & PM SimTraffic Model Area

No Scale

DKS

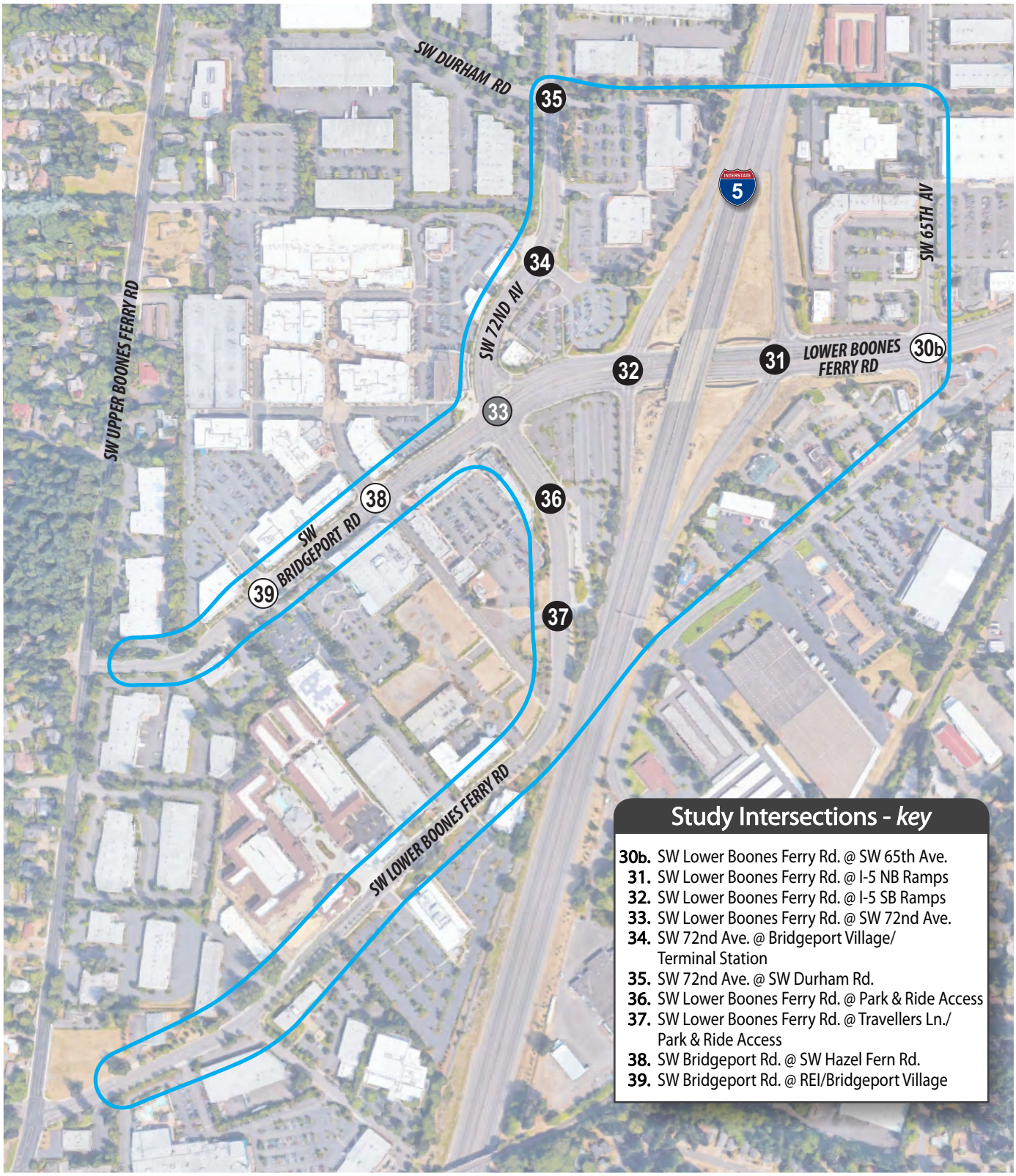
figure 5.1-2

Study Area

Segment C: Carman/UBF

5.1.3. Bridgeport Subarea

The Bridgeport subarea of Segment C has ten study intersections near the SW Lower Boones Ferry Road interchange and the Bridgeport Village shopping center. It includes eight signalized intersections and two stop controlled accesses near the proposed Bridgeport Park and Ride. Traffic count data was collected, and Synchro and SimTraffic were used to determine the LOS analysis, V/C ratio and selective queuing results to evaluate intersection operations. Figure 5.1-3 below illustrates the Bridgeport subarea of Segment C.



Segment C

- # - PM Study Intersection *(Performance Measures Reported)*
- # - AM & PM Study Intersection *(Performance Measures Reported)*
- # - Modeled Intersection for System Operations *(No Measures Reported)*
- PM SimTraffic Model Area

No Scale

DKS

figure 5.1-3

Study Area

Segment C: Bridgeport

5.2. Segment C Existing Conditions

Within Segment C, light rail is expected to run from just west of SW 68th Parkway to Tigard and the Bridgeport Village terminus, station and park and ride facility. The analysis for Segment C includes intersections mostly likely to be affected by the various alignment alternatives. Existing turning movement counts were collected for some study area intersections as part of a previous study. Where recent turning movement counts were not available, new counts were taken in March 2017.

5.2.1. Segment C Roadway Functional Classification

Table 5.2-1 shows the functional classification for every roadway that is included in the study area of Segment C.

Functional classifications are listed for the jurisdictional owner. In Segment C, almost all of the roadways are owned by the City of Tigard; however, ODOT and Washington County also have jurisdiction.

Table 5.2-1. Roadway Functional Classifications in Segment C

Roadway Name(s)	Jurisdiction	Functional Classification
Pacific Hwy W/OR 99W	ODOT	Principal Arterial (NHS Route)
SW Main St. (east of SW Scoffins St.)	City of Tigard	Minor Arterial
SW Main St. (west of SW Scoffins St.)	City of Tigard	Collector
SW Hall Blvd./Beaverton-Tualatin Hwy.	ODOT	Minor Arterial
SW Scoffins St.	City of Tigard	Collector
SW Burnham St	City of Tigard	Collector
SW Hunziker Rd.	City of Tigard	Collector
SW Wall St.	City of Tigard	Collector
SW Haines St./SW Haines Rd. Connection No. 3	ODOT	Collector
SW Haines Rd. Connection No. 1	ODOT	Local
SW Atlanta St.	City of Tigard	Collector
SW 68th Pkwy. (north of SW Clinton St.)	City of Tigard	Collector
SW Greenburg Rd.	Washington County	Arterial
SW Clinton St.	City of Tigard	Neighborhood Route
SW Ash Ave.	City of Tigard	Collector
SW Commercial St.	City of Tigard	Neighborhood Route
SW 72nd Ave.	Washington County (ODOT at Ramp Terminals)	Arterial
SW Dartmouth St.	City of Tigard	Collector
SW Baylor St.	City of Tigard	Neighborhood Route
SW Beveland St.	City of Tigard	Neighborhood Route
SW 70th Ave.	City of Tigard	Neighborhood Route
SW Bangy Rd.	City of Lake Oswego	Collector
SW Bonita Rd.	City of Tigard	Arterial
SW Sequoia Pkwy.	City of Tigard	Collector
SW Carman Dr.	Washington County	Minor Arterial
SW Upper Boones Ferry Rd. (between SW Durham Rd. & I-5 southbound ramps)	Washington County	Arterial

Roadway Name(s)	Jurisdiction	Functional Classification
SW Lower Boones Ferry Rd (east of I-5 southbound ramps)	Washington County	Principal Arterial (NHS route)
SW Lower Boones Ferry Rd. (west of I-5 southbound ramps)	Washington County	Minor Arterial
SW Upper Boones Ferry Rd./Beaverton-Tualatin Hwy.	ODOT	Minor Arterial
SW Durham Rd. (west of SW Upper Boones Ferry Rd.)	Washington County	Arterial
SW Durham Rd. (east of SW Upper Boones Ferry Rd.)	Washington County	Collector
SW Travelers Ln.	Washington County	Neighborhood Route
SW Hazel Fern Rd.	Washington County	Neighborhood Route
SW Bridgeport Rd.	Washington County	Arterial

5.2.2. Active Transportation

In Segment C, the study area includes a variety of streets with a range of pedestrian and bicycle facilities. Table 5.2-2 categorizes the relevant streets in Segment C according to the extent of existing sidewalks.

Table 5.2-2. Segment C: Description of Existing Sidewalks

Streets with Full Sidewalks	Streets with Partial Sidewalks	Streets with No Sidewalks
SW 70th Ave. SW 72nd Ave. SW Dartmouth St. SW Hunziker St. SW Commercial St. SW Hermoso St. SW Bonita Rd. SW Upper Boones Ferry Rd. SW Lower Boones Ferry Rd. SW Beveland St. (west of SW 72nd Ave.)	SW Atlanta St. SW Beveland St. (east of SW 72nd Ave.) SW Scoffins St. SW Landmark Ln. SW Hall Blvd.	SW Baylor St. SW 69th Ave. SW Clinton St. SW Knoll Dr. SW Ash Ave.

Many of the streets in Segment C are low-volume, local streets that do not include bike lanes. Substantial portions of bike lanes exist on the following streets within the study area in Segment C:

- SW Bonita Road
- SW Dartmouth Street
- SW Hall Boulevard
- SW Lower Boones Ferry Road

Figure 5.2-1 and Figure 5.2-2 show existing bike lane and sidewalk gaps in Segment C, respectively. These maps focus on collector and arterial streets, because they reflect the locations of greatest need for sidewalks and bicycle facilities. Local streets typically carry less motor vehicle volumes, and can still be safely used for walking and bicycling by many people, even without proper facilities.

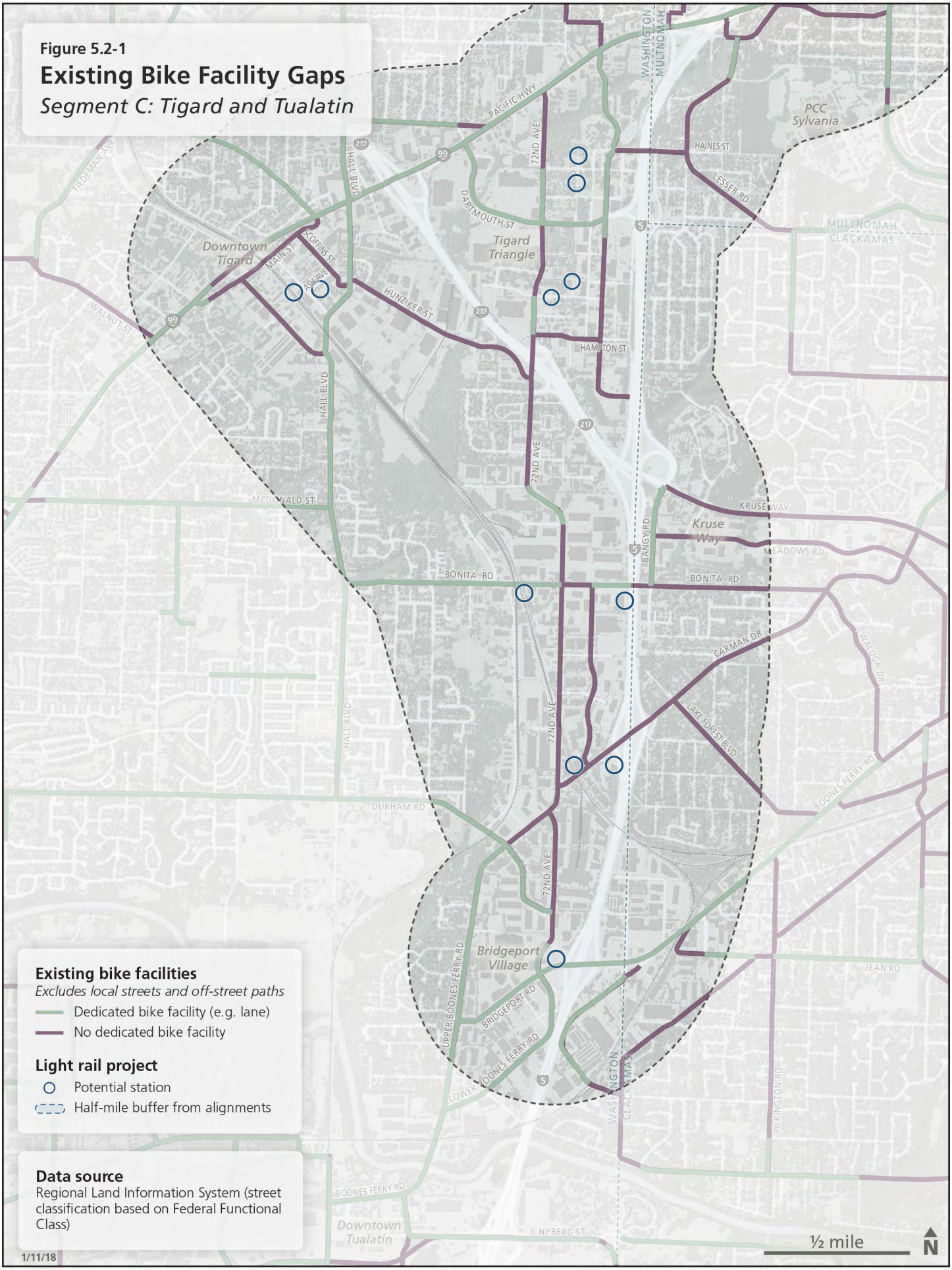


Figure 5.2-1
Existing Bike Facility Gaps
Segment C: Tigard and Tualatin
Existing bike facilities
Excludes local streets and off-street paths
Dedicated bike facility (e.g. lane)
No dedicated bike facility
Light rail project
Potential station
Half-mile buffer from alignments
Data source
Regional Land Information System (street classification based on Federal Functional Class)
1/11/18
½ mile
N
Downtown Tigard
Tigard Triangle
PCC Sylvania
Kruse Way
Bridgeport Village
Downtown Tualatin
PACIFIC HWY
HALL BLVD
72ND AVE
DARTMOUTH ST
HAINES ST
LESSER RD
HUNZIKER ST
HAMPTON ST
MCDONALD ST
KRUSE WAY
BANGY RD
MEADOWS RD
BONITA RD
CARMAN DR
WALLUGA DR
LAKE FOREST BLVD
BOONES FERRY RD
DURHAM RD
UPPER BOONES FERRY RD
BRIDGEPORT RD
LOWER BOONES FERRY RD
JEAN RD
PILKINGTON RD
NYBERG ST
WASHINGTON
MULTNOMAH
CLACKAMAS
MAIN ST
COFFINS ST
ASH AVE
WALNUT ST
VIEDEMAN AVE

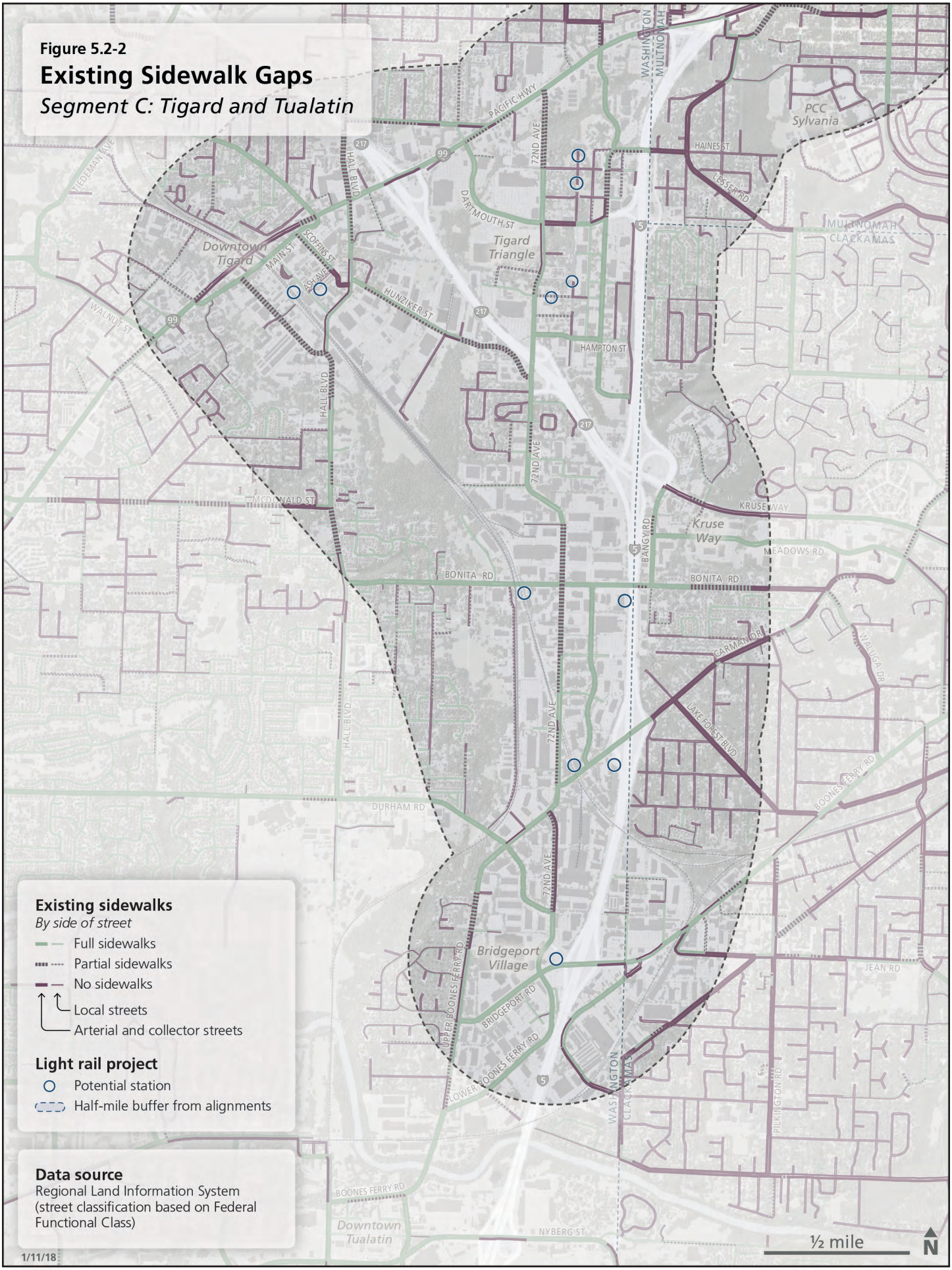


Figure 5.2-2
Existing Sidewalk Gaps
Segment C: Tigard and Tualatin
Existing sidewalks
By side of street
Full sidewalks
Partial sidewalks
No sidewalks
Local streets
Arterial and collector streets
Light rail project
Potential station
Half-mile buffer from alignments
Data source
Regional Land Information System
(street classification based on Federal Functional Class)
1/11/18
½ mile
N
Downtown Tigard
Tigard Triangle
Kruse Way
Bridgeport Village
Downtown Tualatin
PCC Sylvania
PACIFIC HWY
72ND AVE
HALL BLVD
DARTMOUTH ST
HUNZIKER ST
HAMPTON ST
BONITA RD
DURHAM RD
BOONES FERRY RD
BRIDGEPORT RD
NYBERG ST
HAINES ST
LESSER RD
MULTNOMAH
CLACKAMAS
WASHINGTON
KRUSE WAY
BANGY RD
MEADOWS RD
CARMAN DR
LAKE FOREST BLVD
WALLUGA DR
JEAN RD
PILKINGTON RD
MAIN ST
SCOFFINS ST
ASH AVE
MCDONALD ST
WALNUT ST
TIEDEMAN AVE
99
217
5

5.2.3. Segment C Motor Vehicle Operations

2017 Existing HCM Operations

This section describes the current operational conditions for the study area intersections that exist currently for each subarea within Segment C. Under existing conditions, 37 intersections were analyzed in the PM peak hour and four intersections were analyzed in the AM peak hour. Three additional rail crossings were analyzed in the PM peak hour.

To accurately model the existing conditions on the roadway network, turning movement counts were obtained for all existing study area intersections. The turning movement count data is shown in Appendix B. The count volumes were balanced according to the ODOT Analysis Procedures Manual to account for differences in data collected on different dates. The balanced network reflects the typical 2017 weekday peak-hour traffic conditions. Additional data, including peaking profiles, pedestrian volumes, bicycle volumes and heavy vehicle percentages, were also input into the models.

Tigard Subarea

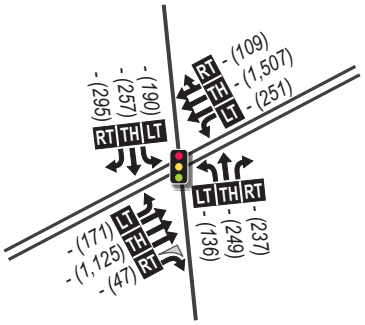
Synchro was used to report LOS, delay and V/C ratio using HCM 2000 methodology for signalized intersections and HCM 2010 methodology for unsignalized intersections. Table 5.2-3 show Synchro analysis results for the existing PM peak hour; the AM peak hour was not analyzed for the Tigard subarea. Twenty-two intersections were analyzed for the Tigard subarea.

Mobility targets for the appropriate jurisdiction are shown for every intersection. Intersection results that do not meet those targets in a particular peak hour are shaded gray. The worst lane group is listed under the WLANE columns for two-way stop controlled intersections.

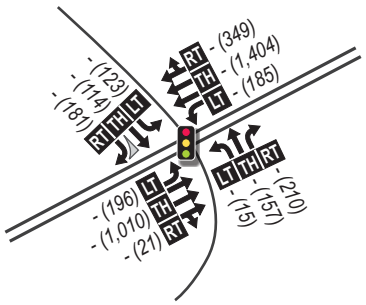
During the PM peak hour, only the intersection of SW 65th Avenue at SW Haines Street/I-5 northbound ramps exceeds applicable mobility targets.

Figures 5.2-3 through 5.2-5 illustrate the traffic volumes for Segment C in graphical format.

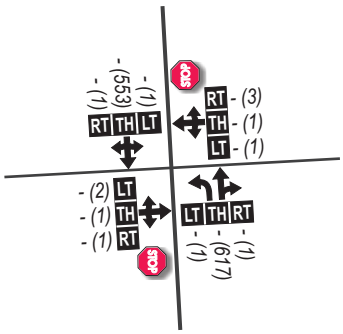
C2. *99W @ SW Hall Blvd.*



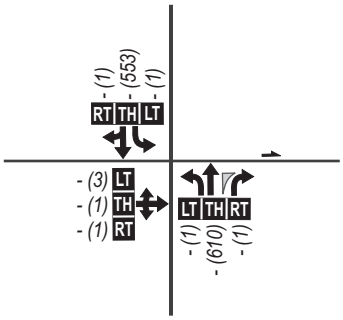
C3. *99W @ SW Greenburg Rd./SW Main St.*



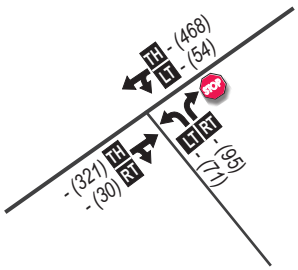
C4. *SW Hall Blvd. @ Clinton*



C5. *SW Hall Blvd. @ Ash/Knoll*

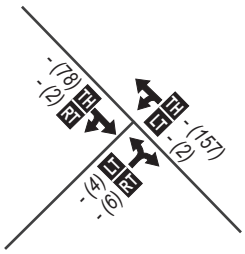


C6. *SW Main St. @ SW Commercial St.*

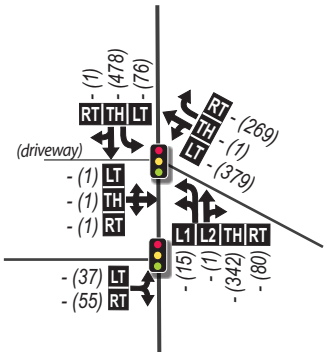


C7. *SW Main St. @ SW Scoffins St.*

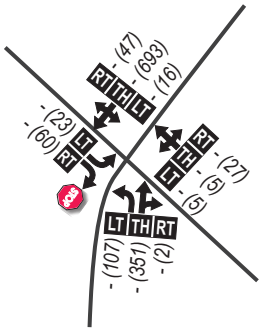
C8. *SW Commercial St. @ Magno Humphries Driveway*



C9. *SW Hall Blvd. @ SW Hunziker St./ SW Scoffins St.*

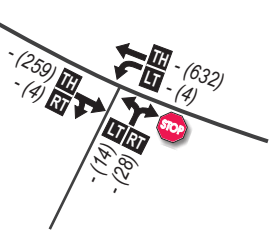


C10. *SW Hall Blvd. @ SW Commercial St.*

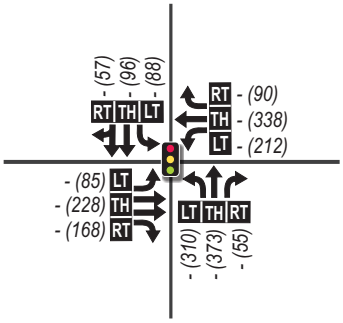


C11. *SW Hall Blvd. @ SW Burnham St.*

C12. *SW Hunziker St. @ Beveland Bridge/Wall St.*



C13. *SW 72nd Ave. @ SW Dartmouth St.*



LEGEND

00. - Study Intersection No.
STOP - Stop Sign
- Yield Sign
- Traffic Signal
← - Lane Configuration
AM (PM) - Peak Hour Traffic Volumes
LT TH RT - Volume Turn Movement
Left•Thru•Right

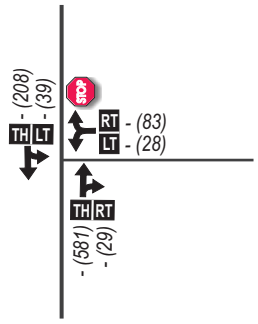
DKS

No Scale

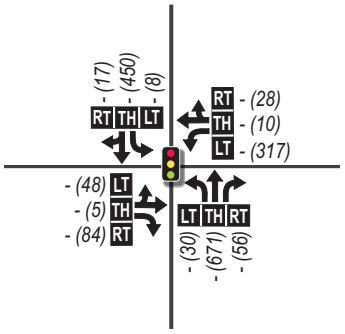
figure **5.2-3a**

2017 Existing Conditions
AM/PM Peak Hour
Segment C: Tigard

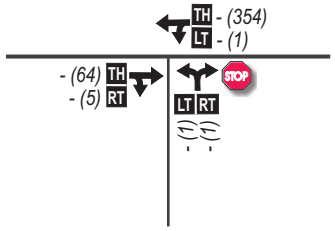
C14. *SW 72nd Ave. @ SW Baylor St.*



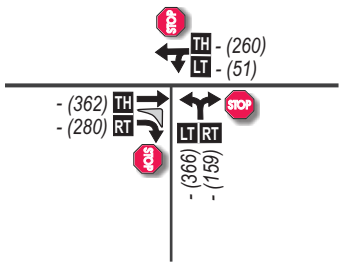
C15. *SW 72nd Ave. @ SW Beveland St.*



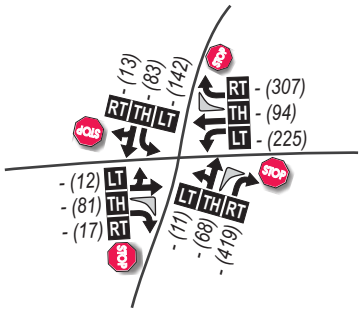
C16. *SW 70th Ave. @ SW Beveland St.*



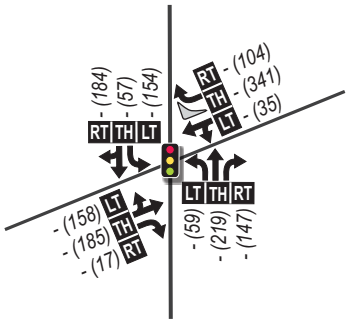
C17. *SW 65th Ave. @ SW Haines St./ I-5 NB Ramps*



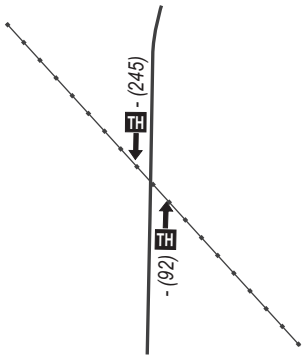
C18. *SW 68th Pkwy. @ SW Atlanta St.*



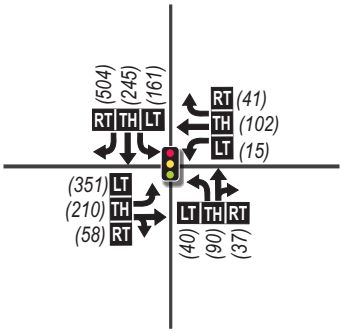
C19. *SW 68th Pkwy. @ SW Dartmouth St./ I-5 SB Ramps*



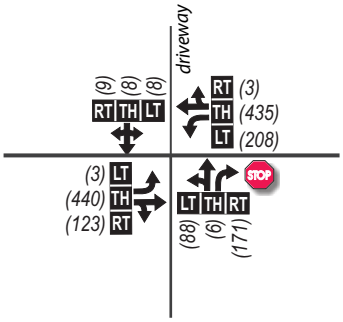
C20a. *SW Hall Blvd. @ Rail Crossing*



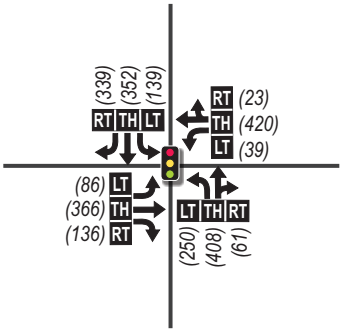
C20b. *SW Bonita Rd. @ Bangy Rd.*



C21. *SW Bonita Rd. @ SW Sequoia Pkwy.*



C22. *SW Bonita Rd. @ SW 72nd Ave.*



LEGEND

00. - Study Intersection No.
STOP - Stop Sign
- Yield Sign
- Traffic Signal
- Lane Configuration
AM (PM) - Peak Hour Traffic Volumes
LT TH RT - Volume Turn Movement
Left•Thru•Right

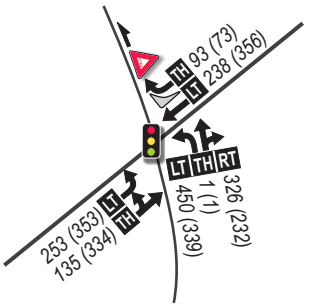
DKS

No Scale

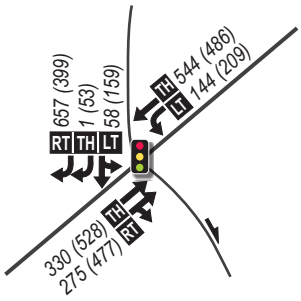
figure **5.2-3b**

2017 Existing Conditions
AM/PM Peak Hour
Segment C: Tigard

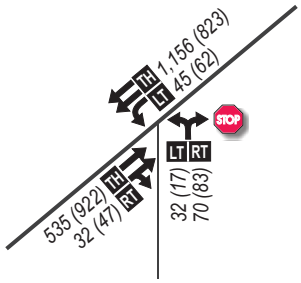
C23. *SW Upper Boones Ferry Rd. @ I-5 NB Ramps*



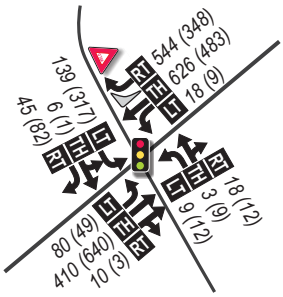
C24. *SW Upper Boones Ferry Rd. @ I-5 SB Ramps*



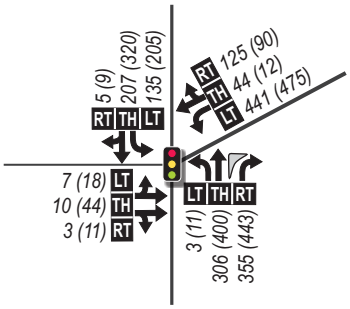
C25. *SW Upper Boones Ferry Rd. @ Burgerville/ Chevron Driveway*



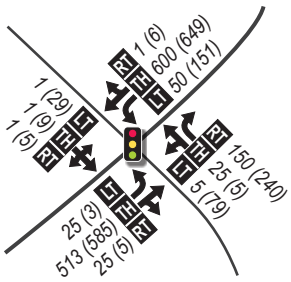
C26. *SW Upper Boones Ferry Rd. @ SW Sequoia Pkwy.*



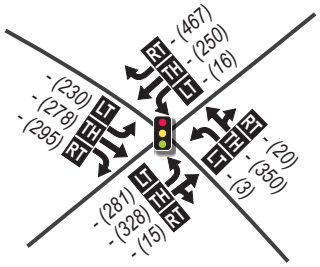
C27. *SW Upper Boones Ferry Rd. @ SW 72nd Ave. (North)*



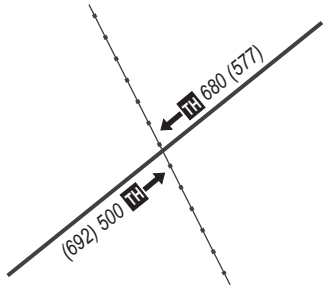
C28. *SW Upper Boones Ferry Rd. @ SW 72nd Ave. (South)*



C29. *SW Upper Boones Ferry Rd. @ SW Durham Rd.*



C30a. *SW Upper Boones Ferry Rd. @ Rail Crossing*



LEGEND

00. - Study Intersection No.
STOP - Stop Sign
- Yield Sign
- Traffic Signal
← - Lane Configuration
AM (PM) - Peak Hour Traffic Volumes
LT TH RT - Volume Turn Movement
Left • Thru • Right

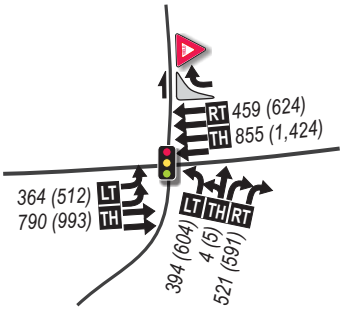
DKS

No Scale

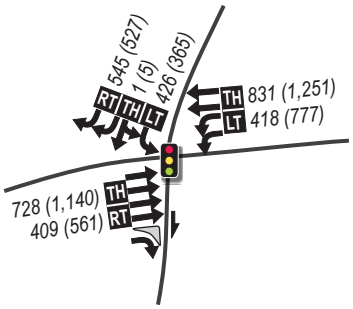
figure **5.2-4**

2017 Existing Conditions
AM/PM Peak Hour
Segment C: Carman/UBF

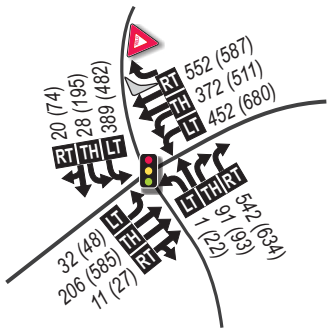
C31. *SW Lower Boones Ferry Rd. @ I-5 NB Ramps*



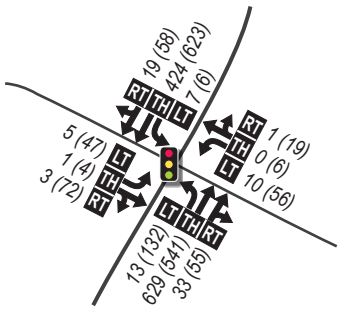
C32. *SW Lower Boones Ferry Rd. @ I-5 SB Ramps*



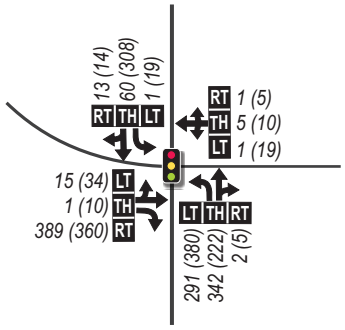
C33. *SW Lower Boones Ferry Rd. @ SW 72nd Ave.*



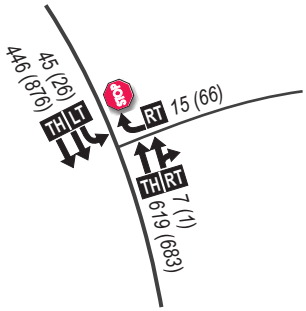
C34. *SW 72nd Ave. @ Bridgeport Village/ Terminal Station*



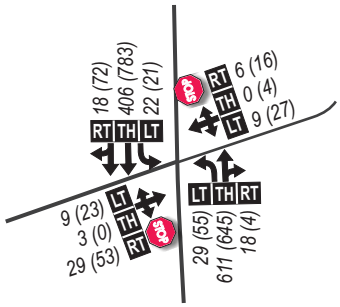
C35. *SW 72nd Ave. @ SW Durham Rd.*



C36. *SW Lower Boones Ferry Rd. @ Park & Ride Access*



C37. *SW Lower Boones Ferry Rd. @ Travellers Ln./Park & Ride Access*



LEGEND

00. - Study Intersection No.
STOP - Stop Sign
- Yield Sign
- Traffic Signal
← - Lane Configuration
AM (PM) - Peak Hour Traffic Volumes
LT TH RT - Volume Turn Movement
Left • Thru • Right

DKS

No Scale

figure **5.2-5**

2017 Existing Conditions
AM/PM Peak Hour
Segment C: Bridgeport

Table 5.2-3. Segment C 2017 Existing Conditions HCM (Synchro) Analysis – Tigard Subarea

ID	Tigard Subarea	Note	Mobility Target		2017 Existing Conditions				
						PM			
					Control	Delay	LOS	V/C	WLANE
C2	SW Hall Blvd./OR 99W		ODOT	1.10	Signal	40.4	D	0.80	-
C3	SW Greenburg Rd./SW Main St./OR 99W		ODOT	1.10	Signal	30.0	C	0.71	-
C4	SW Hall Blvd./Clinton St.		ODOT	1.10	Future	Future intersections			
C5	SW Hall Blvd./Ash Ave.		ODOT	1.10	Future	Future intersections			
C6	SW Commercial St./SW Main St.		Tigard	1.00	TWSC	3.4 [27.2]	A [D]	0.33	NBLn1
C7	SW Scoffins St./SW Main St.		Tigard	1.00	AWSC	16.2 [18.5]	C [C]	0.60	EBLn1
C8	Magno Humphries Drvwy./SW Commercial St.		-	-	TWSC	0.4 [9.3]	A [A]	0.01	EBLn1
C9a	SW Hall Blvd./SW Hunziker St./SW Scoffins St. (North)		ODOT	1.10	Signal	24.3	C	0.60	-
C9B	SW Hall Blvd./SW Hunziker St./SW Scoffins St. (South)		ODOT	1.10		22.9	C	0.59	-
C10	SW Hall Blvd./SW Commercial St.		ODOT	1.10	TWSC	3.7 [78.1]	A [F]	0.35	EBLn1
C11	SW Hall Blvd./SW Burnham St.		ODOT	1.10	Signal	19.9	B	0.63	-
C12	Wall St./SW Hunziker St.		Tigard	1.00	TWSC	0.7 [14.2]	A [B]	0.11	NBLn1
C13	SW 72nd Ave./SW Dartmouth St.		Tigard	1.00	Signal	19.9	B	0.70	-
C14	SW 72nd Ave./SW Baylor St.		Tigard	1.00	TWSC	2.4 [18.1]	A [C]	0.31	WBLn1
C15	SW 72nd Ave./SW Beveland St.		Tigard	1.00	Signal	21.6	C	0.70	-
C16	SW 70th Ave./SW Beveland St.		Tigard	1.00	TWSC	Future intersections			
C17	SW 65th Ave./SW Haines St./I-5 northbound ramps		ODOT Ramp	0.85	AWSC	**38.6 [64.6]**	**E [F]**	**1.00**	**NBLn1**
C18	SW 68th Pkwy./SW Atlanta St.		Tigard	1.00	AWSC	28.6 [40.7]	D [E]	0.87	NBLn2
C19	SW 68th Pkwy./Dartmouth St./I-5 southbound ramps		ODOT Ramp	0.85	Signal	31.1	C	0.68	-
C20a	SW Hall Blvd./Existing RR (WES)				RR	2.9	A	0.45	-
C20b	SW Bangy Rd./SW Bonita Rd.		Lake Oswego	LOS E	Signal	14.8	B	0.59	-
C21	SW Sequoia Pkwy./SW Bonita Rd.		Tigard	1.00	TWSC	6.2 [78.7]	A [F]	0.50	NBLn1
C22	SW 72nd Ave./SW Bonita Rd.		Tigard	1.00	Signal	37.3	D	0.75	-

Notes: ID = Intersection ID #

TWSC = Two-way stop control

AWSC = All-way stop control

Delay = Average vehicle delay (seconds)

LOS = Level of service

V/C = Volume-to-capacity ratio

Ln = lane; EB = eastbound; NB = northbound; WB = westbound.

Delay, LOS, and V/C ratio reported for average and worst approach for two-way stop control and worst lane for all-way stop control.

1. Intersection analysis completed as part of 2016 Southwest Corridor study with review by ODOT, PBOT and Metro.
2. Intersection reflects Financially Constrained Project in future year 2035 analysis.

SW Carman Drive/SW Upper Boones Ferry Road Subarea

Table 5.2-4 shows the Synchro (HCM) analysis results under existing conditions for the AM and PM peak hours for the SW Carman Drive/SW Upper Boones Ferry Road subarea. Eight intersections were analyzed during the PM peak hour for this subarea, and three intersections were analyzed in the AM peak hour.

All of the analyzed intersections operate within applicable mobility targets under existing conditions in both peak hours in the SW Carman Drive/SW Upper Boones Ferry Road subarea. Data available for the existing Portland & Western Railroad crossing indicate that train traffic does not cross at this location on the average day during the PM peak hour; therefore, traffic along SW Upper Boones Ferry is not impacted by train traffic and operational outputs are not available.

Table 5.2-4: Segment C 2017 Existing Conditions HCM (Synchro) Analysis – SW Carman Drive/SW Upper Boones Ferry Road Subarea

ID	SW Carman Dr./SW Upper Boones Ferry Rd. Subarea	Note	Mobility Target		2017 Existing Conditions								
						AM				PM			
					Control	Delay	LOS	V/C	WLANE	Delay	LOS	V/C	WLANE
C23	I-5 northbound ramps/SW Carman Dr.		ODOT Ramp	0.85	Signal	27.1	C	0.68	-	33.2	C	0.80	-
C24	I-5 southbound ramps/SW Upper Boones Ferry Rd.		ODOT Ramp	0.85	Signal	16.6	B	0.46	-	16.7	B	0.57	-
C25	Burgerville/Chevron/SW Upper Boones Ferry Rd.		-	-	TWSC	PM Only				1.5 [22.6]	A [C]	0.34	NBLn1
C26	SW Sequoia Pkwy./SW Upper Boones Ferry Rd.	2	Tigard	1.00	Signal	14.2	B	0.56	-	15.0	B	0.52	-
C27	SW 72nd Ave. (north)/SW Upper Boones Ferry Rd.	2	Tigard	1.00	Signal	PM Only				37.8	D	0.85	-
C28	SW Upper Boones Ferry Rd./SW 72nd Ave. (south)	2	Tigard	1.00	Signal					10.8	B	0.58	-
C29	SW Durham Rd./SW Upper Boones Ferry Rd.	2	Tigard	1.00	Signal					45.1	D	0.71	-
C30a	SW Upper Boones Ferry Rd at RR				Railroad					-	-	-	-

Notes: ID = Intersection ID #

TWSC = Two-way stop control

Delay = Average vehicle delay (seconds)

LOS = Level of service

V/C = Volume-to-capacity ratio

Ln = lane; NB = northbound.

Delay, LOS, and V/C ratio reported for average and worst approach for two-way stop control and worst lane for all-way stop control.

1. Intersection analysis completed as part of 2016 Southwest Corridor study with review by ODOT, PBOT and Metro.
2. Intersection reflects Financially Constrained Project in future year 2035 analysis.

Bridgeport Subarea

Table 5.2-5 shows Synchro (HCM) analysis results for the existing AM and PM peak hours for the Bridgeport subarea in Segment C. Ten intersections were analyzed during the PM peak hour for this sub area, and one intersection was analyzed during the AM peak hour.

All of the analyzed intersections operate within applicable mobility targets under existing conditions in both peak hours in the Bridgeport subarea.

Table 5.2-5. Segment C 2017 Existing Conditions HCM (Synchro) Analysis – Bridgeport Subarea

ID	Bridgeport Subarea	Note	Mobility Target		2017 Existing Conditions								
						AM				PM			
					Control	Delay	LOS	V/C	WLANE	Delay	LOS	V/C	WLANE
C30b	SW 65th Ave./SW Lower Boones Ferry Rd.	1	Wash. Co.	0.99	Signal	PM Only				42.9	D	0.78	-
C31	I-5 northbound ramps/SW Lower Boones Ferry Rd.	1	ODOT Ramp	0.85	Signal					18.6	B	0.84	-
C32	I-5 southbound ramps/SW Lower Boones Ferry Rd.	1	ODOT Ramp	0.85	Signal					12.5	B	0.69	-
C33	SW 72nd Ave./SW Lower Boones Ferry Rd.	1	Wash. Co.	0.99	Signal	29.7	C	0.59	-	36.8	D	0.75	-
C34	SW 72nd Ave./Bridgeport Village/Terminal Station	1	Tigard	1.00	Signal	PM Only				15.0	B	0.43	-
C35	SW 72nd Ave./SW Durham Rd.	1	Tigard	1.00	Signal					12.6	B	0.59	-
C36	Park and Ride access/SW Lower Boones Ferry Rd.	1	Wash. Co.	0.99	TWSC					0.7 [12.3]	A [B]	0.13	WBLn1
C37	SW Travelers Ln./Park and Ride access/SW Lower Boones Ferry Rd.	1	Wash. Co.	0.99	TWSC					9 [139.9]	A [F]	0.89	EBLn1
C38	SW Hazel Fern Rd./SW Bridgeport Rd.	1	Wash. Co.	0.99	Signal					23.4	C	0.32	-
C39	REI/Bridgeport Village/SW Bridgeport Rd.	1	Wash. Co.	0.99	Signal					14.4	B	0.29	-

Notes: ID = Intersection ID #

TWSC = Two-way stop control

Delay = Average vehicle delay (seconds)

LOS = Level of service

V/C = Volume-to-capacity ratio

Ln = lane; EB = eastbound; WB = westbound.

Delay, LOS, and v/c ratio reported for average and worst approach for two-way stop control and worst lane for all-way stop control.

1. Intersection analysis completed as part of 2016 Southwest Corridor study with review by ODOT, PBOT and Metro.
2. Intersection reflects Financially Constrained Project in future year 2035 analysis.

Intersections Exceeding Mobility Targets Under Current Conditions

As mentioned in the previous section, under existing conditions, the only intersection exceeding applicable mobility targets in Segment C is the intersection of SW 65th Avenue at SW Haines Street/I-5 northbound ramps. This intersection is currently an all-way stop, and the northbound traffic must use a shared lane, which operates at capacity (V/C = 1.0). The majority of the northbound movements are traveling through the intersection after exiting northbound I-5 at exit 293 (SW Haines Street).

Preliminary Signal Warrant Analysis

Signal warrant analysis was completed for study area intersections in Segment C where new signals or significant changes to the signal were proposed. Details on the analyzed warrants can be found in Appendix D. Intersections there were analyzed are:

- C4: SW Hall Boulevard/SW Clinton Street
- C5: SW Hall Boulevard/SW Knoll Drive
- C12: SW Hunziker Street/SW Wall Street
- C16: SW 70th Avenue/SW Beveland Street

All of the Segment C study area intersections that might have new signals fail to meet traffic signal warrants under existing conditions (2015) conditions. The discussion of the signal warrant analysis for the future year 2035 in Segment C can be found in Section 5.3.6.

Queuing Analysis

Tigard Subarea

Under existing conditions, queuing along SW Hall Boulevard at the existing Westside Express Service (WES) Commuter Rail can extend beyond the next adjacent intersection (SW Commercial Street) for vehicles traveling southbound. Queuing at the WES crossing for northbound vehicles does not appear to be a concern under existing conditions. That said, there is a Tigard School District Bus facility south of the WES crossing along SW Hall Boulevard. School busses from this facility must stop at the WES tracks, causing minor delays along SW Hall Boulevard. This is an existing condition not changed by the project.

The SW Haines Street and SW 65th Avenue intersection is an all-way stop controlled intersection. Field observations at this intersection indicate queuing for traffic traveling northbound and eastbound in the PM peak period.

Table 5.2-6 illustrates the 95th percentile queues reported from Synchro HCM under existing conditions in the Tigard subarea of Segment C. For the Tigard subarea, there was one study intersection with railroad crossings that was analyzed for existing conditions.

Table 5.2-6. Segment C Synchro 2017 Existing PM Queuing – Tigard Subarea

Queuing Results for PM Peak Hour								
95th Percentile Queue								
Study Intersection No.		C4	C5	C12	C15	C17	C19	C20a
Approach	Movement	SW Hall Blvd./SW Clinton St.	SW Hall Blvd./SW Ash Ave.	SW Wall St./SW Hunziker St.	SW 72nd Ave./SW Beveland St.	SW 65th Ave./SW Haines St./I-5 northbound ramps	SW 68th Pkwy./SW Dartmouth St./I-5 southbound ramps	SW Hall Blvd./Existing Railroad (WES)
NB	Left					-	83	-
	Thru					15	196	225
	Right					-	45	-
SB	Left					-	259	-
	Thru					-	96	450
	Right					-	-	-
EB	Left					-	146	-
	Thru					7	179	-
	Right					-	-	-
WB	Left					-	-	-
	Thru					5	438	-
	Right					-	18	-

Under existing conditions, queuing along SW Hall Boulevard at the existing WES commuter rail can extend beyond the next adjacent intersection (SW Commercial Street) for vehicles traveling southbound. Queuing at the WES crossing for northbound vehicles does not appear to be a concern under existing conditions.

SW Carman Drive/SW Upper Boones Ferry Road Subarea

During the AM peak hour under existing conditions, the longest queues generally occur at the northbound ramp terminal at SW Carman Drive/Upper Boones Ferry Road because of commuter traffic bound for downtown Portland in the morning. Observed traffic queuing also exists in the PM peak period for westbound traffic along SW Carman Drive in the single lane approaching the northbound ramp terminal.

The PM peak hour experiences increased congestion throughout the subarea. Traffic heading eastbound along SW Upper Boones Ferry Road between the southbound ramp terminal and SW 72nd Avenue experiences more queuing and congestion in the right lane for vehicles trying to get onto I-5 southbound. In some cases, this queue will extend across the existing railroad crossing, but standing queues on the railroad tracks do not occur.

Field observations along SW Upper Boones Ferry Road indicate that the intersections at SW 72nd Avenue (north leg) and SW 72nd Avenue (south leg) cause slowing and some slow-moving queuing in the PM peak period. The AM peak period also experiences slowing at these locations but not to the same extent as the PM. Calibration of the simulation was performed to mimic field observations and are visually depicted in the queuing results pictured in Figure 5.2-6 and Figure 5.2-7 for the SW Carman Drive/SW Boones Ferry Road subarea.

Table 5.2-7 and Table 5.2-8 illustrate the 95th percentile queues reported from SimTraffic under existing conditions in the SW Carman Drive/SW Upper Boones Ferry Road subarea for the AM and PM peak hours, respectively. Figure 5.2-6 and Figure 5.2-7 show the queues depicted in the tables.

Table 5.2-7. Segment C SimTraffic 2017 Existing AM Queuing – SW Carman Drive/SW Upper Boones Ferry Road Subarea

Queuing Results for AM Peak Hour									
95th Percentile Queue									
Study Intersection No.		C23	C24	C25	C26	C27	C28	C29	C30a
Approach	Movement	I-5 northbound ramps/SW Carman Dr.	I-5 southbound ramps / SW Upper Boones Ferry Rd.	Burgerville/Chevron/SW Upper Boones Ferry Rd.	SW Sequoia Pkwy./SW Upper Boones Ferry Rd.	SW 72nd Ave. (north)/SW Upper Boones Ferry Rd.	SW Upper Boones Ferry Rd. / SW 72nd Ave. (South)	SW Durham Rd. / SW Upper Boones Ferry Rd.	SW Upper Boones Ferry Rd. / Existing RR Crossing
NB	Left	722	-	257	31	19			
	Thru	400	-	-	38	312			
	Right	-	-	257	-	156			
SB	Left	-	77	-	65	126			
	Thru	-	175	-	107	710			
	Right	-	-	-	61	-			
EB	Left	195	-	-	104	-			
	Thru	149	177	16	129	40			
	Right	-	-	-	-	-			
WB	Left	-	177	55	56	163			
	Thru	242	122	13	279	132			
	Right	-	-	-	51	-			

Table 5.2-8. Segment C SimTraffic 2017 Existing PM Queuing – SW Carman Drive/SW Upper Boones Ferry Road Subarea

Queuing Results for PM Peak Hour									
95th Percentile Queue									
Study Intersection No.		C23	C24	C25	C26	C27	C28	C29	C30a
Approach	Movement	I-5 northbound ramps/SW Carman Dr.	I-5 southbound ramps/SW Upper Boones Ferry Rd.	Burgerville/Chevron/SW Upper Boones Ferry Rd.	SW Sequoia Pkwy./SW Upper Boones Ferry Rd.	SW 72nd Ave. (north)/SW Upper Boones Ferry Rd.	SW Upper Boones Ferry Rd./SW 72nd Ave. (south)	SW Durham Rd./SW Upper Boones Ferry Rd.	SW Upper Boones Ferry Rd./existing railroad crossing
NB	Left	483	-	323	43	88	-	26	
	Thru	329	-	-	46	531	510	616	
	Right	-	-	323	-	264	203	-	
SB	Left	-	-	-	300	629	-	458	
	Thru	-	202	-	605	541	82	580	
	Right	-	136	-	226	-	-	202	
EB	Left	243	-	-	119	-	17	395	
	Thru	265	291	361	251	93	332	431	
	Right	-	-	-	-	-	-	-	
WB	Left	-	191	116	61	156	102	98	
	Thru	520	343	180	313	116	180	474	
	Right	-	-	-	19	-	-	364	

During the AM peak hour under existing conditions, the longer queues generally occur at the northbound ramp terminal at SW Carman Drive/Upper Boones Ferry Road because of commuter traffic bound for downtown Portland in the morning.

The PM peak hour experiences increased congestion throughout the subarea. Traffic heading eastbound along SW Upper Boones Ferry Road between the southbound ramp terminal and SW 72nd Avenue experiences more queuing and congestion in the right lane for vehicles trying to get onto I-5 southbound. In some cases, this queue will extend across the existing railroad crossing, but standing queues on the railroad tracks do not occur.

figure **5.2-6**

2017 Existing Conditions
7:30 AM - 8:30 AM Queues

Segment C: SW Carman Drive/SW Upper Boones Ferry Road

figure 5.2-7

2017 Existing Conditions
4:30 PM - 5:30 PM Queues

Segment C: SW Carman Drive/SW Upper Boones Ferry Road

Bridgeport Subarea

Analysis in this subarea during the AM peak period is limited to the intersection of SW Lower Boones Ferry Road at SW 72nd Avenue because prior analysis of the full interchange indicated this intersection would have the only potential AM peak traffic impacts from the park and ride. Existing queuing at this intersection begins to approach adjacent intersections for the southbound left turn and northbound right turns, likely from morning commuters heading toward the freeway.

The PM peak hour experiences increased congestion throughout the subarea. The areas of highest congestion are along SW Lower Boones Ferry Road between SW 72nd Avenue and the eastern edge of the subarea, where traffic is traveling west. Traffic also queues north along SW 72nd Avenue from SW Lower Boones Ferry Road, likely compounding into traffic congestion in the SW Carman Drive/SW Upper Boones Ferry Road subarea. Queuing also exists for vehicles attempting to head southbound on the freeway. Calibration of the simulation was performed to mimic field observations and are visually depicted in the queuing results pictured in Figure 5.2-8 and Figure 5.2-9 for the Bridgeport subarea.

In instances where queues back up to adjacent intersections, vehicles are likely sitting through multiple traffic signal cycles for various movements, even if the average operations for the overall intersection meets operational targets.

Table 5.2-9 and Table 5.2-10 illustrate the 95th percentile queues reported from SimTraffic under existing conditions in the Bridgeport subarea for the AM and PM peak hours, respectively. Figure 5.2-8 and Figure 5.2-9 show the queues depicted in the tables.

Table 5.2-9. Segment C SimTraffic 2017 Existing AM Queuing – Bridgeport Subarea

Queuing Results for AM Peak Hour – 95th Percentile Queue											
Study Intersection No.		**C30b[1]**	**C31[1]**	**C32[1]**	**C33**	**C34[1]**	**C35[1]**	**C36[1]**	**C37[1]**	**C38[1]**	**C39[1]**
Approach	**Movement**	SW 65th Ave./SW Lower Boones Ferry Rd.	I-5 northbound ramps/SW Lower Boones Ferry Rd.	I-5 southbound ramps/SW Lower Boones Ferry Rd.	SW 72nd Ave./SW Lower Boones Ferry Rd.	SW 72nd Ave./ Bridgeport Village/Terminal Station	SW 72nd Ave./SW Durham Rd.	Park and Ride access/SW Lower Boones Ferry Rd.	SW Travelers Ln./Park and Ride access/SW Lower Boones Ferry Rd.	SW Hazel Fern Rd./SW Bridgeport Rd.	REI/Bridgeport Village/SW Bridgeport Rd.
NB	Left	133	167	-	8	49	128	-	37	62	-
	Thru	144	229	-	146	135	91	67	11	85	64
	Right	-	117	-	241	-	-	-	-	-	43
SB	Left	-	-	167	383	13	-	74	36	58	61
	Thru	69	-	174	43	126	61	107	24	47	49
	Right	55	-	147	-	-	-	-	-	26	-
EB	Left	230	210	-	60	19	-	-	-	-	26
	Thru	345	141	173	120	12	46	-	58	77	40
	Right	151	-	221	-	-	149	-	-	-	-
WB	Left	90	-	369	271	36	-	39	-	72	33
	Thru	475	373	198	196	12	35	-	68	104	72

Queuing Results for AM Peak Hour – 95th Percentile Queue											
Study Intersection No.		C30b[1]	C31[1]	C32[1]	C33	C34[1]	C35[1]	C36[1]	C37[1]	C38[1]	C39[1]
Approach	Movement	SW 65th Ave./SW Lower Boones Ferry Rd.	I-5 northbound ramps/SW Lower Boones Ferry Rd.	I-5 southbound ramps/SW Lower Boones Ferry Rd.	SW 72nd Ave./SW Lower Boones Ferry Rd.	SW 72nd Ave./ Bridgeport Village/Terminal Station	SW 72nd Ave./SW Durham Rd.	Park and Ride access/SW Lower Boones Ferry Rd.	SW Travelers Ln./Park and Ride access/SW Lower Boones Ferry Rd.	SW Hazel Fern Rd./SW Bridgeport Rd.	REI/Bridgeport Village/SW Bridgeport Rd.
	Right	-	367	-	84	-	-	39	-	-	46

[1]Data is from intersection analysis completed as part of 2016 SWC study with review by ODOT, PBOT and Metro.

Table 5.2-10. Segment C SimTraffic 2017 Existing PM Queuing – Bridgeport Subarea

Queuing Results for PM Peak Hour – 95th Percentile Queue											
Study Intersection No.		C30b	C31	C32	C33	C34	C35	C36	C37	C38	C39
Approach	Movement	SW 65th Ave./SW Lower Boones Ferry Rd.	I-5 northbound ramps/SW Lower Boones Ferry Rd.	I-5 southbound ramps/SW Lower Boones Ferry Rd.	SW 72nd Ave./SW Lower Boones Ferry Rd.	SW 72nd Ave./Bridgeport Village/Terminal Station	SW 72nd Ave./SW Durham Rd.	Park and Ride access/SW Lower Boones Ferry Rd.	SW Travelers Ln./Park and Ride access/SW Lower Boones Ferry Rd.	SW Hazel Fern Rd./SW Bridgeport Rd.	REI/Bridgeport Village/SW Bridgeport Rd.
NB	Left	146	291	-	79	165	230	-	58	83	-
	Thru	148	299	-	199	155	89	131	36	158	117
	Right	-	178	-	315	-	-	-	-	-	63
SB	Left	-	-	145	549	71	46	50	37	88	179
	Thru	580	-	164	409	369	250	43	81	123	91
	Right	165	-	162	-	292	-	-	-	38	-
EB	Left	391	279	-	120	70	-	-	-	44	55
	Thru	459	219	563	324	61	133	-	108	209	80
	Right	408	-	432	-	-	388	-	-	-	-
WB	Left	373	-	412	386	98	-	-	-	152	64
	Thru	845	282	218	275	49	81	-	88	206	110
	Right	-	324	-	98	-	-	73	-	-	70

figure **5.2-8**

2017 Existing Conditions
7:30 AM - 8:30 AM Queues
Segment C: Bridgeport Subarea

figure **5.2-9**

2017 Existing Conditions
4:30 PM - 5:30 PM Queues
Segment C: Bridgeport Subarea

5.2.4. Segment C Freight Operations

Federal, state and local jurisdictions designate freight routes to ensure that those roadways are maintained in a manner that allows for the effective operation of freight-hauling trucks. Freight designations of major facilities within the study corridor include the following:

- The National Highway System, or NHS, is a network of highways serving strategic economic, defense and transportation facilities such as ports, terminals and railway stations. States are encouraged to focus federal highway funding on maintaining the NHS in a state of good repair.
- The OHP state freight system has implications for roadway design and mobility standards to accommodate trucks, and may override exceptions granted from other designations.
- ORS 366.215 specifies a series of "Reduction Review" routes, which are designated for the movement of oversized freight trucks. These routes require review during planning, project development review and maintenance to examine any "hole in the air" capacity in order to ensure that freight movement is not restricted.
- Regional freight routes are designated by Metro and are intended to prioritize areas for investment in freight mobility.
- Tigard's freight network designates the most desirable routes for trucks and is intended to ensure that the system is designed to accommodate necessary freight movement.

In Segment C, none of the potential light rail alignment alternatives would operate on streets designated as freight routes.

5.2.5. Segment C On-Street Parking

The supply and utilization of on-street parking within the footprint of the proposed light rail alignment alternatives was determined by measuring the currently available and legal parking within the public right of way using 22.5 feet[5] to define a parking space. In some locations, there is privately owned land that is used for parking adjacent to the alignments, and these locations were not included in the inventory. The utilization survey was conducted on weekdays in May and August 2017.

In Segment C: Tigard and Tualatin, there are three locations with existing on-street parking within the alignment alternatives footprints: in the vicinity of SW Dartmouth Street and SW 70th Avenue (Alternatives C1, C2, C5 and C6), SW Beveland Street between SW 69th Avenue and SW Hermoso Way (Alternatives C1, C2, C5 and C6), and SW Ash Avenue from SW Scoffins Street to SW Commercial Street (Alternatives C1, C2 and C5).

In several locations in Segment C, there are no curbs or signs defining where legal on-street parking exists. The inventory process included judgments based on available information to estimate the number of legal parking spaces in these locations. Table 5.2-11 summarizes the results of the inventory and utilization survey.

[5] City of Portland Bureau of Development Services, Permanent Administrative Rules, Streets, Alleys, Shared Courts, Common Greens and Pedestrian Connections, July 19, 2010.

Table 5.2-11. Segment C On-Street Parking Supply and Utilization

Parking Location	Alignment Alternatives	On-Street Parking Supply	AM Utilization	AM Percent Utilization	PM Utilization	PM Percent Utilization	Parking Restrictions
SW Dartmouth St. and SW 70th Ave.	C1, C2, C5, C6	29	23	79%	1	3%	Plan sheets include replacing 21 angled, on-street spaces
SW Beveland St. west of SW 69th Ave.	C1, C2, C5, C6	63	34	54%	11	17%	Signed No Parking near the intersection of SW Beveland St. and SW 72nd Ave.
SW Ash Ave. from SW Scoffins St. to SW Commercial St.	C1, C2, C5	18	8	44%	13	72%	Three spaces near SW Scoffins St. signed No Parking 8:00–4:30

There are also local streets perpendicular to the light rail alignment where the project would modify the streetscape for a small portion of the street immediately adjacent to the alignment, often adding curbs, water quality facilities, sidewalks and bike lanes. These streetscape modifications have not been defined in detail and may or may not include on-street parking.

5.2.6. Segment C Safety Analysis

The following safety analysis uses the same methodology and datasets as described in Section 3.2.6, Safety Analysis. The crash history maps are included in Appendix BB.

In Segment C, there are three identified clusters of fatal and serious injury collisions:

- OR 99W between I-5 and OR-217
- OR 99W/SW Hall Boulevard
- Oregon Highway 217 (OR-217)/SW 72nd Avenue

In the study area in the period of 2011 to 2015, there were a total of 24 collisions, 3 fatal injuries and 21 serious injuries. The two most common collision types were fixed-object and turning-related collisions. Table 5.2-12 shows the collision severity and Table 5.2-13 shows the collision type in the study area at each identified cluster. A map of the clustered data is provided in Appendix BB.

Table 5.2-12. Segment C Fatal and Serious Collision Severity (2011–2015)

Location	Fatal	Serious Injury	Total
Study Area Corridor	3	21	24
OR 99W between I-5 and OR-217	2	12	14
OR 99W/SW Hall Boulevard	1	4	5
OR-217/SW 72nd Avenue	0	4	4
I-5/SW Lower Boones Ferry Road Interchange	0	1	1

Table 5.2-13: Segment C Fatal and Serious Injury Collision Type (2011–2015)

Location	Pedestrian	Bicycle	Rear-End	Fixed Object	Turning	Other[1]	Total

Study Area Corridor	7	1	7	3	4	2	24
OR 99W in Tigard	4	1	3	2	3	1	14
Highway 99W/Hall Boulevard	2	0	3	0	0	0	5
Highway 217/72nd Avenue	1	0	1	0	1	1	4
I-5/Lower Boones Ferry Road Interchange	0	0	0	1	0	0	1

[1]Other collision types include head-on, sideswipe and non-collision.

OR 99W between I-5 and OR-217[6]

Along OR 99W from the I-5 interchange to the OR-217 interchange, there were a total of 14 collisions (fatal or serious injury), 2 of which were fatal and 12 of which resulted in serious injuries. Of the total collisions, four involved a pedestrian, four were turning-related, and three were rear end.

The two fatalities were pedestrians and occurred at night. Along this segment of the corridor, there are several pedestrian generators, such as restaurants and shopping businesses, as well as many bus stops for Route 12-Parkrose TC via Portland City Center. The segment is a high-speed, high-volume motor vehicle route with approximately five signals that provide controlled crossing locations for pedestrians.

Three of the four pedestrian collisions were at a midblock location (not at an intersection), and all occurred between 8 p.m. and 2 a.m., when lighting conditions make pedestrians less visible. The collision reports indicate that there was lighting at the time of the collisions; however, the reports also stated that the pedestrians hit while in the roadway were not visible, indicated that although there is lighting along OR 99W, it could be improved to increase visibility.

The turning collisions, one of which involved a bicycle, were caused either by failing to yield correctly or by disregarding the traffic signal.

Recommended improvements include intersection illumination, raised median crossings (median refuge island), crosswalk markings and advance pedestrian warning signs at uncontrolled locations, and considering pedestrian signals at key crossing locations.

The second All Roads Transportation Safety (ARTS) project in the project alignment is along OR 99W from SW Versailles Road to SW Barbur Boulevard in downtown Tigard, and is intended to improve corridor safety and access to transit. Design of the project is expected to begin in late 2018. The project includes sidewalk infill, enhanced pedestrian crossings, bus shelters and pads, bike and pedestrian facilities, retaining walls and drainage improvements, and transit priority signals.

5.3. Future Conditions in Segment C

This section identifies potential impacts to non-motorized and motorized modes of travel associated with the No-Build Alternative and the light rail alternatives in 2035 within the segment, and in 2045 for freeway ramp terminals. In addition, potential improvements outside of this project are developed to address these potential deficiencies in the transportation network.

[6] Note that the SW Corridor Light Rail Project would not impact traffic operations or safety on OR 99W in this area. The collision information presented here was collected for a broad study area and is made available as a resource for ODOT and the City of Tigard.

5.3.1. Alternatives Description

No-Build Alternative

The No-Build Alternative assumes that the project will not be built in any capacity. In addition to the proper No-Build Alternative, Segment C also includes a secondary No-Build Alternative that includes a project from the Tigard Triangle to extend SW Beveland Street across OR-217 to intersect with SW Hunziker Street at SW Wall Street. To account for this potential project and provide a more appropriate No-Build Alternative comparison for Alternative C6 (Wall and I-5 Branched), a secondary set of No-Build Alternative volumes was developed for Segment C in Tigard that assumes that the overcrossing is constructed in the future.

Light Rail Alternatives

Segment C has six distinct alignment alternatives: C1, C2, C3, C4, C5 and C6. A full description of these alignment alternatives is included in Chapter 2 of the Draft EIS.

Operations and Maintenance (O&M) Facilities Options

There are four potential options for the locations for an O&M facility to store and maintain the vehicles required for the Southwest Corridor Light Rail Project. All four locations would displace active light industrial buildings. The trip generation for the existing land uses was estimated and compared with the anticipated trip generation for the O&M facility. The estimated trips for the existing uses are shown for each site in Table 5.3-1.

Table 5.3-1. Estimated Trip Generations for O&M Facilities Options

O&M Facilities Options	Estimated Existing Employees	Estimated Existing AM Peak Hour Trips	Estimated Existing PM Peak Hour Trips	Estimated Existing Daily Trips
Hunziker Full and Hunziker Partial B	185	81	78	559
Hunziker Partial A	15	7	6	45
Branched 72nd	505	222	212	1,525
Through 72nd	58	26	24	175

Note: Existing trip estimate is based on ITE Trip Generation 9th Edition average rate for light industrial use.

Based on employee density at TriMet's Ruby Junction O&M facility, the planned O&M facility for the project is estimated to have approximately 130 employees reporting to the site in three shifts. Because of the timing of the shifts, only 10 auto trips are expected to be generated by the site both during the AM peak hour and the PM peak hour. The planned O&M facility is estimated to generate fewer trips during the AM and PM peak hours than the existing land uses for all but the Hunziker Partial A for which the site is estimated to generate three additional AM peak-hour trips and four additional PM peak-hour trips. The small increase in additional trips at Hunziker Partial A would have no impact on traffic operations on nearby streets.

5.3.2. Segment C Active Transportation

With the No-Build Alternative, pedestrian and bicycle activity would remain similar to existing activity, with some increased activity as a result of the forecasted residential and employment growth in the corridor, and planned improvements to bicycle and pedestrian facilities. Previous planning in the corridor identified a series of station access improvements that would improve and facilitate bicycle

and pedestrian access to the planned light rail stations. These projects are not included as project elements, but the potential impacts of these planned improvements are referenced in the discussion of active transportation impacts.

Impacts on Pedestrian and Bicycle Facilities

The light rail alternatives would include new or improved pedestrian and bicycle facilities on all in-street segments of the light rail alignments and on structures crossing OR-217. These new and improved facilities would fill in existing gaps in the sidewalk and bike route system, and attract increased pedestrian and bicycle activity on the streets and structures. Areas near light rail stations would see an increase in pedestrian and bicycle activity as a result of riders accessing the stations.

In Segment C: Tigard and Tualatin, the alignment for all of the light rail alignment alternatives would travel on local streets and on exclusive right of way. These alignments would cross a mix of local streets, arterials and state highways at intersections that would include pedestrian crosswalks. The Segment C alignment alternatives would include from 8 to 14 new designated pedestrian crossings.

The bicycle facilities included with the Segment C alignment alternatives are shown in Table 5.3-2.

Table 5.3-2. Segment C – Bicycle Improvements

Bicycle Improvements	C1: Ash-I-5	C2: Ash-Railroad	C3: Clinton-I-5	C4: Clinton-Railroad	C5: Ash-I-5 Branched	C6: Wall-I-5 Branched
SW Beveland St. bike lane, SW 70th Ave. to SW Hermoso Way	•	•				
Multi-use path on OR-217 structure at SW Beveland St. through SW Ash Ave. to SW Commercial St.	•	•				
Multi-use path on OR-217 structure at SW Beveland St. via SW Wall St. to SW Tech Center Rd.						•
Multi-use path on OR-217 structure at SW Beveland St. via SW Clinton St. to SW Commercial St.			•	•		
Multi-use path on OR-217 structure at SW 70th Ave. to I-5					•	•
I-5 multi-use path Bonita Station (I-5 and Railroad) to SW Upper Boones Ferry Rd.	•		•		•	•

Station Access Improvements

In addition to the walking and biking facility investments included as part of the alignment alternatives, the light rail project includes five station access improvement options in Segment C (see Table 5.3-3).

Table 5.3-3: Segment C – Station Access Improvements

Segment C: Tigard and Tualatin	Major Design Elements	Potential Impacts	Notes
Station Access Improvement			
SA24: Baylor Sidewalks	Sidewalk, water quality	Possible property impacts	Sidewalk extension from LRT project sidewalk (plan sheet C70 – C100)
SA25: 72nd Sidewalks and Bikeway	Sidewalk, bike lanes, water quality	Possible property impacts, parking impacts, traffic impacts during construction	
SA26: Hall Sidewalks	Sidewalk, RR crossing	Possible property impacts, access impacts	
SA27: Bonita Sidewalks and Bikeway	Sidewalk infill, bike lanes, restriping	Possible property impacts, on-street parking impacts	
SA28: Carman Sidewalks and Bikeway	Sidewalk, bike lanes, water quality	Possible property impacts, on-street parking impacts	

5.3.3. Segment C System-wide Analysis

The proposed alignment alternatives in Segment C result in minor changes to the roadway network that maintain roadway capacity and motor vehicle traffic patterns. From a system-wide perspective, all light rail alternatives are expected to perform similarly for motor vehicle traffic. The effects of a SW Beveland Street roadway bridge over OR-217 on motor vehicle traffic patterns are discussed separately from the effects of the light rail project, below.

Impacts of the Light Rail Alternatives

With the light rail alternatives, total north-south motor vehicle volume at screenlines would change as follows:

- SW Bonita Road screenline: no change (AM and PM)
- Tualatin River screenline (south of terminus): increases by less than 1 percent (AM and PM)

Pacific Highway (OR 99W) and I-5 would see changes in volume of less than 1 percent throughout this segment. The segment of SE 72nd Avenue between Pacific Highway and SW Dartmouth Street would see a reduction of 6 percent/4 percent (AM/PM). No other significant impacts were observed. Small volume increases in Segment C are due to vehicles accessing the park and ride lots that are adjacent to I-5.

SW Beveland Street Overcrossing Impacts

The planned extension of SW Beveland Street across OR-217 was evaluated for its effects on motor vehicle travel patterns (see Figure 5.3-1).

A new overcrossing of OR-217 at SW Beveland Street attracts motor vehicle trips along SW 72nd Avenue and SW Hunziker Street north of SW Beveland Street, an increase of 25 percent/19 percent (AM/PM) on SE 72nd Avenue and 20 percent/24 percent (AM/PM) on SW Hunziker Street. It would reduce motor vehicle traffic along the same two streets south of SW Beveland Street to the intersection of SW 72nd Avenue/SW Hunziker Street, specifically a reduction of 12 percent/13 percent (AM/PM) on SW 72nd Avenue including its OR-217 overcrossing and 51 percent/57 percent (AM/PM) on SW Hunziker Street. The segment of SW Dartmouth Street between SW 72nd and SW 68th avenues would see an increase of 12 percent/20 percent (AM/PM). No other significant impacts were observed.

figure **5.3-1**

Systemwide Traffic Diversion Analysis – ***Beveland-OR 217 Overcrossing***

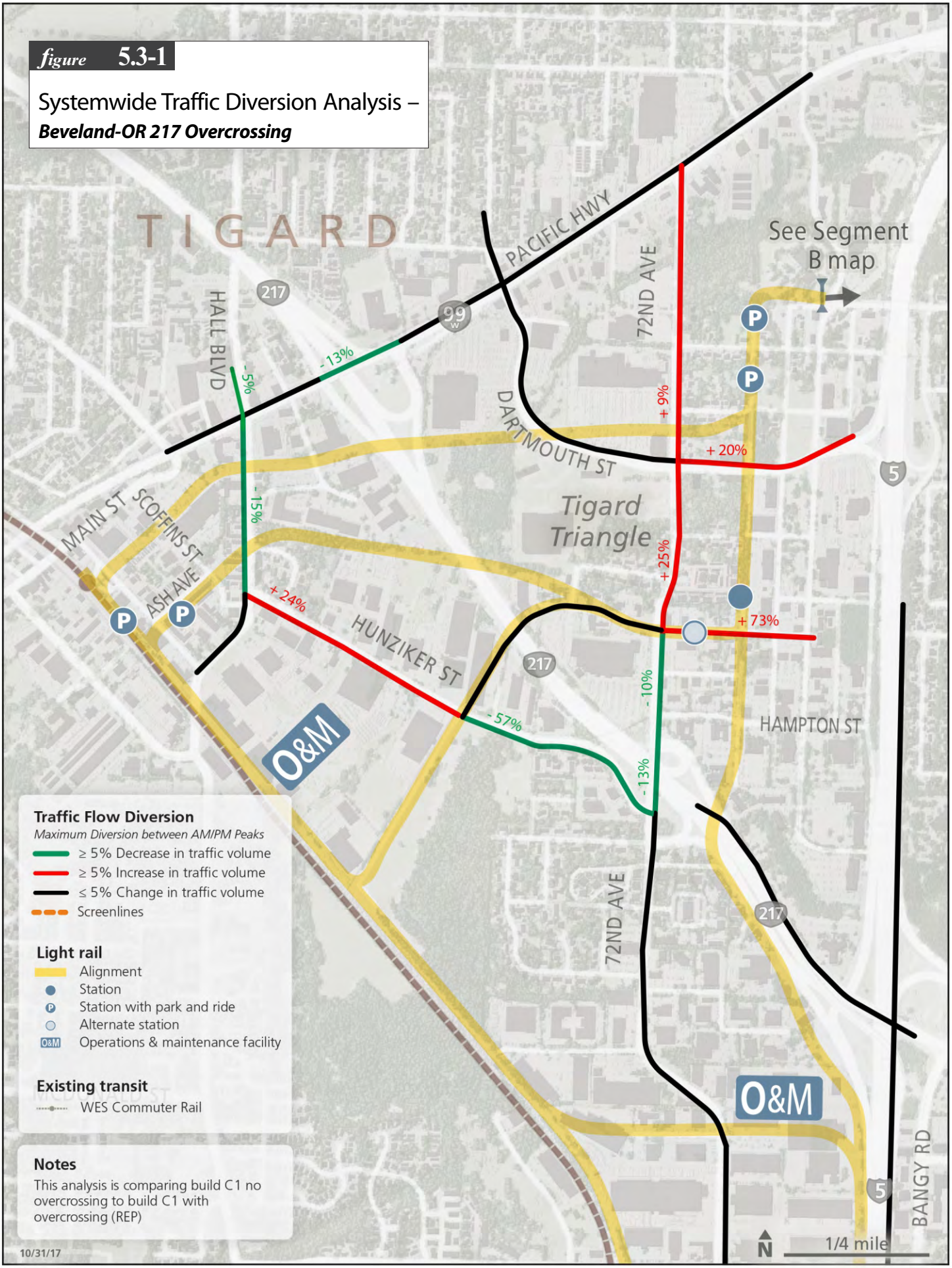


Table 5.3-4. Peak Two-hour Motor Vehicle Volumes in Segment C

			Effects of Light Rail Alternatives				Effects of SW Beveland St./OR-217 Overcrossing			
			2035 No-Build (With Overcrossing)		2035 Light Rail (All C Alignment Alternatives, With Overcrossing)		2035 Light Rail No Overcrossing		2035 Light Rail With Overcrossing	
			2-hour Volume		Change from No-Build		2-hour Volume		Change from No-Build	
	From	To	AM	PM	AM	PM	AM	PM	AM	PM
A	**Pacific Hwy W**									
1	Greenburg	Hall	6,534	6,712	-0.6%	-0.2%	6,498	6,696	-0.1%	0.0%
2	Hall	OR-217 SB	7,199	6,900	-0.7%	+0.0%	3,501	2,654	-1.2%	-1.8%
3	OR-217 SB	OR-217 NB	7,027	7,467	-0.4%	-0.1%	2,866	3,757	+10.2%	-13.2%
4	217 NB	Dartmouth	8,059	8,128	-0.4%	+0.0%	3,891	3,763	-1.8%	-1.6%
5	Dartmouth	72nd	6,604	6,562	-0.2%	+0.2%	3,014	3,314	-0.0%	-0.4%
6	72nd	69th	7,522	7,974	-1.0%	-0.5%	3,407	4,308	+0.9%	-0.3%
B	**72nd/Lower Boones Ferry**									
1	Pacific Hwy.	Dartmouth	918	1,412	-6.2%	-3.5%	394	994	+9.1%	+0.7%
2	Dartmouth	Beveland	2,020	2,067	-2.4%	-1.5%	1,224	1,079	+25.3%	+19.3%
3	Beveland	OR-217 NB	2,485	3,069	+3.3%	+1.1%	1,122	1,599	-9.7%	-10.4%
4	OR-217 NB	Hunziker	2,757	2,802	-0.6%	+0.9%	1,333	1,455	-12.5%	-12.6%
5	Hunziker	OR-217 SB	3,094	3,146	-0.9%	+0.3%	1,507	1,621	+1.9%	+4.8%
6	OR-217 SB	Bonita	3,976	3,491	+0.0%	+0.3%	2,498	1,933	+3.5%	+3.4%
7	Bonita	72nd/UBF (n)	3,188	3,432	+0.2%	+1.3%				
8	72nd/UBF(n)	72nd/UBF(s)	6,194	6,610	-0.3%	-0.5%				
9	72nd/UBF(s)	Durham	1,938	2,118	-3.0%	-2.5%				
10	Durham	LBF/Bridgeport	4,447	4,740	-1.8%	-1.3%				
11	LBF/Bridgeport	UBF/LBF	2,830	3,223	+1.8%	+0.4%				
C	**Hunziker**									
1	Hall	Wall	2,372	2,543	-1.5%	-1.0%	984	1,157	+19.7%	+24.2%
2	Wall	72nd	897	725	-1.7%	-5.4%	429	341	-50.8%	-57.3%
D	**Hall**									
1	Pfaffle	Pacific Hwy.	2,903	3,066	-1.6%	-0.4%	1,211	1,671	-5.0%	-4.4%
2	Pacific Hwy.	Hunziker	1,611	1,590	-1.7%	-0.6%	987	724	-11.3%	-15.2%
3	Hunziker	Commercial	2,282	2,464	-0.2%	+0.1%	846	984	+2.7%	+4.4%
E	**Dartmouth**									
1	Pfaffle	Pacific Hwy.	1,015	1,401	-0.7%	-0.6%	160	617	-1.3%	-4.6%
2	Pacific Hwy.	72nd	1,656	2,102	-0.9%	-0.9%	962	1,086	-4.3%	-0.4%
3	72nd	68th	2,154	1,985	+0.1%	+0.1%	1,495	786	+12.2%	+20.4%
F	**Wall/Beveland**									
1	(west of)	Hunziker	58	319	+12.1%	+4.7%				
2	Hunziker	72nd	1,418	1,499	-2.0%	-0.3%				
3	72nd	68th	586	758	-1.2%	+1.5%				
G	**I-5**									
1	I-205	Nyberg	26,052	26,912	+0.2%	+0.1%				
2	Nyberg	LBF	29,696	31,230	+0.2%	+0.2%				
3	LBF	UBF	28,590	29,809	-0.1%	-0.1%				
4	UBF	OR-217	31,331	32,520	-0.1%	-0.1%				
5	OR-217	Haines	20,649	21,887	-0.4%	-0.3%				
H	**OR-217**									
1	I-5	72nd	19,545	20,329	+0.2%	+0.2%				
J	**Tualatin-Sherwood Road**									
1	95th	Boones Ferry	7,890	7,937	-0.1%	0.0%				
2	Boones Ferry	I-5	9,076	9,128	+0.1%	+0.2%				
K	**Upper Boones Ferry/Boones Ferry**									
1	72nd	Durham	4,257	4,491	+1.0%	+0.5%				
2	Durham	Bridgeport	3,071	3,102	-0.3%	-0.4%				
3	Bridgeport	LBF/BF	3,298	3,236	+0.5%	+0.7%				
4	LBF/BF	Martinazzi	6,128	6,459	+1.1%	+0.5%				
North-South Screenlines										
Measured at Bonita (I-5, 72nd)			34,519	35,952	-0.1%	+0.0%				
Measured at Tualatin Rvr (I-5, Boones Ferry)			35,824	37,689	+0.4%	+0.2%				

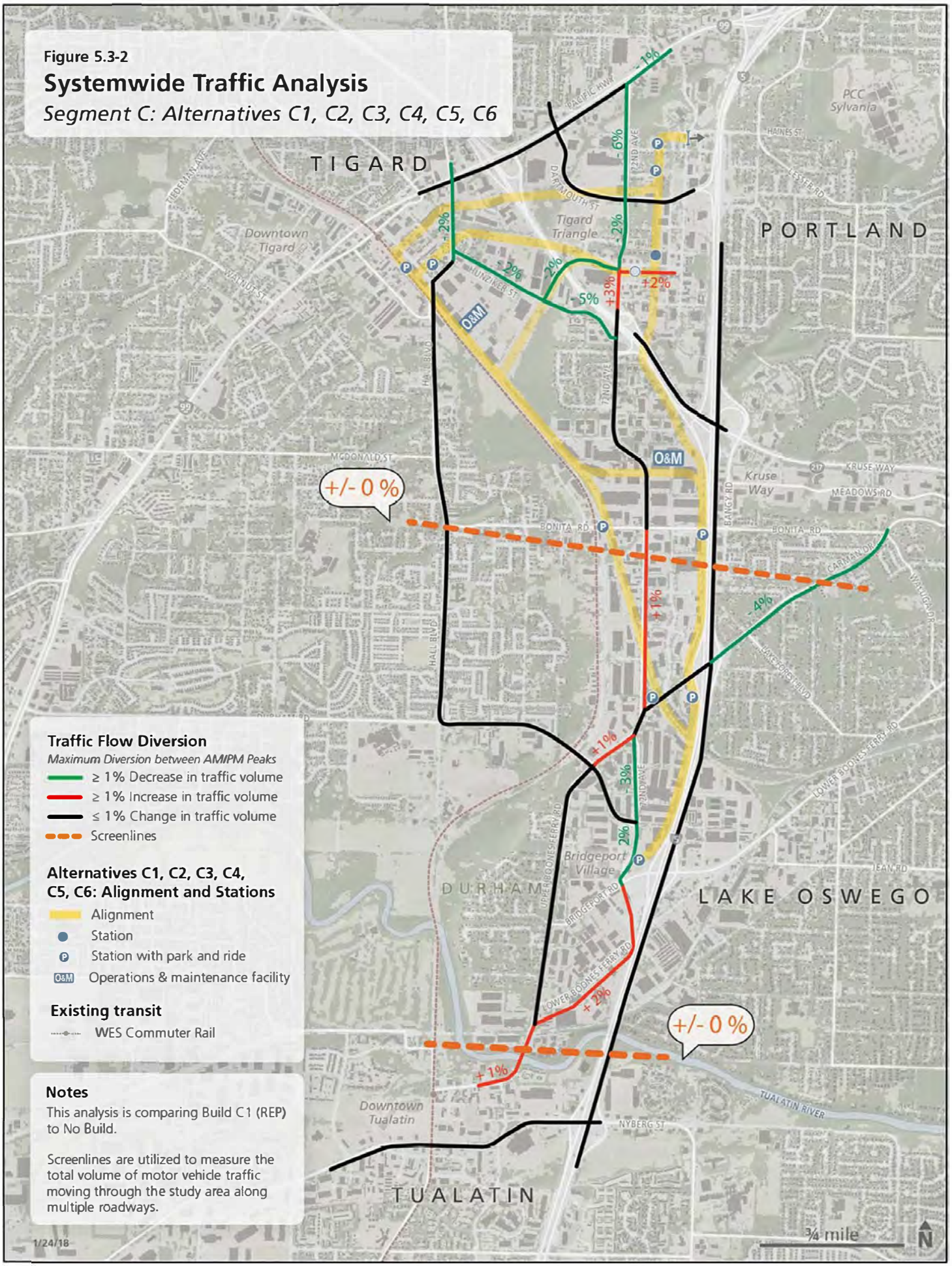


Figure 5.3-2
Systemwide Traffic Analysis
Segment C: Alternatives C1, C2, C3, C4, C5, C6
TIGARD
PORTLAND
DURHAM
LAKE OSWEGO
TUALATIN
Downtown Tigard
Tigard Triangle
Bridgeport Village
Downtown Tualatin
Kruse Way
PCC Sylvania
O&M
+/- 0 %
+/- 0 %
- 1%
- 6%
- 2%
- 2%
- 2%
- 2%
- 5%
+3%
+2%
+ 1%
- 4%
+1%
- 3%
- 2%
+ 2%
+ 1%
Traffic Flow Diversion
Maximum Diversion between AM/PM Peaks
≥ 1% Decrease in traffic volume
≥ 1% Increase in traffic volume
≤ 1% Change in traffic volume
Screenlines
Alternatives C1, C2, C3, C4, C5, C6: Alignment and Stations
Alignment
Station
Station with park and ride
Operations & maintenance facility
Existing transit
WES Commuter Rail
Notes
This analysis is comparing Build C1 (REP) to No Build.
Screenlines are utilized to measure the total volume of motor vehicle traffic moving through the study area along multiple roadways.
1/24/18
¾ mile
N

5.3.4. Segment C Motor Vehicle Operations

2035 No-Build Alternative

Tigard Subarea

Table 5.3-5 and Table 5.3-6 show Synchro analysis results under the No-Build Alternative for the PM peak hour in the Tigard subarea of Segment C. Twenty-two intersections were analyzed for the Tigard subarea under the No-Build Alternative.

Mobility targets for the appropriate jurisdiction are shown for every intersection. Intersection results that do not meet those mobility targets in a particular peak hour are shaded gray. The worst lane group is listed under the WLANE columns for each two-way stop controlled intersection.

During the PM peak hour, as in existing conditions, the intersection of SW 65th Avenue at SW Haines Street/I-5 northbound ramps exceeds the applicable mobility targets.

Intersection volumes are shown graphically in Figure 5.3-3.

Table 5.3-5. Segment C 2035 No-Build Alternative HCM (Synchro) Analysis – Tigard Subarea (Tigard Downtown and Tigard Triangle)

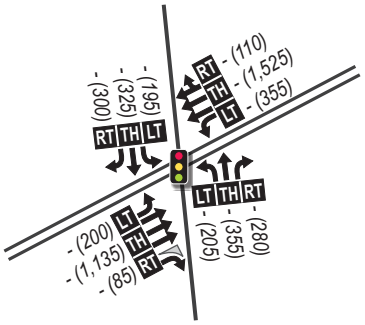
ID	Tigard Subarea (Tigard Downtown & Tigard Triangle)	Mobility Target		2035 No-Build (Without Overcrossing)				
					PM			
				Control	Delay	LOS	V/C	WLANE
C2	SW Hall Blvd./OR 99W	ODOT	1.10	Signal	52.3	D	0.91	-
C3	SW Greenburg Rd./SW Main St./OR 99W	ODOT	1.10	Signal	35.0	C	0.81	-
C4	SW Hall Blvd./SW Clinton St.	ODOT	1.10	TWSC	1.0 [50.6]	A [F]	0.17	WBLn1
C5	SW Hall Blvd./SW Ash Ave.	ODOT	1.10	TWSC	1.4 [61.3]	A [F]	0.26	EBLn1
C6	SW Commercial St./SW Main St.	Tigard	1.00	TWSC	5.4 [65.5]	A [F]	0.61	NBLn1
C7	SW Scoffins St./SW Main St.	Tigard	1.00	AWSC	31.4 [40.9]	D [D]	0.86	EBLn1
C8	Magno Humphries Driveway/SW Commercial St.	-	-	TWSC	0.9 [9.6]	A [A]	0.04	EBLn1
C9a	SW Hall Blvd./SW Hunziker St./SW Scoffins St. (north)	ODOT	1.10	Signal	26.1	C	0.73	-
C9B	SW Hall Blvd./SW Hunziker St./SW Scoffins St. (south)	ODOT	1.10		36.1	D	0.76	-
C10	SW Hall Blvd./SW Commercial St.	ODOT	1.10	TWSC	10 [238.9]	A [F]	0.96	EBLn1
C11	SW Hall Blvd./SW Burnham St.	ODOT	1.10	Signal	28.6	C	0.80	-
C12	SW Wall St./SW Hunziker St.	Tigard	1.00	TWSC	0.9 [15.5]	A [C]	0.16	NBLn1
C13	SW 72nd Ave./SW Dartmouth St.	Tigard	1.00	Signal	26.4	C	0.87	-
C14	SW 72nd Ave./SW Baylor St.	Tigard	1.00	TWSC	7.5 [49]	A [E]	0.74	WBLn1
C15	SW 72nd Ave./SW Beveland St.	Tigard	1.00	Signal	26.2	C	0.74	-
C16	SW 70th Ave./SW Beveland St.	Tigard	1.00	TWSC	0.3 [10.6]	A [B]	0.02	NBLn1
C17	SW 65th Ave./SW Haines St./I-5 northbound ramps	ODOT Ramp	0.85	AWSC	**51.7 [87.5]**	**F [F]**	**1.08**	**NBLn1**
C18	SW 68th Pkwy./SW Atlanta St.	Tigard	1.00	AWSC	18.4 [26.5]	C [D]	0.77	WBLn2
C19	SW 68th Pkwy./SW Dartmouth St./I-5 southbound ramps	ODOT Ramp	0.85	Signal	30.4	C	0.69	-
C20a	SW Hall Blvd./Existing Railroad (WES)			Railroad Signal	3.6	A	0.54	-

Key: [Worst stop-controlled delay] for TWSC intersections.

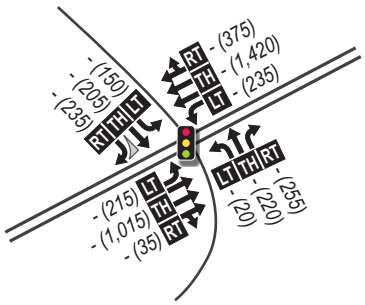
V/C represents intersection average for signals and worst movement for stop controlled intersections.

Ln = lane; NB = northbound.

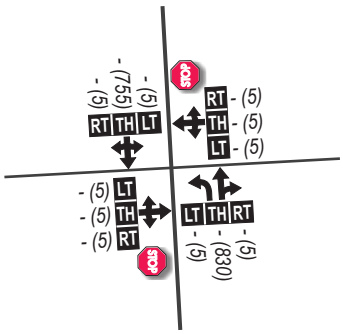
C2. *99W @ SW Hall Blvd.*



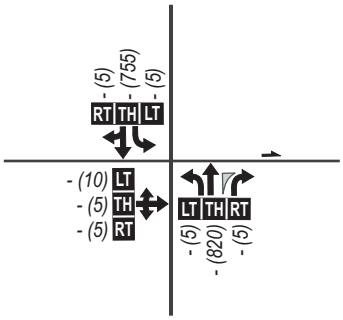
C3. *99W @ SW Greenburg Rd./SW Main St.*



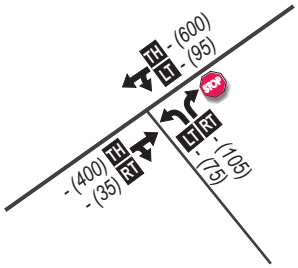
C4. *SW Hall Blvd. @ Clinton*



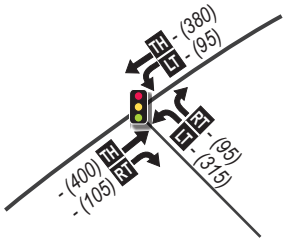
C5. *SW Hall Blvd. @ Ash/Knoll*



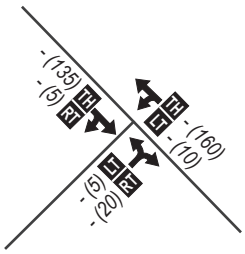
C6. *SW Main St. @ SW Commercial St.*



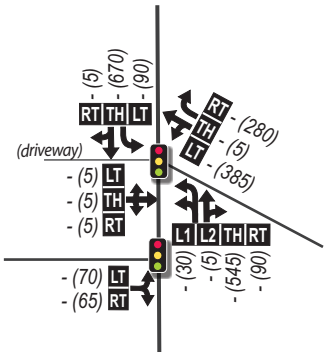
C7. *SW Main St. @ SW Scoffins St.*



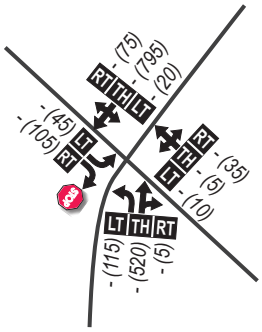
C8. *SW Commercial St. @ Magno Humphries Driveway*



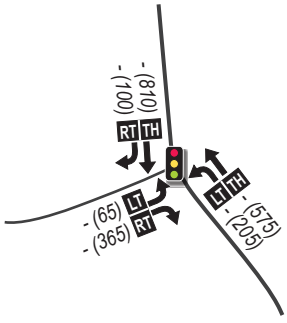
C9. *SW Hall Blvd. @ SW Hunziker St./ SW Scoffins St.*



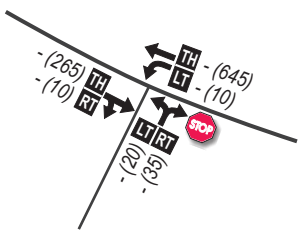
C10. *SW Hall Blvd. @ SW Commercial St.*



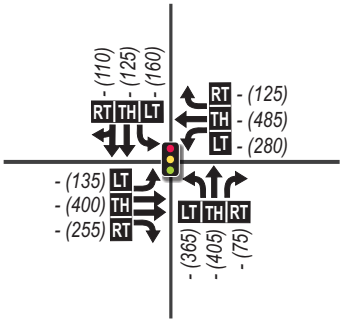
C11. *SW Hall Blvd. @ SW Burnham St.*



C12. *SW Hunziker St. @ Beveland Bridge/Wall St.*



C13. *SW 72nd Ave. @ SW Dartmouth St.*



LEGEND

00. - Study Intersection No.
STOP - Stop Sign
- Yield Sign
- Traffic Signal
← - Lane Configuration
AM (PM) - Peak Hour Traffic Volumes
LT TH RT - Volume Turn Movement
Left•Thru•Right

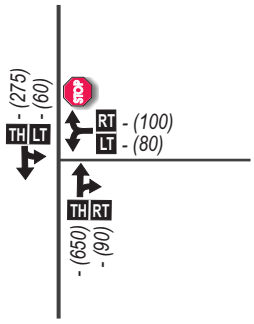
DKS

No Scale

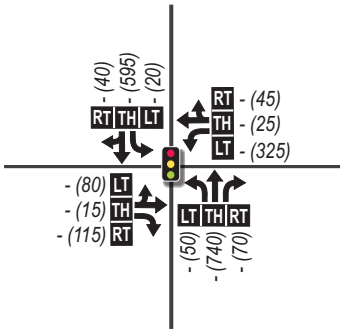
figure **5.3-3a**

2035 No Build Alternative
AM/PM Peak Hour
Segment C: Tigard

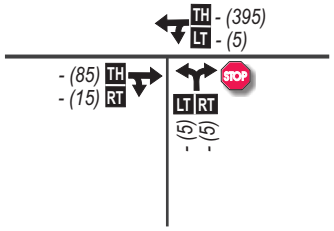
C14. *SW 72nd Ave. @ SW Baylor St.*



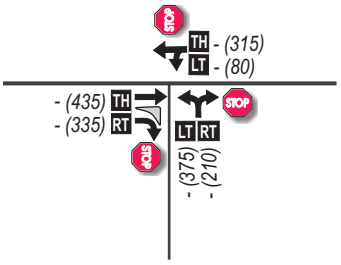
C15. *SW 72nd Ave. @ SW Beveland St.*



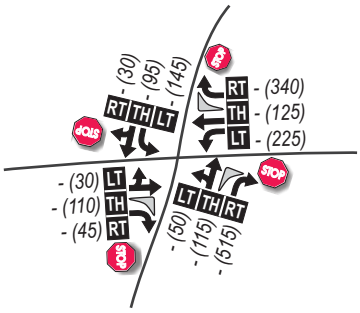
C16. *SW 70th Ave. @ SW Beveland St.*



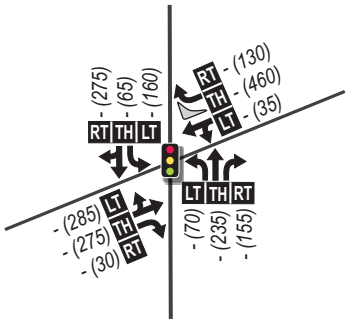
C17. *SW 65th Ave. @ SW Haines St./ I-5 NB Ramps*



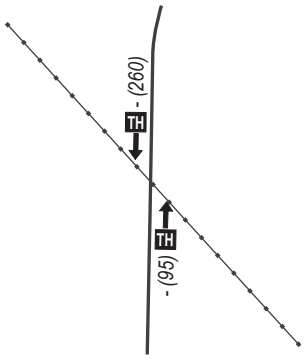
C18. *SW 68th Pkwy. @ SW Atlanta St.*



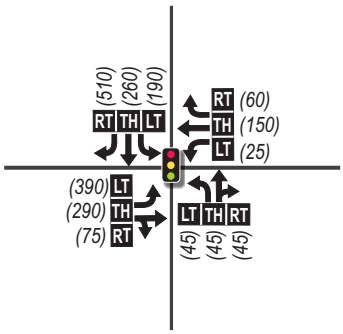
C19. *SW 68th Pkwy. @ SW Dartmouth St./ I-5 SB Ramps*



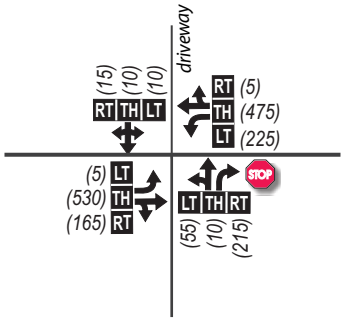
C20a. *SW Hall Blvd. @ Rail Crossing*



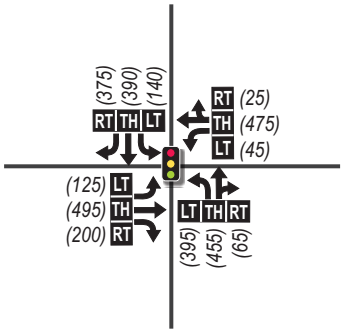
C20b. *SW Bonita Rd. @ Bangy Rd.*



C21. *SW Bonita Rd. @ SW Sequoia Pkwy.*



C22. *SW Bonita Rd. @ SW 72nd Ave.*



LEGEND

00. - Study Intersection No.
STOP - Stop Sign
- Yield Sign
- Traffic Signal
← - Lane Configuration
AM (PM) - Peak Hour Traffic Volumes
LT TH RT - Volume Turn Movement
Left•Thru•Right

DKS

No Scale

figure **5.3-3b**

2035 No Build Alternative
AM/PM Peak Hour
Segment C: Tigard

Table 5.3-6. Segment C 2035 No-Build Alternative HCM (Synchro) Analysis – Tigard Subarea (SW Bonita Road)

ID	Tigard Subarea (SW Bonita Road)	Mobility Target		2035 No-Build (Without Overcrossing)				
					PM			
				Control	Delay	LOS	V/C	WLANE
C20b	SW Bangy Rd./SW Bonita Rd.	Lake Oswego	LOS E	Signal	17.7	B	0.66	-
C21	SW Sequoia Pkwy./SW Bonita Rd.	Tigard	1.00	Signal	11.3	B	0.64	-
C22	SW 72nd Ave./SW Bonita Rd.	Tigard	1.00	Signal	46.8	D	0.87	-

Key: [Worst stop-controlled delay] for TWSC intersections.

V/C represents intersection average for signals and worst movement for stop controlled intersections.

Ln = lane; NB = northbound.

SW Carman Drive/SW Upper Boones Ferry Road Subarea

Table 5.3-7 shows the Synchro analysis results under the No-Build Alternative for the existing AM and PM peak hours in this subarea of Segment C. Eight intersections were analyzed during the PM peak hour for this subarea, and three intersections were analyzed in the AM peak hour.

All of the intersections analyzed during the AM peak hour operate within applicable mobility targets. During the PM peak hour, the I-5 northbound ramp terminal is expected to exceed the ODOT mobility target. Data available for the existing Portland & Western Railroad crossing indicates that train traffic does not cross at this location on the average day during the PM peak hour; therefore, traffic along SW Upper Boones Ferry is not impacted by train traffic and operational outputs are not available.

Intersection volumes are shown graphically in Figure 5.3-4.

Table 5.3-7. Segment C 2035 No-Build Alternative HCM (Synchro) Analysis – SW Carman Drive/SW Upper Boones Ferry Road Subarea

ID	SW Carman Dr./SW Upper Boones Ferry Road Subarea	Note	Mobility Target		2035 No-Build (Without Overcrossing)								
						AM				PM			
					Control	Delay	LOS	V/C	WLANE	Delay	LOS	V/C	WLANE
C23	I-5 northbound ramps/SW Carman Dr.		ODOT Ramp	0.85	Signal	32.5	C	0.83	-	**37.8**	**D**	**0.89**	**-**
C24	I-5 southbound ramps/SW Upper Boones Ferry Rd.		ODOT Ramp	0.85	Signal	18.9	B	0.84	-	16.2	B	0.69	-
C25	Burgerville/Chevron/SW Upper Boones Ferry Rd.		-	-	TWSC	PM Only				6.9 [136.2]	A [F]	0.98	NBLn1
C26	SW Sequoia Pkwy./SW Upper Boones Ferry Rd.	2	Tigard	1.00	Signal	14.3	B	0.55	-	15.6	B	0.57	-
C27	SW 72nd Ave. (north)/SW Upper Boones Ferry Rd.	2	Tigard	1.00	Signal	PM Only				40.1	D	0.94	-
C28	SW Upper Boones Ferry Rd./SW 72nd Ave. (south)	2	Tigard	1.00	Signal					16.3	B	0.74	-
C29	SW Durham Rd./SW Upper Boones Ferry Rd.	2	Tigard	1.00	Signal					50.9	D	0.86	-
C30a	SW Upper Boones Ferry Rd at RR				Railroad					-	-	-	-

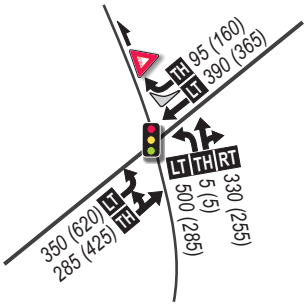
Key: [Worst stop-controlled delay] for TWSC intersections.

V/C represents intersection average for signals and worst movement for stop controlled intersections.

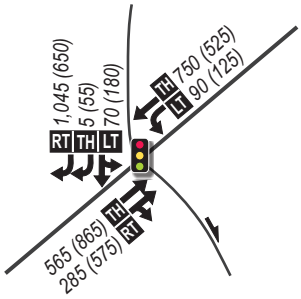
Ln = lane; NB = northbound.

1. Intersection analysis completed as part of 2016 Southwest Corridor study with review by ODOT, PBOT and Metro.
2. Intersection reflects Financially Constrained Project in future year 2035 analysis.

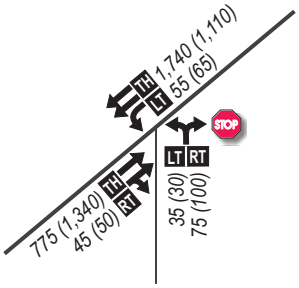
C23. *SW Upper Boones Ferry Rd. @ I-5 NB Ramps*



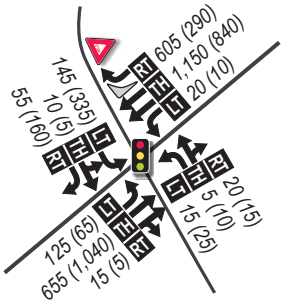
C24. *SW Upper Boones Ferry Rd. @ I-5 SB Ramps*



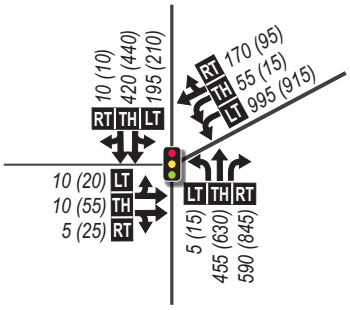
C25. *SW Upper Boones Ferry Rd. @ Burgerville/ Chevron Driveway*



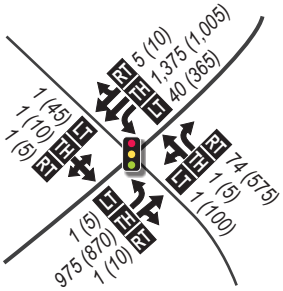
C26. *SW Upper Boones Ferry Rd. @ SW Sequoia Pkwy.*



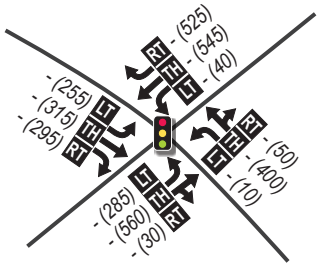
C27. *SW Upper Boones Ferry Rd. @ SW 72nd Ave. (North)*



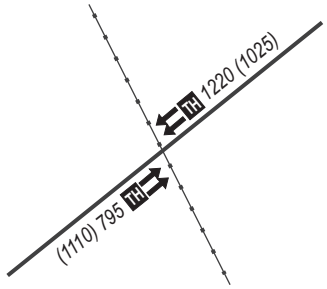
C28. *SW Upper Boones Ferry Rd. @ SW 72nd Ave. (South)*



C29. *SW Upper Boones Ferry Rd. @ SW Durham Rd.*



C30a. *SW Upper Boones Ferry Rd. @ Rail Crossing*



LEGEND

00. - Study Intersection No.
STOP - Stop Sign
- Yield Sign
- Traffic Signal
- Lane Configuration
AM (PM) - Peak Hour Traffic Volumes
LT TH RT - Volume Turn Movement
Left • Thru • Right

DKS

No Scale

figure **5.3-4**

2035 No Build
AM/PM Peak Hour
Segment C: Carman/UBF

Bridgeport

Table 5.3-8 shows the Synchro analysis results under the No-Build Alternative for the AM and PM peak hours in the Bridgeport subarea of Segment C. Ten intersections were analyzed during the PM peak hour for this subarea, and one intersection was analyzed in the AM peak hour.

The analyzed intersection operates within applicable mobility targets during the AM peak hour in the Bridgeport subarea. During the PM peak hour, the I-5 northbound ramp terminal is expected to exceed the mobility target, while the intersection of SW Travelers Lane/SW Lower Boones Ferry Road at the existing park and ride access is expected to exceed the mobility target.

Intersection volumes are shown graphically in Figure 5.3-5.

Table 5.3-8. Segment C 2035 No-Build Alternative HCM (Synchro) Analysis – Bridgeport Subarea

ID	Bridgeport Subarea	Note	Mobility Target		2035 No-Build (Without Overcrossing)								
						AM				PM			
					Control	Delay	LOS	V/C	WLANE	Delay	LOS	V/C	WLANE
C30b	SW 65th Ave./SW Lower Boones Ferry Rd.	1	Wash. Co.	0.99	Signal	PM Only				47.5	D	0.83	-
C31	I-5 northbound ramps/SW Lower Boones Ferry Rd.	1	ODOT Ramp	0.85	Signal					**22.6**	**C**	**0.90**	**-**
C32	I-5 southbound ramps/SW Lower Boones Ferry Rd.	1	ODOT Ramp	0.85	Signal					11.7	B	0.70	-
C33	SW 72nd Ave./SW Lower Boones Ferry Rd.	1	Wash. Co.	0.99	Signal	36.8	D	0.72	-	41.9	D	0.81	-
C34	SW 72nd Ave./Bridgeport Village/Terminal Station	1	Tigard	1.00	Signal	PM Only				15.0	B	0.51	-
C35	SW 72nd Ave./W Durham Rd.	1	Tigard	1.00	Signal					15.2	B	0.82	-
C36	Park and Ride access/SW Lower Boones Ferry Rd.	1	Wash. Co.	0.99	TWSC					0.7 [13.9]	A [B]	0.17	WBLn1
C37	SW Travelers Ln./Park and Ride access/SW Lower Boones Ferry Rd.	1	Wash. Co.	0.99	TWSC					**15.3 [231.7]**	**C (F)**	**1.13**	**EBLn1**
C38	SW Hazel Fern Rd./SW Bridgeport Rd.	1	Wash. Co.	0.99	Signal					25.3	C	0.35	-
C39	REI/Bridgeport Village/SW Bridgeport Rd.	1	Wash. Co.	0.99	Signal					14.5	B	0.27	-

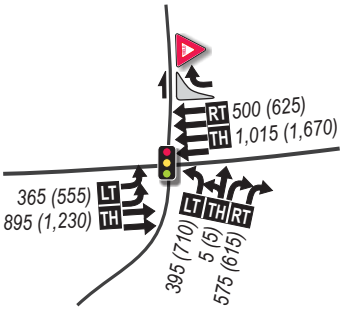
Key: [Worst stop-controlled delay] for TWSC intersections.

V/C represents intersection average for signals and worst movement for stop controlled intersections.

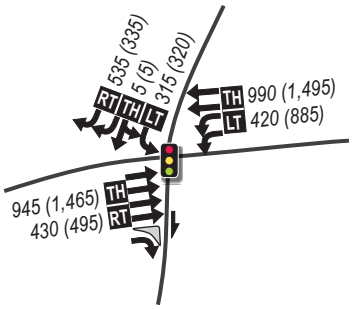
Ln = lane; EB = eastbound; WB = westbound.

1. Intersection analysis completed as part of 2016 Southwest Corridor study with review by ODOT, PBOT and Metro.
2. Intersection reflects Financially Constrained Project in future year 2035 analysis.

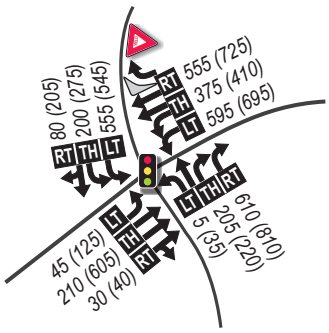
C31. *SW Lower Boones Ferry Rd. @ I-5 NB Ramps*



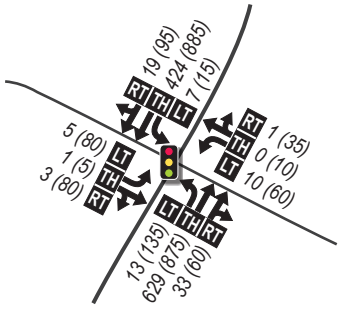
C32. *SW Lower Boones Ferry Rd. @ I-5 SB Ramps*



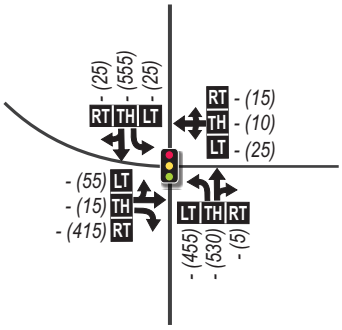
C33. *SW Lower Boones Ferry Rd. @ SW 72nd Ave.*



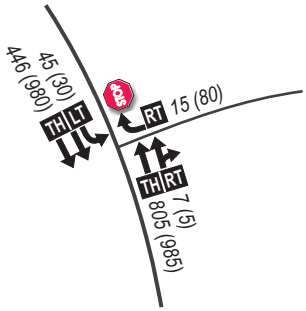
C34. *SW 72nd Ave. @ Bridgeport Village/ Terminal Station*



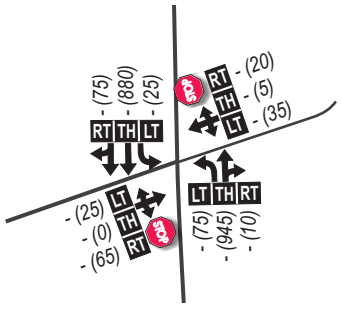
C35. *SW 72nd Ave. @ SW Durham Rd.*



C36. *SW Lower Boones Ferry Rd. @ Park & Ride Access*



C37. *SW Lower Boones Ferry Rd. @ Travellers Ln./Park & Ride Access*



LEGEND

00. - Study Intersection No.
STOP - Stop Sign
- Yield Sign
- Traffic Signal
← - Lane Configuration
AM (PM) - Peak Hour Traffic Volumes
LT TH RT - Volume Turn Movement
Left • Thru • Right

DKS

No Scale

figure **5.3-5**

2035 No Build
AM/PM Peak Hour
Segment C: Bridgeport

Intersections Exceeding Mobility Targets Under 2035 No-Build Alternative Conditions

All of the intersections analyzed during the AM peak hour in Segment C are expected to meet applicable operating standards. Four intersections would fail to meet applicable operating standards in the PM peak hour under the No-Build Alternative in 2035:

- **SW 65th Avenue at SW Haines Street/I-5 northbound ramps.** This intersection is currently an all-way stop, and the northbound traffic must use a shared lane, which operates above capacity (V/C = 1.08) in the PM peak hour. Most of the northbound movements are traveling through the intersection after exiting northbound I-5 at exit 293 (SW Haines Street).
- **I-5 northbound ramps at SW Carman Drive.** During the PM peak hour, this intersection would exceed ODOT's mobility target. The large volume of traffic getting onto the freeway from the west would approach its current capacity and cut into the green time of the opposing traffic because of split phasing for eastbound and westbound approaches.
- **I-5 northbound ramps at SW Lower Boones Ferry Road**. During the PM peak hour, this intersection would exceed ODOT's mobility target.
- **SW Travelers Lane/SW Lower Boones Ferry Road at the Bridgeport Park and Ride access.** This two-way stop controlled intersection would exceed Washington County mobility targets in the PM peak hour. Traffic on the side streets would experience long delays attempting to turn left onto SW Travelers Lane/SW Lower Boones Ferry Road.

2045 No-Build Alternative

A supplemental analysis was conducted at the Segment C freeway ramp terminals for a forecast year of 2045. As shown in Table 5.3-9, Table 5.3-10 and Table 5.3-11 for each of the subareas, three of the six ramp terminals in Segment C would fail to meet applicable operating standards under the No-Build Alternative in forecast year 2045; this is the same as for forecast year 2035.

Table 5.3-9. Segment C 2045 No-Build Alternative HCM (Synchro) Analysis – Tigard Subarea

ID	Tigard Subarea	Mobility Target		2045 No-Build				
					PM			
				Control	Delay	LOS	V/C	WLANE
C17	SW 65th Ave./SW Haines St./I-5 northbound ramps	ODOT Ramp	0.85	AWSC	**60.3 [101.7]**	**F [F]**	**1.11**	**NBLn1**
C19	SW 68th Pkwy./SW Dartmouth St./I-5 southbound ramps	ODOT Ramp	0.85	Signal	32.2	C	0.72	-

Key: [Worst stop-controlled delay] for TWSC intersections.

V/C represents intersection average for signals and worst movement for stop controlled intersections.

Ln = lane; NB = northbound.

Table 5.3-10. Segment C 2045 No-Build Alternative HCM (Synchro) Analysis – SW Carman Drive/SW Upper Boones Ferry Road Subarea

ID	SW Carman Drive/SW Upper Boones Ferry Road Subarea	Mobility Target		2045 No-Build				
					PM			
				Control	Delay	LOS	V/C	WLANE
C23	I-5 northbound ramps/SW Carman Dr.	ODOT Ramp	0.85	Signal	**43.9**	**D**	**0.92**	**-**
C24	I-5 southbound ramps/SW Upper Boones Ferry Rd.	ODOT Ramp	0.85	Signal	16.5	B	0.70	-

Key: [Worst stop-controlled delay] for TWSC intersections.

V/C represents intersection average for signals and worst movement for stop controlled intersections.

Ln = lane; NB = northbound.

As mentioned in the previous section, three ramp terminals would exceed mobility targets under the 2035 No-Build Alternative during the PM peak hour: SW 65th Avenue at SW Haines Street/I-5 northbound ramps, I-5 northbound ramps at SW Carman Drive, and I-5 northbound ramps at Lower Boones Ferry Road. Under 2045 conditions, the same locations exceed mobility targets.

Table 5.3-11. Segment C 2045 No-Build Alternative HCM (Synchro) Analysis – Bridgeport Subarea

ID	Bridgeport Subarea	Note	Mobility Target		2045 No-Build				
						PM			
					Control	Delay	LOS	V/C	WLANE
C31	I-5 NB Ramps/SW Lower Boones Ferry Rd.	1	ODOT Ramp	0.85	Signal	**35.2**	**D**	**0.96**	-
C32	I-5 SB Ramps/SW Lower Boones Ferry Rd.	1	ODOT Ramp	0.85	Signal	13.6	B	0.73	-

Key: [Worst stop-controlled delay] for TWSC intersections.

V/C represents intersection average for signals and worst movement for stop controlled intersections.

1. Intersection analysis completed as part of 2016 Southwest Corridor study with review by ODOT, PBOT and Metro.

2. Intersection reflects Financially Constrained Project in future year 2035 analysis.

2035 Light Rail Alternatives

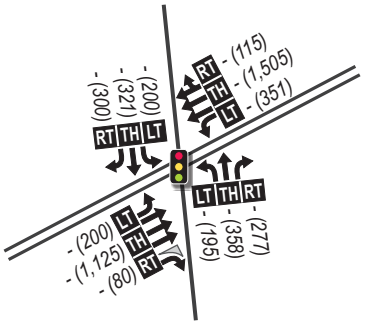
Tigard Subarea

Table 5.3-12 through Table 5.3-15 show the Synchro analysis results for the light rail alternatives for the PM peak hour for the Tigard subarea in Segment C. Twenty-two intersections were analyzed for this subarea for the light rail alternatives in 2035. It should be noted that under certain light rail alignment alternatives, some intersections will have their intersection control or lane configurations modified from the existing configuration; the "control" column indicates the assumed traffic control for 2035.

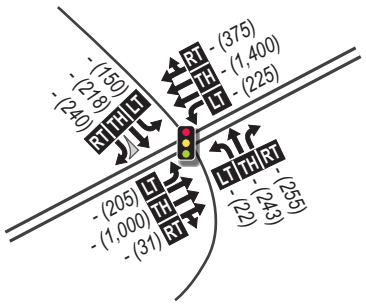
Mobility targets for the appropriate jurisdiction are shown for every intersection. Intersection results that do not meet these mobility targets in a particular peak hour are shaded gray. The worst lane group is listed under the WLANE columns for two-way stop controlled intersections.

Compared to the No-Build Alternative, two additional intersections would exceed operational standards during the PM peak hour for all light rail alternatives. Volumes are shown graphically in Figure 5.3-6 below.

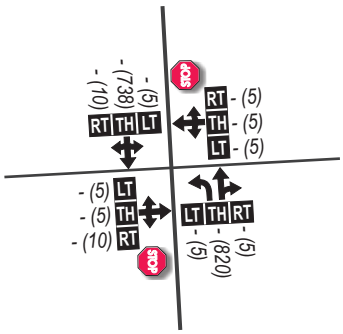
C2. *99W @ SW Hall Blvd.*



C3. *99W @ SW Greenburg Rd./SW Main St.*

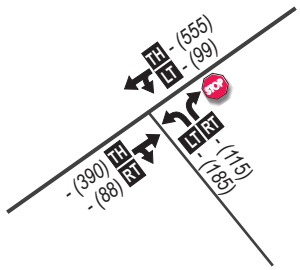


C4. *SW Hall Blvd. @ Clinton*

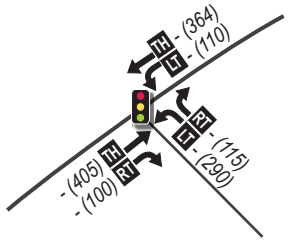


C5. *SW Hall Blvd. @ Ash/Knoll*

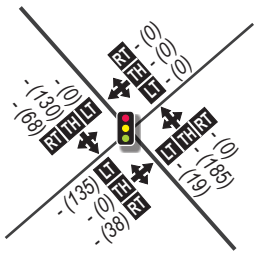
C6. *SW Main St. @ SW Commercial St.*



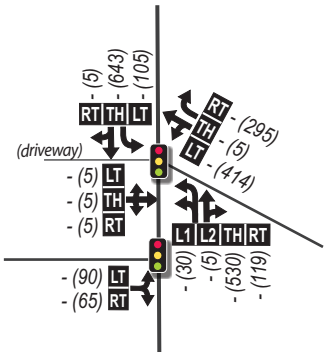
C7. *SW Main St. @ SW Scoffins St.*



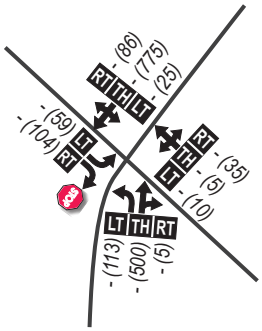
C8. *SW Commercial St. @ Magno Humphries Driveway*



C9. *SW Hall Blvd. @ SW Hunziker St./ SW Scoffins St.*

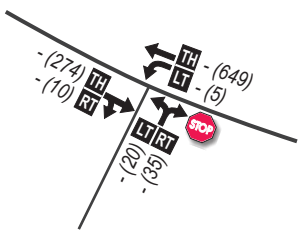


C10. *SW Hall Blvd. @ SW Commercial St.*

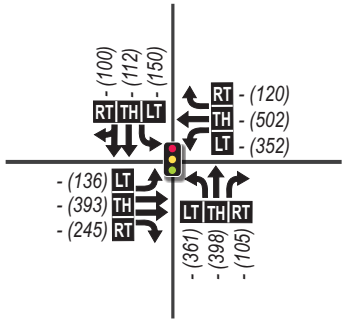


C11. *SW Hall Blvd. @ SW Burnham St.*

C12. *SW Hunziker St. @ Beveland Bridge/Wall St.*



C13. *SW 72nd Ave. @ SW Dartmouth St.*



LEGEND

00. - Study Intersection No.
STOP - Stop Sign
- Yield Sign
- Traffic Signal
← - Lane Configuration
AM (PM) - Peak Hour Traffic Volumes
LT TH RT - Volume Turn Movement
Left•Thru•Right

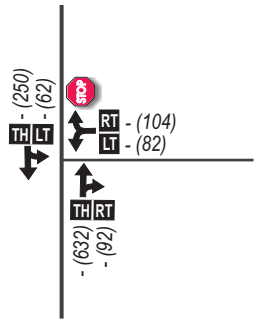
DKS

No Scale

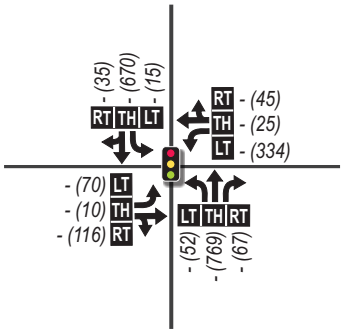
figure **5.3-6a**

2035 Build (C1, C2, C5 Ash)
AM/PM Peak Hour
Segment C: Tigard

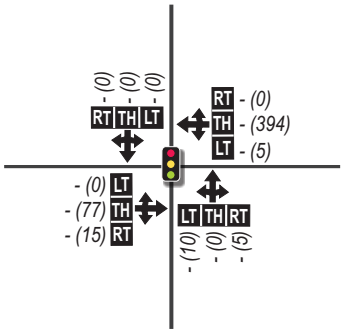
C14. *SW 72nd Ave. @ SW Baylor St.*



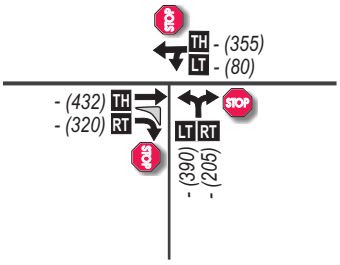
C15. *SW 72nd Ave. @ SW Beveland St.*



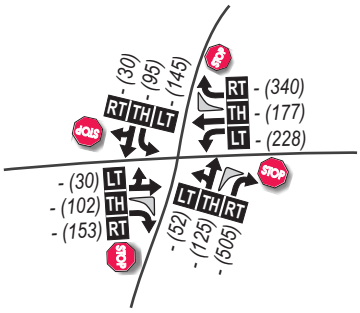
C16. *SW 70th Ave. @ SW Beveland St.*



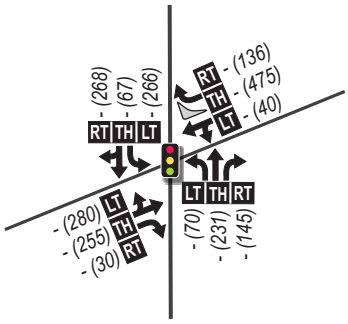
C17. *SW 65th Ave. @ SW Haines St./ I-5 NB Ramps*



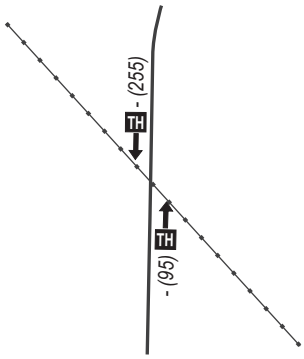
C18. *SW 68th Pkwy. @ SW Atlanta St.*



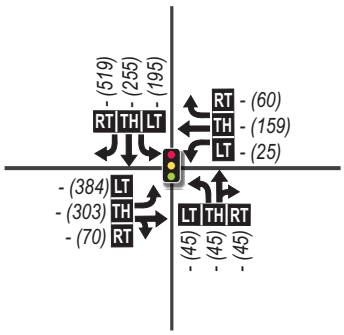
C19. *SW 68th Pkwy. @ SW Dartmouth St./ I-5 SB Ramps*



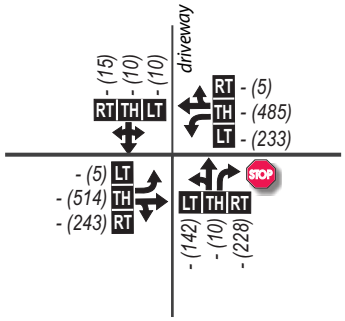
C20a. *SW Hall Blvd. @ Rail Crossing*



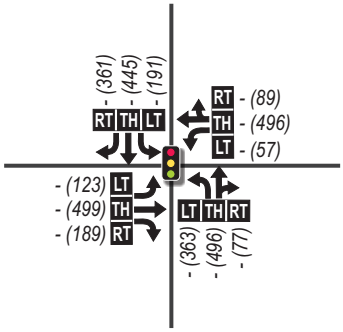
C20b. *SW Bonita Rd. @ Bangy Rd.*



C21. *SW Bonita Rd. @ SW Sequoia Pkwy.*



C22. *SW Bonita Rd. @ SW 72nd Ave.*



LEGEND

00. - Study Intersection No.
STOP - Stop Sign
- Yield Sign
- Traffic Signal
← - Lane Configuration
AM (PM) - Peak Hour Traffic Volumes
LT TH RT - Volume Turn Movement
Left•Thru•Right

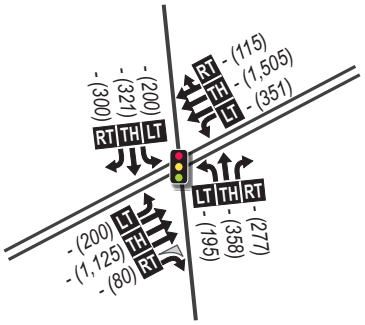
DKS

No Scale

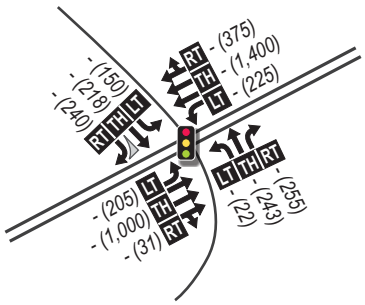
figure **5.3-6b**

2035 Build (C1, C2, C5 Ash)
AM/PM Peak Hour
Segment C: Tigard

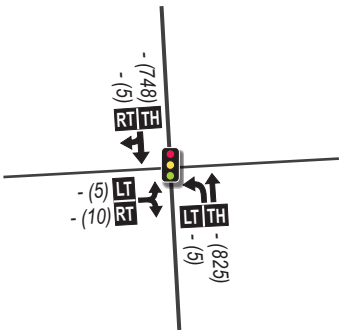
C2. *99W @ SW Hall Blvd.*



C3. *99W @ SW Greenburg Rd./SW Main St.*

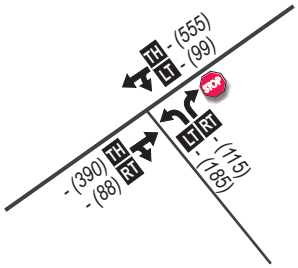


C4. *SW Hall Blvd. @ Clinton*

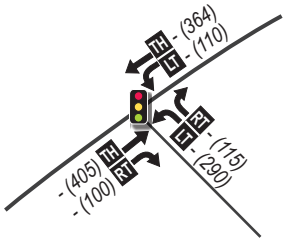


C5. *SW Hall Blvd. @ Ash/Knoll*

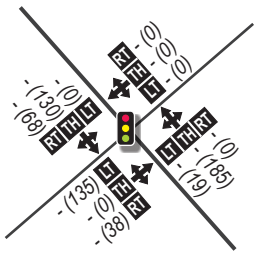
C6. *SW Main St. @ SW Commercial St.*



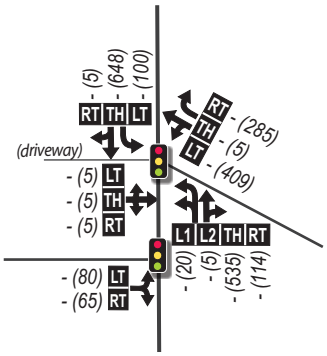
C7. *SW Main St. @ SW Scoffins St.*



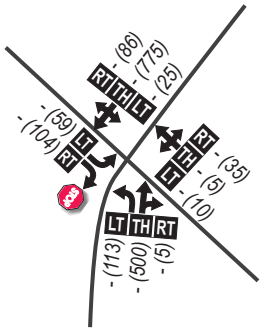
C8. *SW Commercial St. @ Magno Humphries Driveway*



C9. *SW Hall Blvd. @ SW Hunziker St./ SW Scoffins St.*

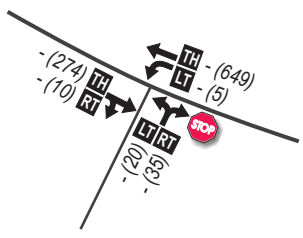


C10. *SW Hall Blvd. @ SW Commercial St.*

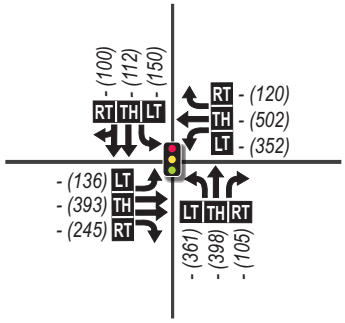


C11. *SW Hall Blvd. @ SW Burnham St.*

C12. *SW Hunziker St. @ Beveland Bridge/Wall St.*



C13. *SW 72nd Ave. @ SW Dartmouth St.*



LEGEND

00. - Study Intersection No.
STOP - Stop Sign
- Yield Sign
- Traffic Signal
← - Lane Configuration
AM (PM) - Peak Hour Traffic Volumes
LT TH RT - Volume Turn Movement
Left•Thru•Right

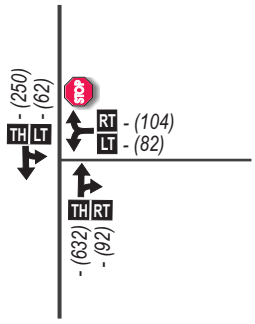
DKS

No Scale

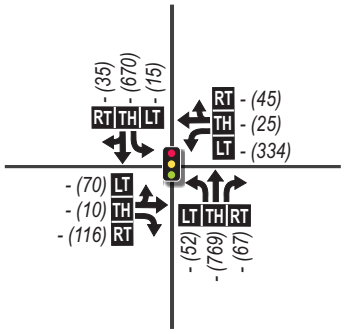
figure **5.3-6c**

2035 Build (C3, C4 Clinton)
AM/PM Peak Hour
Segment C: Tigard

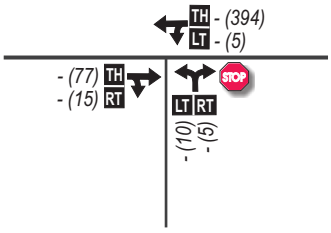
C14. *SW 72nd Ave. @ SW Baylor St.*



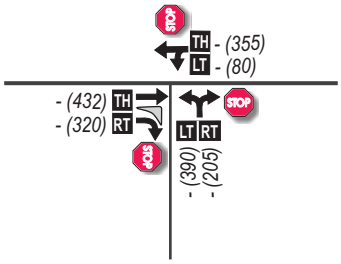
C15. *SW 72nd Ave. @ SW Beveland St.*



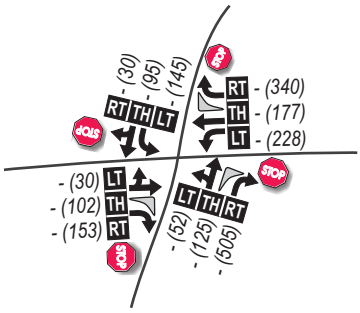
C16. *SW 70th Ave. @ SW Beveland St.*



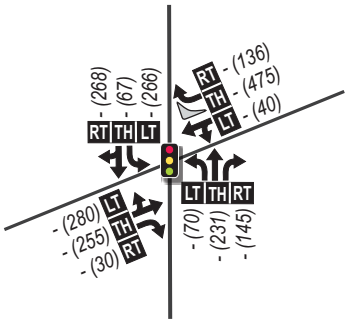
C17. *SW 65th Ave. @ SW Haines St./ I-5 NB Ramps*



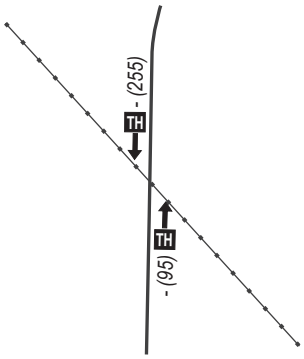
C18. *SW 68th Pkwy. @ SW Atlanta St.*



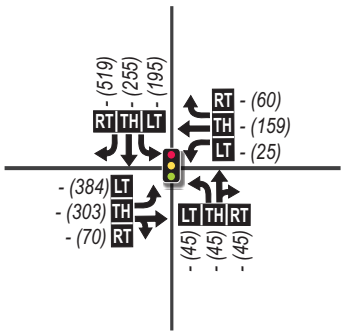
C19. *SW 68th Pkwy. @ SW Dartmouth St./ I-5 SB Ramps*



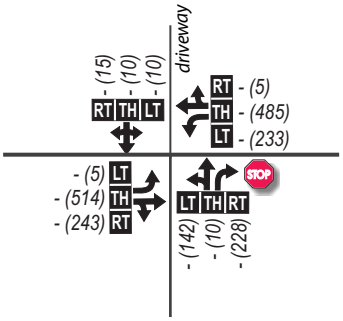
C20a. *SW Hall Blvd. @ Rail Crossing*



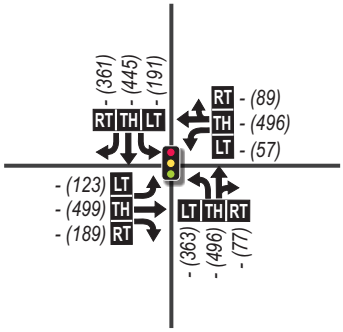
C20b. *SW Bonita Rd. @ Bangy Rd.*



C21. *SW Bonita Rd. @ SW Sequoia Pkwy.*



C22. *SW Bonita Rd. @ SW 72nd Ave.*



LEGEND

00. - Study Intersection No.
STOP - Stop Sign
- Yield Sign
- Traffic Signal
← - Lane Configuration
AM (PM) - Peak Hour Traffic Volumes
LT TH RT - Volume Turn Movement
Left•Thru•Right

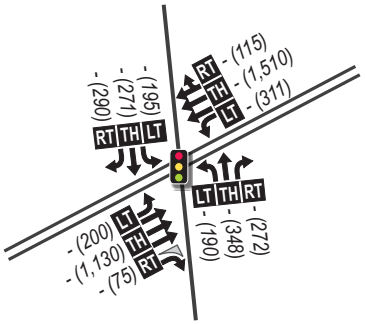
DKS

No Scale

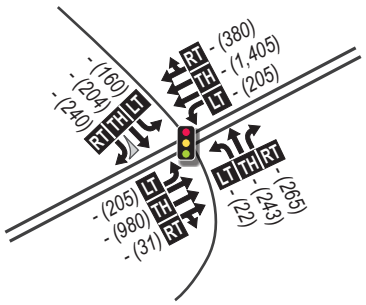
figure **5.3-6d**

2035 Build (C3, C4 Clinton)
AM/PM Peak Hour
Segment C: Tigard

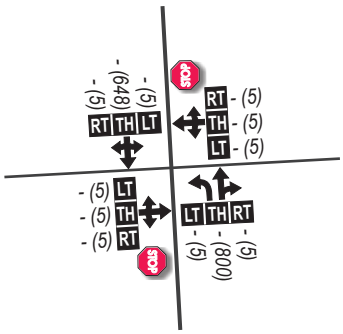
C2. *99W @ SW Hall Blvd.*



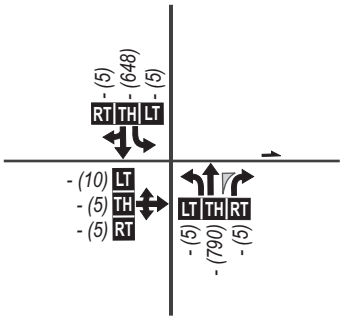
C3. *99W @ SW Greenburg Rd./SW Main St.*



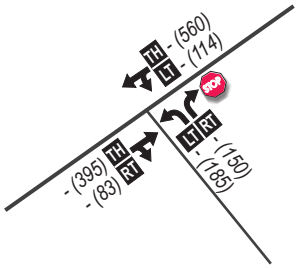
C4. *SW Hall Blvd. @ Clinton*



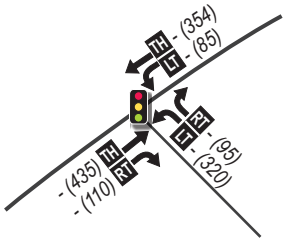
C5. *SW Hall Blvd. @ Ash/Knoll*



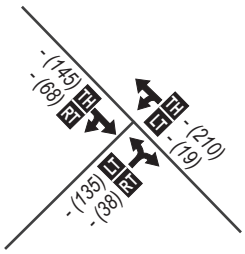
C6. *SW Main St. @ SW Commercial St.*



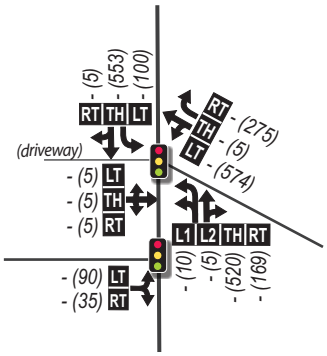
C7. *SW Main St. @ SW Scoffins St.*



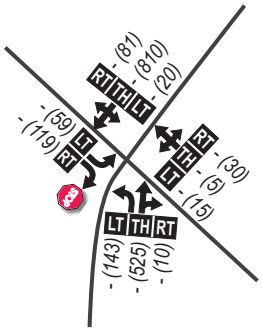
C8. *SW Commercial St. @ Magno Humphries Driveway*



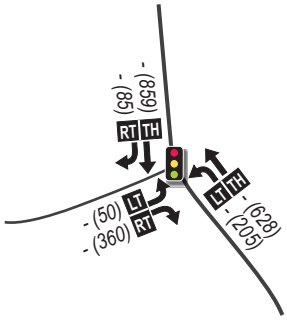
C9. *SW Hall Blvd. @ SW Hunziker St./ SW Scoffins St.*



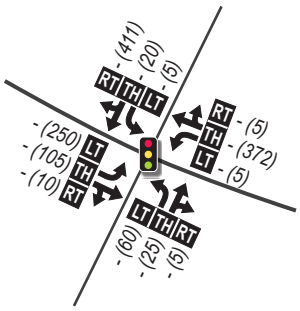
C10. *SW Hall Blvd. @ SW Commercial St.*



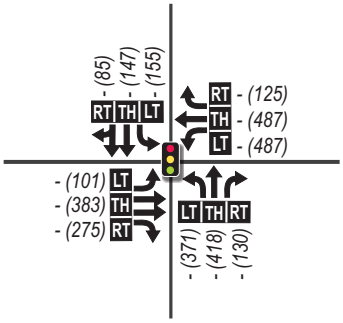
C11. *SW Hall Blvd. @ SW Burnham St.*



C12. *SW Hunziker St. @ Beveland Bridge/Wall St.*



C13. *SW 72nd Ave. @ SW Dartmouth St.*



LEGEND

00. - Study Intersection No.
STOP - Stop Sign
- Yield Sign
- Traffic Signal
← - Lane Configuration
AM (PM) - Peak Hour Traffic Volumes
LT TH RT - Volume Turn Movement
Left•Thru•Right

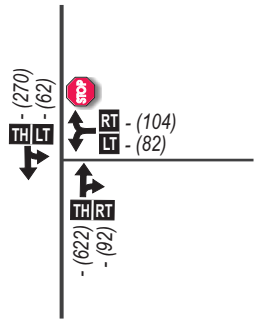
DKS

No Scale

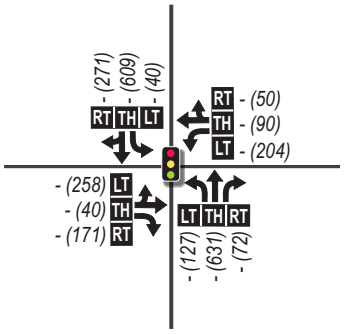
figure **5.3-6e**

2035 Build (C6 Wall with Overcrossing)
AM/PM Peak Hour
Segment C: Tigard

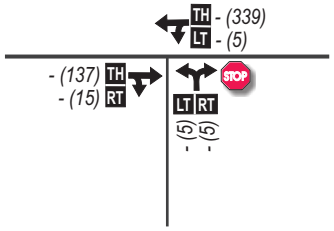
C14. *SW 72nd Ave. @ SW Baylor St.*



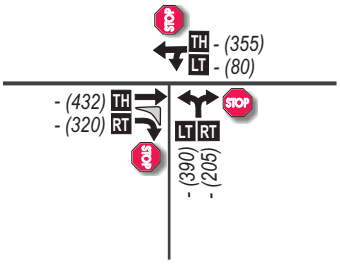
C15. *SW 72nd Ave. @ SW Beveland St.*



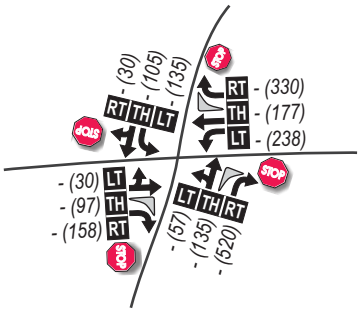
C16. *SW 70th Ave. @ SW Beveland St.*



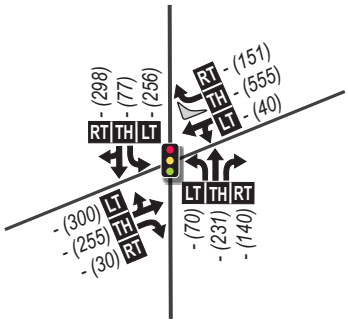
C17. *SW 65th Ave. @ SW Haines St./ I-5 NB Ramps*



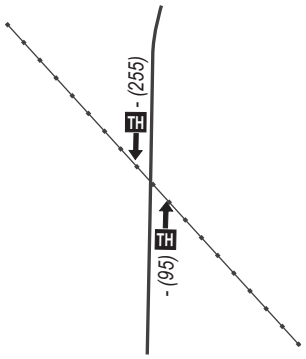
C18. *SW 68th Pkwy. @ SW Atlanta St.*



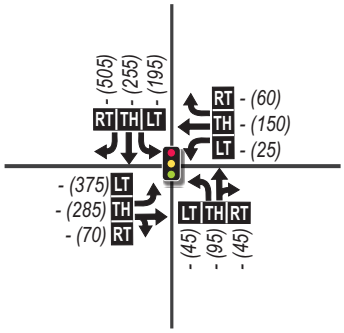
C19. *SW 68th Pkwy. @ SW Dartmouth St./ I-5 SB Ramps*



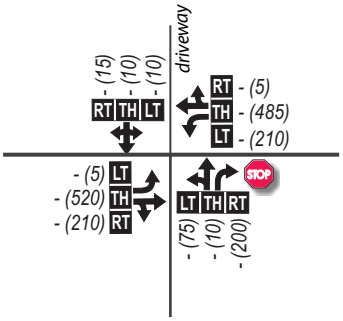
C20a. *SW Hall Blvd. @ Rail Crossing*



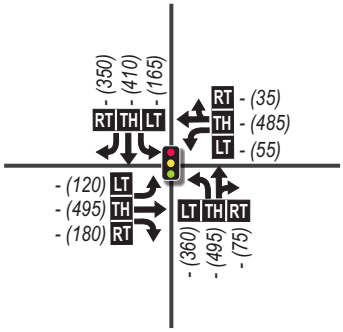
C20b. *SW Bonita Rd. @ Bangy Rd.*



C21. *SW Bonita Rd. @ SW Sequoia Pkwy.*



C22. *SW Bonita Rd. @ SW 72nd Ave.*



LEGEND

00. - Study Intersection No.
STOP - Stop Sign
- Yield Sign
- Traffic Signal
← - Lane Configuration
AM (PM) - Peak Hour Traffic Volumes
LT TH RT - Volume Turn Movement
Left•Thru•Right

DKS

No Scale

figure **5.3-6f**

2035 Build (C6 Wall with Overcrossing)
AM/PM Peak Hour
Segment C: Tigard

Table 5.3-12. Segment C 2035 Alternatives C3 and C4 Clinton HCM (Synchro) Analysis – Tigard Subarea

ID	Tigard Subarea (Tigard Downtown & Tigard Triangle)	Mobility Target		2035 Light Rail (Without Overcrossing) Alternatives C3, C4 Clinton				
					PM			
				Control	Delay	LOS	V/C	WLANE
C2	SW Hall Blvd. at OR 99W	ODOT	1.10	Signal	50.0	D	0.87	-
C3	SW Greenburg Rd./SW Main St. at OR 99W	ODOT	1.10	Signal	35.0	D	0.80	-
C4	SW Hall Blvd. at SW Clinton St.	ODOT	1.10	Signal	2.3	A	0.53	-
C5	SW Hall Blvd. at SW Ash Ave.	ODOT	1.10	TWSC	1.1 [45.8]	A [E]	0.19	EBLn1
C6	SW Commercial St. at SW Main St.	Tigard	1.00	TWSC	**19.5 [138.2]**	**B [F]**	**1.06**	**NBLn1**
C7	SW Scoffins St. at SW Main St.	Tigard	1.00	AWSC	22.0 [28.6]	C [D]	0.77	EBLn1
C8	Magno Humphries at SW Commercial St.	-	-	TWSC	4.0 [12.4]	A [B]	0.26	EBLn1
C9a	SW Hall Blvd. at SW Hunziker St./SW Scoffins St. (north)	ODOT	1.10	Signal	21.7	C	0.73	-
C9B	SW Hall Blvd. at SW Hunziker St./SW Scoffins St. (south)	ODOT	1.10		44.7	D	0.70	-
C10	SW Hall Blvd. at SW Commercial St.	ODOT	1.10	TWSC	**14.5 [>300]**	**B [F]**	**1.19**	**EBLn1**
C11	SW Hall Blvd. at SW Burnham St.	ODOT	1.10	Signal	22.5	C	0.68	-
C12	SW Wall St. at SW Hunziker St.	Tigard	1.00	TWSC	0.8 [13.5]	A [B]	0.12	NBLn1
C13	SW 72nd Ave. at SW Dartmouth St.	Tigard	1.00	Signal	24.6	C	0.85	-
C14	SW 72nd Ave. at SW Baylor St.	Tigard	1.00	TWSC	5.1 [30.6]	A [D]	0.58	WBLn1
C15	SW 72nd Ave. at SW Beveland St.	Tigard	1.00	Signal	23.3	C	0.72	-
C16	SW 70th Ave. at SW Beveland S.	Tigard	1.00	TWSC	0.4 [11.3]	A [B]	0.03	NBLn1
C17	SW 65th Ave. at SW Haines St./I-5 northbound ramps	ODOT Ramp	0.85	AWSC	**58.8 [101.0]**	**F [F]**	**1.11**	**NBLn1**
C18	SW 68th Pkwy. at SW Atlanta St.	Tigard	1.00	AWSC	**60.0 [107.9]**	**F [F]**	**1.14**	**WBLn2**
C19	SW 68th Pkwy. at SW Dartmouth St./I-5 southbound ramps	ODOT Ramp	0.85	Signal	43.8	D	0.77	-
C20a	SW Hall Blvd. at existing railroad (WES)			Railroad	5.6	A	0.49	-

Key: [Worst stop-controlled delay] for TWSC intersections.

V/C represents intersection average for signals and worst movement for stop controlled intersections.

Ln = lane; NB = northbound.

Table 5.3-13. Segment C 2035 Alternatives C1, C2 and C5 Ash HCM (Synchro) Analysis – Tigard Subarea

ID	Tigard Subarea (Tigard Downtown & Tigard Triangle)	Mobility Target		2035 Light Rail (Without Overcrossing) Alternatives C1, C2, C5 Ash				
					PM			
				Control	Delay	LOS	V/C	WLANE
C2	SW Hall Blvd./OR 99W	ODOT	1.10	Signal	50.0	D	0.87	-
C3	SW Greenburg Rd./SW Main St./OR 99W	ODOT	1.10	Signal	35.0	D	0.80	-
C4	SW Hall Blvd./SW Clinton St.	ODOT	1.10	TWSC	0.9 [38.9]	A [E]	0.12	WBLn1
C5	SW Hall Blvd./SW Ash Ave.	ODOT	1.10	Signal	5.3	A	0.45	-
C6	SW Commercial St./SW Main St.	Tigard	1.00	TWSC	**19.5 [138.2]**	**B [F]**	**1.06**	**NBLn1**
C7	SW Scoffins St./SW Main St.	Tigard	1.00	AWSC	22.0 [28.6]	C [D]	0.77	EBLn1
C8	Magno Humphries Driveway/SW Commercial St.	-	-	TWSC	4.0 [12.4]	A [B]	0.26	EBLn1
C9a	SW Hall Blvd./SW Hunziker St./SW Scoffins St. (north)	ODOT	1.10	Signal	22.1	C	0.73	-
C9b	SW Hall Blvd./SW Hunziker St./SW Scoffins St. (south)	ODOT	1.10		46.2	D	0.71	-
C10	SW Hall Blvd./SW Commercial St.	ODOT	1.10	TWSC	**14.5 [>300]**	**B [F]**	**1.19**	**EBLn1**
C11	SW Hall Blvd./SW Burnham St.	ODOT	1.10	Signal	22.5	C	0.68	-
C12	SW Wall St./SW Hunziker St.	Tigard	1.00	TWSC	0.8 [13.5]	A [B]	0.12	NBLn1
C13	SW 72nd Ave./SW Dartmouth St.	Tigard	1.00	Signal	24.6	C	0.85	-

ID	Tigard Subarea (Tigard Downtown & Tigard Triangle)	Mobility Target		2035 Light Rail (Without Overcrossing) Alternatives C1, C2, C5 Ash				
					PM			
				Control	Delay	LOS	V/C	WLANE
C14	SW 72nd Ave./SW Baylor St.	Tigard	1.00	TWSC	5.1 [30.6]	A [D]	0.58	WBLn1
C15	SW 72nd Ave./SW Beveland St.	Tigard	1.00	Signal	24.2	C	0.77	-
C16	SW 70th Ave./SW Beveland St.	Tigard	1.00	TWSC	0.4 [11.3]	A [B]	0.03	NBLn1
C17	SW 65th Ave./SW Haines St./I-5 northbound ramps	ODOT Ramp	0.85	AWSC	**58.8 [101.0]**	**F [F]**	**1.11**	**NBLn1**
C18	SW 68th Pkwy./SW Atlanta St.	Tigard	1.00	AWSC	**60.0 [107.9]**	**F [F]**	**1.14**	**WBLn2**
C19	SW 68th Pkwy./SW Dartmouth St./I-5 southbound ramps	ODOT Ramp	0.85	Signal	43.8	D	0.77	-
C20a	SW Hall Blvd./existing railroad (WES)			Railroad	5.6	A	0.49	-

Key: [Worst stop-controlled delay] for TWSC intersections.

V/C represents intersection average for signals and worst movement for stop controlled intersections.

Ln = lane; NB = northbound.

Table 5.3-14. Segment C 2035 Alternative C6 Wall HCM (Synchro) Analysis – Tigard Subarea

ID	Tigard Subarea (Tigard Downtown & Tigard Triangle)	Mobility Target		2035 Light Rail (With Overcrossing) Alternative C6 Wall				
					PM			
				Control	Delay	LOS	V/C	WLANE
C2	SW Hall Blvd./OR 99W	ODOT	1.10	Signal	47.6	D	0.86	-
C3	SW Greenburg Rd./SW Main St./OR 99W	ODOT	1.10	Signal	34.7	C	0.80	-
C6	SW Commercial St./SW Main St.	Tigard	1.00	TWSC	**23.2 [170.7]**	**C [F]**	**1.14**	**NBLn1**
C7	SW Scoffins St./SW Main St.	Tigard	1.00	AWSC	26.2 [36.6]	D [E]	0.83	EBLn1
C8	Magno Humphries Driveway/SW Commercial St.	-	-	TWSC	3.9 [13.0]	A [B]	0.28	EBLn1
C9a	SW Hall Blvd./SW Hunziker St./SW Scoffins St. (north)	ODOT	1.10	Signal	30.6	C	0.89	-
C9B	SW Hall Blvd./SW Hunziker St./SW Scoffins St. (south)	ODOT	1.10		128.3	F	0.74	-
C10	SW Hall Blvd./SW Commercial St.	ODOT	1.10	TWSC	**20.6 [>300}**	**C [F]**	**1.49**	**-**
C11	SW Hall Blvd./SW Burnham St.	ODOT	1.10	Signal	23.6	C	0.74	-
C12	SW Wall St./SW Hunziker St.	Tigard	1.00	Signal	15.6	B	0.54	-
C13	SW 72nd Ave./SW Dartmouth St.	Tigard	1.00	Signal	26.6	C	0.91	-
C14	SW 72nd Ave./SW Baylor St.	Tigard	1.00	TWSC	5.1 [30.8]	A [D]	0.58	WBLn1
C15	SW 72nd Ave./SW Beveland St.	Tigard	1.00	Signal	47.5	D	0.98	-
C16	SW 70th Ave./SW Beveland St.	Tigard	1.00	TWSC	0.3 [10.8]	A [B]	0.02	NBLn1
C17	SW 65th Ave./SW Haines St./I-5 northbound ramps	ODOT Ramp	0.85	AWSC	**58.8 [101.0]**	**F [F]**	**1.11**	**WBLn2**
C18	SW 68th Pkwy./SW Atlanta St.	Tigard	1.00	AWSC	**60.3 [100.5]**	**F [F]**	**1.12**	**WBLn2**
C19	SW 68th Pkwy./SW Dartmouth St./I-5 southbound ramps	ODOT Ramp	0.85	Signal	36.4	D	0.79	-
C20a	SW Hall Blvd./existing railroad (WES)			Railroad	8.7	A	0.52	-

Key: [Worst stop-controlled delay] for TWSC intersections.

V/C represents intersection average for signals and worst movement for stop controlled intersections.

Ln = lane; NB = northbound.

Table 5.3-15. Segment C 2035 Alternatives C1 through C6 Synchro Analysis – Tigard Subarea (SW Bonita Road)

ID	Tigard Subarea (SW Bonita Road)	Mobility Target		2035 PM Light Rail Alternatives C1 through C6				
					PM			
				Control	Delay	LOS	V/C	WLANE
C20	SW Bangy Rd./SW Bonita Rd.	Lake Oswego	LOS E	Signal	17.6	B	0.65	-
C21	SW Sequoia Pkwy./SW Bonita Rd.	Tigard	1.00	Signal	15.9	B	0.73	-
C22	SW 72nd Ave./SW Bonita Rd.	Tigard	1.00	Signal	53.1	D	0.90	-

Key: [Worst stop-controlled delay] for TWSC intersections.

V/C represents intersection average for signals and worst movement for stop controlled intersections.

Ln = lane; NB = northbound.

Of the four intersections that would exceed their mobility target under Alternatives C1 through C6, all four likely would be the result of project impacts and might require mitigation. All of these impacts are due to proposed park and rides and the traffic volumes they are expected to generate. Further details on these four intersections are as follows:

- **SW Hall Boulevard at SW Commercial Street.** This intersection would remain a two-way stop controlled intersection under the light rail alternatives. The side street volumes on SW Commercial Street would be increased by vehicles exiting the park and ride. The operational analysis suggests that the vehicles would experience increased delays waiting to turn left onto SW Hall Boulevard. The critical movement V/C ratio is expected to increase by 0.23.

- **SW Main Street at SW Commercial Street.** This intersection would remain a two-way stop controlled intersection under the light rail alternatives. The side street volumes on SW Commercial Street would be increased by vehicles exiting the park and ride.

- **SW 65th Avenue at SW Haines Street/I-5 northbound ramps.** Over 50 percent of the inbound PM peak hour Baylor Park and Ride trips would have to travel through this intersection, which would add additional demand to an intersection that already significantly exceeded mobility targets under the No-Build Alternative. The expected increase in the V/C ratio of 0.03 is at the threshold for triggering mitigation.

- **SW 68th Parkway at Atlanta Street.** This intersection would remain an all-way stop controlled intersection under the light rail alternatives but would convert free-flow right turns to stop-control to allow for safer operation. The V/C increases above the target as a result.

SW Carman Drive/SW Upper Boones Ferry Road Subarea

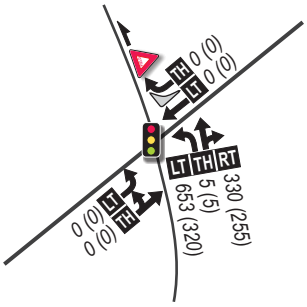
Table 5.3-16 and Table 5.3-17 show the Synchro analysis results for the light rail alternatives for the AM and PM peak hours for the SW Carman Drive/SW Upper Boones Ferry Road subarea. During the PM peak hour, the I-5 northbound ramp terminal at SW Carman Drive/Upper Boones Ferry Road is expected to continue to exceed mobility targets for all of the Segment C alignment alternatives (Alternatives C1 through C6).

Compared to the No-Build Alternative during the AM peak hour, two additional intersections would worsen to exceed operational standards in this subarea for all Segment C alignment alternatives.

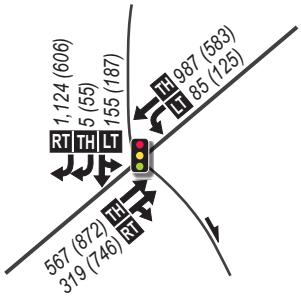
- **SW Carman Drive/I-5 northbound ramps.** The inbound Upper Boones Ferry Road Park and Ride trips travel through this intersection. The additional trips increase the V/C above the mobility target.
- **SW Upper Boones Ferry Road/I-5 southbound ramps.** The inbound Upper Boones Ferry Road Park and Ride trips travel through this intersection. The additional trips increase the V/C above the mobility target.

Volumes are shown graphically in Figure 5.3-7.

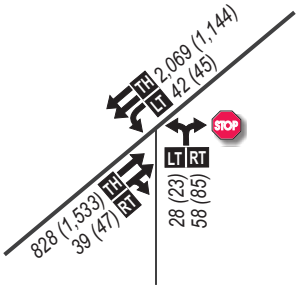
C23. *SW Upper Boones Ferry Rd. @ I-5 NB Ramps*



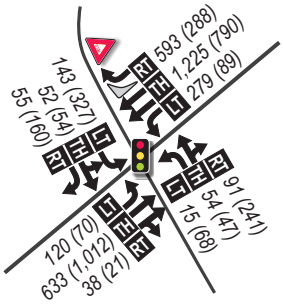
C24. *SW Upper Boones Ferry Rd. @ I-5 SB Ramps*



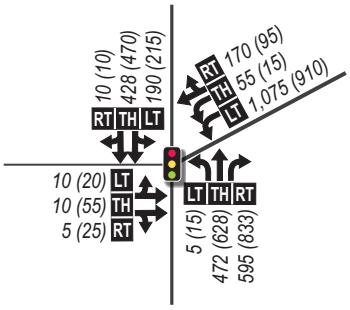
C25. *SW Upper Boones Ferry Rd. @ Burgerville/ Chevron Driveway*



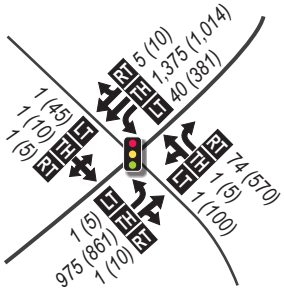
C26. *SW Upper Boones Ferry Rd. @ SW Sequoia Pkwy.*



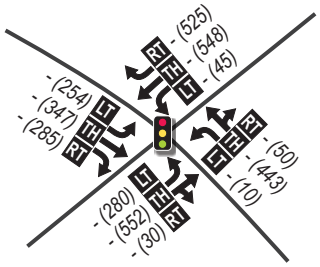
C27. *SW Upper Boones Ferry Rd. @ SW 72nd Ave. (North)*



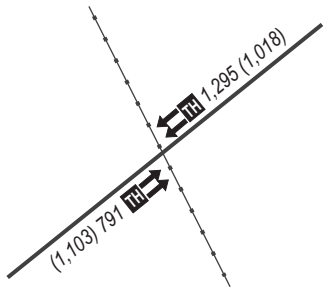
C28. *SW Upper Boones Ferry Rd. @ SW 72nd Ave. (South)*



C29. *SW Upper Boones Ferry Rd. @ SW Durham Rd.*



C30a. *SW Upper Boones Ferry Rd. @ Rail Crossing*



LEGEND

00. - Study Intersection No.
STOP - Stop Sign
- Yield Sign
- Traffic Signal
- Lane Configuration
AM (PM) - Peak Hour Traffic Volumes
LT TH RT - Volume Turn Movement
Left • Thru • Right

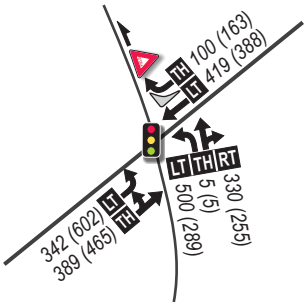
DKS

No Scale

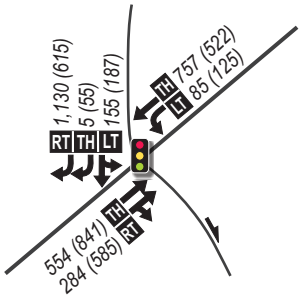
figure **5.3-7a**

2035 Build I-5 Configurations
AM/PM Peak Hour
Segment C: Carman/UBF

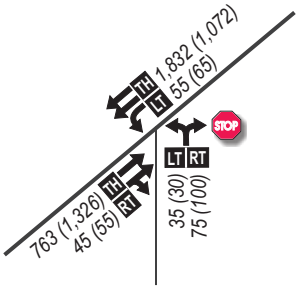
C23. *SW Upper Boones Ferry Rd. @ I-5 NB Ramps*



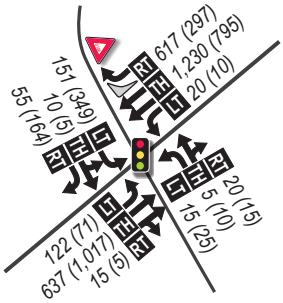
C24. *SW Upper Boones Ferry Rd. @ I-5 SB Ramps*



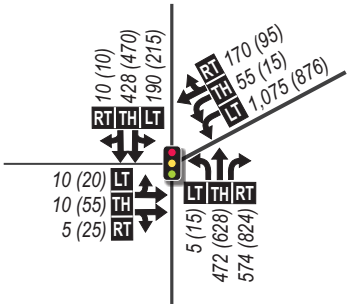
C25. *SW Upper Boones Ferry Rd. @ Burgerville/ Chevron Driveway*



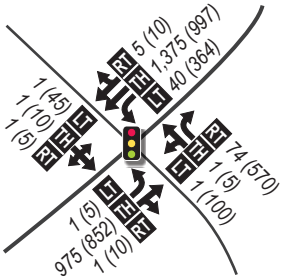
C26. *SW Upper Boones Ferry Rd. @ SW Sequoia Pkwy.*



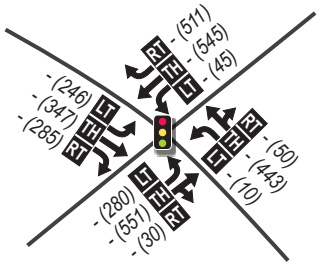
C27. *SW Upper Boones Ferry Rd. @ SW 72nd Ave. (North)*



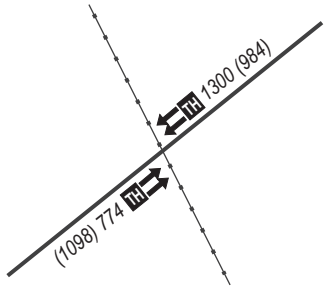
C28. *SW Upper Boones Ferry Rd. @ SW 72nd Ave. (South)*



C29. *SW Upper Boones Ferry Rd. @ SW Durham Rd.*



C30a. *SW Upper Boones Ferry Rd. @ Rail Crossing*



LEGEND

00. - Study Intersection No.
STOP - Stop Sign
- Yield Sign
- Traffic Signal
← - Lane Configuration
AM (PM) - Peak Hour Traffic Volumes
LT TH RT - Volume Turn Movement
Left • Thru • Right

DKS

No Scale

figure **5.3-7b**

2035 Build Railroad Configurations
AM/PM Peak Hour
Segment C: Carman/UBF

Table 5.3-16. Segment C 2035 Alternatives C2 and C4 Railroad HCM (Synchro) Analysis – SW Carman Drive/SW Upper Boones Ferry Road Subarea

ID	SW Carman Drive/ SW Upper Boones Ferry Road Subarea	Note	Mobility Target		2035 Light Rail Alternatives C2, C4 Railroad								
						AM				PM			
					Control	Delay	LOS	V/C	WLANE	Delay	LOS	V/C	WLANE
C23	I-5 northbound ramps/SW Carman Dr.		ODOT Ramp	0.85	Signal	**37.8**	**D**	**0.88**	-	**37.0**	**D**	**0.88**	-
C24	I-5 southbound ramps/SW Upper Boones Ferry Rd.		ODOT Ramp	0.85	Signal	**20.5**	**C**	**0.88**	-	16.1	B	0.68	-
C25	Burgerville/Chevron/SW Upper Boones Ferry Rd.		-	-	TWSC	PM Only				6.4 [124]	A [F]	0.94	NBLn1
C26	SW Sequoia Pkwy./SW Upper Boones Ferry Rd.	2	Tigard	1.00	Signal	14.6	B	0.58	-	15.9	B	0.57	-
C27	SW 72nd Ave. (north)/SW Upper Boones Ferry Rd.	2	Tigard	1.00	Signal	PM Only				37.3	D	0.93	-
C28	SW Upper Boones Ferry Rd./SW 72nd Ave. (south)	2	Tigard	1.00	Signal					15.9	B	0.73	-
C29	SW Durham Rd./SW Upper Boones Ferry Rd.	2	Tigard	1.00	Signal					51.7	D	0.87	-
C30a	SW Upper Boones Ferry Rd at railroad				Railroad	6.8	A	0.37	-	5.8	A	0.31	-

Key: [Worst stop-controlled delay] for TWSC intersections.

V/C represents intersection average for signals and worst movement for stop controlled intersections.

Ln = lane; NB = northbound.

1. Intersection analysis completed as part of 2016 Southwest Corridor study with review by ODOT, PBOT and Metro.

2. Intersection reflects Financially Constrained Project in future year 2035 analysis.

Table 5.3-17. Segment C 2035 Alternatives C1, C3, C5 and C6 I-5 HCM (Synchro) Analysis – SW Carman Drive/SW Upper Boones Ferry Road Subarea

ID	SW Carman Drive/ SW Upper Boones Ferry Road Subarea	Note	Mobility Target		2035 Light Rail Alternatives C1, C3, C5, C6 I-5								
						AM				PM			
					Control	Delay	LOS	V/C	WLANE	Delay	LOS	V/C	WLANE
C23	I-5 northbound ramps/SW Carman Dr.		ODOT Ramp	0.85	Signal	**81.3**	**F**	**1.05**	-	**43.5**	**D**	**0.93**	-
C24	I-5 southbound ramps/SW Upper Boones Ferry Rd.		ODOT Ramp	0.85	Signal	**30.1**	**C**	**1.06**	-	16.7	B	0.74	-
C25	Burgerville/Chevron/ SW Upper Boones Ferry Rd.		-	-	TWSC	PM Only				5.7 [144.4]	A [F]	0.96	NBLn1
C26	SW Sequoia Pkwy./SW Upper Boones Ferry Rd.	2	Tigard	1.00	Signal	23.1	C	0.69	-	23.8	C	0.67	-
C27	SW 72nd Ave. (north)/SW Upper Boones Ferry Rd.	2	Tigard	1.00	Signal	PM Only				38.3	D	0.94	-
C28	SW Upper Boones Ferry Rd./SW 72nd Ave. (south)	2	Tigard	1.00	Signal					16.7	B	0.75	-
C29	SW Durham Rd./SW Upper Boones Ferry Rd.	2	Tigard	1.00	Signal					52.0	D	0.88	-

Key: [Worst stop-controlled delay] for TWSC intersections.

V/C represents intersection average for signals and worst movement for stop controlled intersections.

Ln = lane; NB = northbound.

1. Intersection analysis completed as part of 2016 Southwest Corridor study with review by ODOT, PBOT and Metro.

2. Intersection reflects Financially Constrained Project in future year 2035 analysis.

Bridgeport Subarea

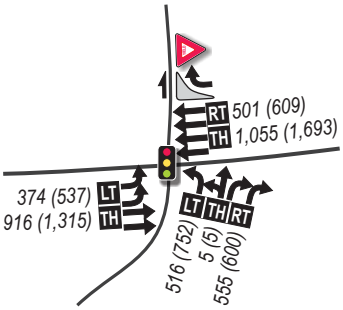
Table 5.3-18 shows Synchro analysis results for the light rail alternatives for the AM and PM peak hour for the Bridgeport subarea in Segment C.

During the PM peak hour, the I-5 northbound ramp terminal and the Bridgeport Park and Ride access at SW Travelers Lane/SW Lower Boones Ferry Road are expected to continue to exceed mobility targets for all of the Segment C alignment alternatives. All other intersections are expected to meet applicable mobility targets.

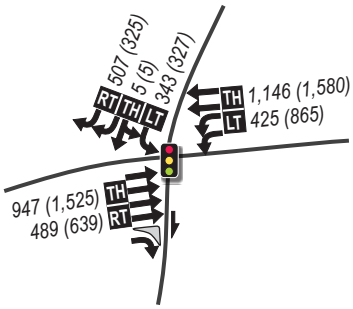
The single intersection analyzed in the AM peak hour is expected to meet applicable mobility targets.

Volumes are shown graphically in Figure 5.3-8 below.

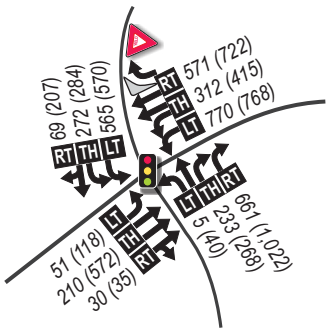
C31. *SW Lower Boones Ferry Rd. @ I-5 NB Ramps*



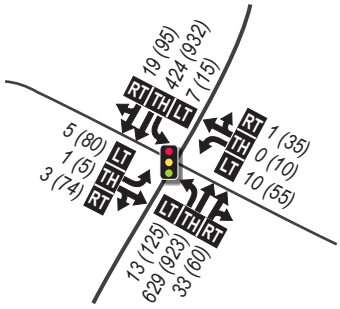
C32. *SW Lower Boones Ferry Rd. @ I-5 SB Ramps*



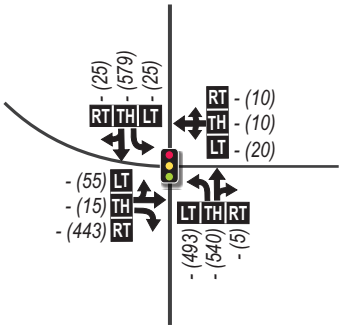
C33. *SW Lower Boones Ferry Rd. @ SW 72nd Ave.*



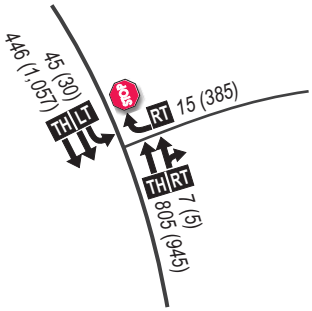
C34. *SW 72nd Ave. @ Bridgeport Village/ Terminal Station*



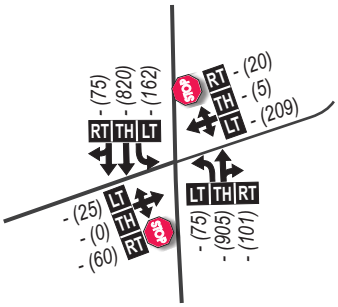
C35. *SW 72nd Ave. @ SW Durham Rd.*



C36. *SW Lower Boones Ferry Rd. @ Park & Ride Access*



C37. *SW Lower Boones Ferry Rd. @ Travellers Ln./Park & Ride Access*



LEGEND

00. - Study Intersection No.
STOP - Stop Sign
- Yield Sign
- Traffic Signal
← - Lane Configuration
AM (PM) - Peak Hour Traffic Volumes
LT TH RT - Volume Turn Movement
Left • Thru • Right

DKS

No Scale

figure **5.3-8**

2035 Build
AM/PM Peak Hour
Segment C: Bridgeport

Table 5.3-18. Segment C 2035 Light Rail Alternatives HCM (Synchro) Analysis – Bridgeport Subarea

ID	Bridgeport Subarea	Note	Mobility Target		2035 Light Rail (All Build Alternatives)								
						AM				PM			
					Control	Delay	LOS	V/C	WLANE	Delay	LOS	V/C	WLANE
C30b	SW 65th Ave./SW Lower Boones Ferry Rd.	1	Wash. Co.	0.99	Signal	PM Only				49.2	D	0.84	-
C31	I-5 northbound ramps/SW Lower Boones Ferry Rd.	1	ODOT Ramp	0.85	Signal					**23.2**	**C**	**0.91**	**-**
C32	I-5 southbound ramps/SW Lower Boones Ferry Rd.	1	ODOT Ramp	0.85	Signal					12.5	B	0.72	-
C33	SW 72nd Ave./SW Lower Boones Ferry Rd.	1	Wash. Co.	0.99	Signal	41.8	D	0.78	-	50.4	D	0.88	-
C34	SW 72nd Ave./Bridgeport Village/Terminal Station	1	Tigard	1.00	Signal	PM Only				14.6	B	0.52	-
C35	SW 72nd Ave./SW Durham Rd.	1	Tigard	1.00	Signal					17.6	B	0.92	-
C36	Park and Ride access/SW Lower Boones Ferry Rd.	1	Wash. Co.	0.99	TWSC					5.3 [32.6]	A [D]	0.77	WBLn1
C37	SW Travelers Ln./Park and Ride access/SW Lower Boones Ferry Rd.	1	Wash. Co.	0.99	TWSC					**>300 [>300]**	**F [F]**	**7.55**	**WBLn1**
C38	SW Hazel Fern Rd./SW Bridgeport Rd.	1	Wash. Co.	0.99	Signal					24.5	C	0.33	-
C39	REI/Bridgeport Village/SW Bridgeport Rd.	1	Wash. Co.	0.99	Signal					14.1	B	0.27	-

Key: [Worst stop-controlled delay] for TWSC intersections.

V/C represents intersection average for signals and worst movement for stop controlled intersections.

Ln = lane; WB = westbound.

1. Intersection analysis completed as part of 2016 Southwest Corridor study with review by ODOT, PBOT and Metro.

2. Intersection reflects Financially Constrained Project in future year 2035 analysis.

Of the two intersections expected to exceed mobility targets under the Alternatives C1 through C6, only the intersection of SW Travelers Lane/SW Lower Boones Ferry Road at the Bridgeport Park and Ride access is expected to be significantly impacted by the project with the existing two-way stop control. All of the inbound trips to the 950-space park and ride would have to travel through this intersection, while 36 percent of the outbound trips would be attempting to turn left onto SW Lower Boones Ferry Road from a two-way stop. This location would likely warrant a traffic signal.

2045 Light Rail Alternatives

As shown in Table 5.3-19, Table 5.3-20 and Table 5.3-21, the light rail alternatives generally would add traffic to the ramp terminals, but no additional intersections would exceed operational standards beyond the same three that would exceed standards for the 2035 light rail alternatives. See the previous section, which summarizes the impacts from the 2035 light rail alternatives for a discussion about the intersections that would be significantly impacted by the project in year 2045.

Table 5.3-19. Segment C 2045 Alternatives C1, C2, C3, C4 and C5 HCM (Synchro) Analysis – Tigard Subarea

ID	Tigard Subarea	Mobility Target		2045 Light Rail Alternative C1 through C5				
				Control	PM			
					Delay	LOS	V/C	WLANE
C17	SW 65th Ave./SW Haines St./I-5 northbound ramps	ODOT Ramp	0.85	AWSC	**55 [91.8]**	**F [F]**	**1.09**	**NBLn1**
C19	SW 68th Pkwy./SW Dartmouth St./I-5 southbound ramps	ODOT Ramp	0.85	Signal	**31.6**	**C**	**0.69**	**-**

Key: [Worst stop-controlled delay] for TWSC intersections.

V/C represents intersection average for signals and worst movement for stop controlled intersections.

Ln = lane; NB = northbound.

Table 5.3-20. Segment C 2045 Alternatives C1, C3, C5 and C6 HCM (Synchro) Analysis – SW Carman Drive/SW Upper Boones Ferry Road Subarea

ID	SW Carman Drive/ SW Boones Ferry Road Subarea	Note	Mobility Target		2045 Light Rail Alternatives C1, C3, C5, C6 Wall				
					Control	PM			
						Delay	LOS	V/C	WLANE
C23	I-5 northbound ramps/SW Carman Dr.		ODOT Ramp	0.85	Signal	**50.6**	**D**	**0.97**	**-**
C24	I-5 southbound ramps/SW Upper Boones Ferry Rd.		ODOT Ramp	0.85	Signal	17.1	B	0.77	-

Key: [Worst stop-controlled delay] for TWSC intersections.

V/C represents intersection average for signals and worst movement for stop controlled intersections.

1. Intersection analysis completed as part of 2016 Southwest Corridor study with review by ODOT, PBOT and Metro.

2. Intersection reflects Financially Constrained Project in future year 2035 analysis.

Table 5.3-21. Segment C 2045 Light Rail Alternatives HCM (Synchro) Analysis – Bridgeport Subarea

ID	Bridgeport Subarea	Note	Mobility Target		2045 Light Rail (All Build Alternatives)				
					Control	PM			
						Delay	LOS	V/C	WLANE
C31	I-5 northbound ramps/SW Lower Boones Ferry Rd.	1	ODOT Ramp	0.85	Signal	**43.0**	**D**	**1.01**	**-**
C32	I-5 southbound ramps/SW Lower Boones Ferry Rd.	1	ODOT Ramp	0.85	Signal	12.3	B	0.74	-

Key: [Worst stop-controlled delay] for TWSC intersections.

V/C represents intersection average for signals and worst movement for stop controlled intersections.

1. Intersection analysis completed as part of 2016 Southwest Corridor study with review by ODOT, PBOT and Metro.

2. Intersection reflects Financially Constrained Project in future year 2035 analysis.

No additional intersections would exceed operational standards for forecast year 2045 beyond the same three that would exceed standards for the 2035 light rail alternatives.

5.3.5. Segment C Queuing Analysis

2035 No-Build Alternative

Table 5.3-22 summarizes the Synchro analysis of the 95th percentile queues in the Tigard subarea. Queuing along SW Hall Boulevard at the existing WES Commuter Rail could extend beyond the next adjacent intersection (SW Commercial Street) for vehicles traveling southbound. Queuing at the WES crossing for northbound vehicles does not appear to be a concern under No Build conditions.

Tigard Subarea

Table 5.3-22. Segment C 2035 No-Build Alternative PM Queuing Synchro Analysis – Tigard Subarea

Queuing Results for PM Peak Hour								
95th Percentile Queue								
Study Intersection No.		C4	C5	C12	C15	C17	C19	C20a
Approach	Movement	SW Hall Blvd./SW Clinton St.	SW Hall Blvd./SW Ash Ave.	SW Hunziker St./SW Wall St.	SW 72nd Ave./SW Beveland St.	SW 65th Ave./SW Haines St./I-5 northbound ramps	SW 68th Ave./SW Dartmouth St./I-5 southbound ramps	SW Hall Blvd./existing railroad crossing (WES)
NB	Left			N/A	58	-	107	-
	Thru			N/A	101	18	225	339
	Right			N/A	14	-	49	-
SB	Left			N/A	29	-	194	-
	Thru			N/A	562	-	159	622
	Right			N/A	-	-	-	-
EB	Left			N/A	98	-	246	-
	Thru			N/A	53	10	234	-
	Right			N/A	-	5	-	-
WB	Left			N/A	394	-	-	-
	Thru			N/A	41	7	214	-
	Right			N/A	-	-	20	-

N/A – Synchro does not calculate 95th percentile queue lengths for stop-controlled intersections.

EB = eastbound; NB = northbound; SB = southbound; WB = westbound.

SW Carman Drive/SW Upper Boones Ferry Road Subarea

Table 5.3-23 and Table 5.3-24 summarize the Synchro analysis of the 95th percentile queues in the SW Carman Drive/SW Upper Boones Ferry subarea for the AM and PM peak periods. In the AM peak period, queuing would be worst on the I-5 northbound ramp terminal, where queues could back up onto the freeway. In the PM peak period, queuing would be compounded along SW Upper Boones Ferry Road in both directions, with westbound traffic queues extending east of the study area. Traffic in both the eastbound and westbound directions would extend across the existing at-grade railroad crossing and the intersection of SW Upper Boones Ferry Road at SW Durham Road would experience particularly long queues for the eastbound through movement.

Table 5.3-23. Segment C 2035 No-Build Alternative AM Queuing SimTraffic Analysis – SW Carman Drive/SW Upper Boones Ferry Road Subarea

Queuing Results for AM Peak Hour									
95th Percentile Queue									
Study Intersection No.		C23	C24	C25	C26	C27	C28	C29	C30a
Approach	Movement	I-5 northbound ramps/ SW Carman Dr.	I-5 southbound ramps/ SW Upper Boones Ferry Rd.	Burgerville/Chevron/ SW Upper Boones Ferry Rd.	SW Sequoia Pkwy./SW Upper Boones Ferry Rd.	SW 72nd Ave. (north)/ SW Upper Boones Ferry Rd.	SW Upper Boones Ferry Rd./SW 72nd Ave. (south)	SW Durham Rd./SW Upper Boones Ferry Rd.	SW Upper Boones Ferry Rd./existing railroad crossing
NB	Left	1,646	-		40				-
	Thru	-	-		39				-
	Right	393	-		-				-
SB	Left	-	85		79				-
	Thru	-	-		131				-
	Right	-	311		69				-
EB	Left	216	-		134				-
	Thru	213	234		165				11
	Right	-	-		-				-
WB	Left	-	68		80				-
	Thru	717	153		256				110
	Right	-	-		107				-

EB = eastbound; NB = northbound; SB = southbound; WB = westbound.

Table 5.3-24. Segment C 2035 No-Build Alternative PM Queuing SimTraffic Analysis – SW Carman Drive/SW Upper Boones Ferry Road Subarea

Queuing Results for PM Peak Hour									
95th Percentile Queue									
Study Intersection No.		C23	C24	C25	C26	C27	C28	C29	C30a
Approach	Movement	I-5 northbound ramps/ SW Carman Dr.	I-5 southbound ramps/ SW Upper Boones Ferry Rd.	Burgerville/Chevron/ SW Upper Boones Ferry Rd.	SW Sequoia Pkwy./SW Upper Boones Ferry Rd.	SW 72nd Ave. (north)/ SW Upper Boones Ferry Rd.	SW Upper Boones Ferry Rd./SW 72nd Ave. (south)	SW Durham Rd./SW Upper Boones Ferry Rd.	SW Upper Boones Ferry Rd./existing railroad crossing
NB	Left	412	-	-	98	73	-	64	-
	Thru	-	-	265	55	537	1001	918	-
	Right	245	-	-	-	614	216	-	-
SB	Left	-	247	-	322	1,063	-	494	-
	Thru	-	-	-	711	1,098	163	705	-
	Right	-	347	-	277	-	-	279	-
EB	Left	593	-	-	155	-	62	537	-
	Thru	545	288	344	238	171	879	1,921	334
	Right	-	-	-	-	-	-	-	-
WB	Left	-	257	140	79	298	240	204	-
	Thru	732	459	245	343	-	469	903	293
	Right	-	-	-	-	310	-	441	-

EB = eastbound; NB = northbound; SB = southbound; WB = westbound.

Bridgeport Subarea

Table 5.3-25 and Table 5.3-26 summarize the SimTraffic simulation for the 95th percentile queues in the Bridgeport subarea for the AM and PM peak periods. In the AM peak period, only the intersection of SW 72nd Avenue at SW Lower Boones Ferry Road was analyzed; the northbound queue is expected to extend beyond the adjacent access and the southbound left-turn to spill out of the storage bay.

In the PM peak period, queuing would begin to back into adjacent intersections in both directions between SW 72nd Avenue and SW 65th Avenue. The northbound I-5 off-ramp would experience the worst queuing, exceeding the length of the off-ramp and creating safety concerns on the freeway.

Table 5.3-25. Segment C 2035 No-Build Alternative AM Queuing SimTraffic Analysis – Bridgeport Subarea

Queuing Results for AM Peak Hour											
95th Percentile Queue											
Study Intersection No.		C30b	C31	C32	C33	C34	C35	C36	C37	C38	C39
Approach	Movement	SW 65th Ave./SW Lower Boones Ferry Rd.	I-5 northbound ramps/ SW Lower Boones Ferry Rd.	I-5 southbound ramps/ SW Lower Boones Ferry Rd.	SW 72nd Ave./SW Lower Boones Ferry Rd.	SW 72nd Ave./ Bridgeport Village/ Terminal Station	SW 72nd Ave./SW Durham Rd.	Park and Ride access/ SW Lower Boones Ferry Rd.	SW Travelers Ln./Park and Ride access/SW Lower Boones Ferry Rd.	SW Hazel Fern Rd./SW Bridgeport Rd.	REI/Bridgeport Village/ SW Bridgeport Rd.
NB	Left				28						
	Thru				279						
	Right				307						
SB	Left				594						
	Thru				341						
	Right				-						
EB	Left				89						
	Thru				147						
	Right				-						
WB	Left				310						
	Thru				190						
	Right				148						

EB = eastbound; NB = northbound; SB = southbound; WB = westbound.

Table 5.3-26. Segment C 2035 No-Build Alternative PM Queuing SimTraffic Analysis – Bridgeport Subarea

Queuing Results for PM Peak Hour											
95th Percentile Queue											
Study Intersection No.		C30b	C31	C32	C33	C34	C35	C36	C37	C38	C39
Approach	Movement	SW 65th Ave./SW Lower Boones Ferry Rd.	I-5 northbound ramps/ SW Lower Boones Ferry Rd.	I-5 southbound ramps/ SW Lower Boones Ferry Rd.	SW 72nd Ave./SW Lower Boones Ferry Rd.	SW 72nd Ave./ Bridgeport Village/ Terminal Station	SW 72nd Ave./SW Durham Rd.	Park and Ride access/ SW Lower Boones Ferry Rd.	SW Travelers Ln./Park and Ride access/SW Lower Boones Ferry Rd.	SW Hazel Fern Rd./SW Bridgeport Rd.	REI/Bridgeport Village/ SW Bridgeport Rd.
NB	Left	150	543	-	96	163	414	-	214	142	-
	Thru	144	587	-	341	229	243	479	532	345	127
	Right	-	219	-	359	-	-	-	-	-	60
SB	Left	-	-	128	520	74	102	57	48	242	193
	Thru	413	-	157	615	525	631	49	107	268	97
	Right	233	-	117	-	-	-	-	78	63	-
EB	Left	404	285	-	187	99	-	-	-	112	53
	Thru	496	276	321	555	79	325	-	281	346	59

Queuing Results for PM Peak Hour											
95th Percentile Queue											
Study Intersection No.		C30b	C31	C32	C33	C34	C35	C36	C37	C38	C39
Approach	Movement	SW 65th Ave./SW Lower Boones Ferry Rd.	I-5 northbound ramps/ SW Lower Boones Ferry Rd.	I-5 southbound ramps/ SW Lower Boones Ferry Rd.	SW 72nd Ave./SW Lower Boones Ferry Rd.	SW 72nd Ave./ Bridgeport Village/ Terminal Station	SW 72nd Ave./SW Durham Rd.	Park and Ride access/ SW Lower Boones Ferry Rd.	SW Travelers Ln./Park and Ride access/SW Lower Boones Ferry Rd.	SW Hazel Fern Rd./SW Bridgeport Rd.	REI/Bridgeport Village/ SW Bridgeport Rd.
	Right	456	-	322	-	-	1,406	-	-	-	-
WB	Left	413	-	369	389	119	-	-	-	173	58
	Thru	790	301	235	285	54	155	-	461	223	104
	Right	-	303	-	379	-	-	385	-	-	66

EB = eastbound; NB = northbound; SB = southbound; WB = westbound.

2045 No-Build Alternative

The 2045 No-Build Alternative was analyzed to understand potential impacts to the freeway ramp terminals during the PM Peak Hour only.

Table 5.3-27 summarizes the Synchro analysis of the 95th percentile queues in the Tigard subarea.

Tigard Subarea

Table 5.3-27. Segment C 2045 No-Build Alternative PM Queuing Synchro Analysis – Tigard Subarea

Queuing Results for PM Peak Hour								
95th Percentile Queue								
Study Intersection No.		C4	C5	C12	C15	C17	C19	C20a
Approach	Movement	SW Hall Blvd./SW Clinton St.	SW Hall Blvd./SW Ash Ave.	SW Hunziker St./SW Wall St.	SW 72nd Ave./SW Beveland St.	SW 65th Ave./SW Haines St./I-5 northbound ramps	SW 68th Ave./SW Dartmouth St./I-5 southbound ramps	SW Hall Blvd./existing railroad crossing (WES)
NB	Left					-	131	
	Thru					20	249	
	Right					-	56	
SB	Left					-	194	
	Thru					-	211	
	Right					-	-	
EB	Left					-	248	
	Thru					12	239	
	Right					5	-	
WB	Left					-	-	

Queuing Results for PM Peak Hour								
95th Percentile Queue								
Study Intersection No.		C4	C5	C12	C15	C17	C19	C20a
Approach	Movement	SW Hall Blvd./SW Clinton St.	SW Hall Blvd./SW Ash Ave.	SW Hunziker St./SW Wall St.	SW 72nd Ave./SW Beveland St.	SW 65th Ave./SW Haines St./I-5 northbound ramps	SW 68th Ave./SW Dartmouth St./I-5 southbound ramps	SW Hall Blvd./existing railroad crossing (WES)
	Thru					8	243	
	Right					-	22	

N/A – Synchro does not calculate 95th percentile queue lengths for stop-controlled intersections.

EB = eastbound; NB = northbound; SB = southbound; WB = westbound.

SW Carman Drive/SW Upper Boones Ferry Road Subarea

Table 5.3-28 summarizes the SimTraffic simulation of the 95th percentile queues in the SW Carman Drive/SW Upper Boones Ferry subarea for the PM peak period in year 2045. Queuing would be similar to the No-Build Alternative in 2035 but with slightly longer queues for most movements.

Table 5.3-28. Segment C 2045 No-Build Alternative Queuing SimTraffic Analysis – SW Carman Drive/SW Upper Boones Ferry Road Subarea

Queuing Results for PM Peak Hour									
95th Percentile Queue									
Study Intersection No.		C23	C24	C25	C26	C27	C28	C29	C30a
Approach	Movement	I-5 northbound ramps/ SW Carman Dr.	I-5 southbound ramps/SW Upper Boones Ferry Rd.	Burgerville/Chevron/SW Upper Boones Ferry Rd.	SW Sequoia Pkwy./SW Upper Boones Ferry Rd.	SW 72nd Ave. (north)/SW Upper Boones Ferry Rd.	SW Upper Boones Ferry Rd./SW 72nd Ave. (south)	SW Durham Rd./SW Upper Boones Ferry Rd.	SW Upper Boones Ferry Rd./existing railroad (Portland & Western)
NB	Left	321	-						
	Thru	198	-						
	Right	-	-						
SB	Left	-	-						
	Thru	-	235						
	Right	-	171						
EB	Left	612	-						
	Thru	584	303						
	Right	-	-						
WB	Left	-	130						
	Thru	1135	51						
	Right	-	-						

EB = eastbound; NB = northbound; SB = southbound; WB = westbound.

Bridgeport Subarea

Table 5.3-29 summarizes the SimTraffic simulation for the 95th percentile queues in the Bridgeport subarea for the PM peak period in year 2045. Queuing would be comparable to the No-Build Alternative in 2035, with the exception of some movements that would increase. The northbound off-ramp queue would increase, which might require mitigation.

Table 5.3-29. Segment C 2045 No-Build Alternative Queuing SimTraffic Analysis – Bridgeport Subarea

Queuing Results for PM Peak Hour											
95th Percentile Queue											
Study Intersection No.		C30b	C31	C32	C33	C34	C35	C36	C37	C38	C39
Approach	Movement	SW 65th Ave./SW Lower Boones Ferry Rd.	I-5 northbound ramps/SW Lower Boones Ferry Rd.	I-5 southbound ramps/SW Lower Boones Ferry Rd.	SW 72nd Ave./SW Lower Boones Ferry Rd.	SW 72nd Ave./Bridgeport Village /Terminal Station	SW 72nd Ave./SW Durham Rd.	Park and Ride access/SW Lower Boones Ferry Rd.	SW Travelers Ln./Park and Ride access/SW Lower Boones Ferry Rd.	SW Hazel Fern Rd./SW Bridgeport Rd.	REI/Bridgeport Village/SW Bridgeport Rd.
NB	Left		3,291	-							
	Thru		3,297	-							
	Right		2,724	-							
SB	Left		-	126							
	Thru		-	142							
	Right		-	83							
EB	Left		226	-							
	Thru		314	301							
	Right		-	294							
WB	Left		-	414							
	Thru		353	236							
	Right		219	-							

EB = eastbound; NB = northbound; SB = southbound; WB = westbound.

2035 Light Rail Alternatives

Tigard Subarea

Table 5.3-30 through Table 5.3-32 summarize the Synchro analysis for the 95th percentile queues in the Tigard subarea for the different light rail alignment alternatives. The addition of light rail through study area intersections is expected to create more delay than the No-Build Alternative, causing queuing to increase where vehicles must wait for trains to pass.

Table 5.3-30. Segment C 2035 Alternatives C3 and C4 Clinton PM Queuing Synchro Analysis – Tigard Subarea

Queuing Results for PM Peak Hour								
95th Percentile Queue – Single Train/Consecutive Trains[1]								
Study Intersection No.		C4	C5	C12	C15	C17	C19	C20a
Approach	Movement	SW Hall Blvd./SW Clinton St.	SW Hall Blvd./SW Ash Ave.	SW Hunziker St./SW Wall St.	SW 72nd Ave./SW Beveland St.	SW 65th Ave./SW Haines St.	SW 68th Ave./SW Dartmouth St./I-5 southbound ramps	SW Hall Blvd./existing railroad crossing (WES)
NB	Left	4/9		N/A	60	-	136	-
	Thru	488/998		N/A	677	20	205	306/626
	Right	-		N/A	11	-	48	-
SB	Left	-		N/A	21	-	409	-
	Thru	418/856		N/A	604	-	154	550/1123
	Right	-		N/A	-	-	-	-
EB	Left	-		N/A	84	-	235	-
	Thru	-		N/A	48	10	210	-
	Right	-		N/A	-	5	-	-
WB	Left	-		N/A	376	-	-	-
	Thru	-		N/A	39	9	216	-
	Right	-		N/A	60	-	21	-

1. The light rail alternatives queuing analysis was performed for two different options: single train/two consecutive trains.

EB = eastbound; NB = northbound; SB = southbound; WB = westbound.

Table 5.3-31. Segment C 2035 Alternatives C1, C2 and C5 Ash PM Queuing Synchro Analysis – Tigard Subarea

Queuing Results for PM Peak Hour								
95th Percentile Queue – Single Train/Consecutive Trains[1]								
Study Intersection No.		C4	C5	C12	C15	C17	C19	C20a
Approach	Movement	SW Hall Blvd. /SW Clinton St.	SW Hall Blvd./SW Ash Ave.	SW Hunziker St./SW Wall St.	SW 72nd Ave./SW Beveland St.	SW 65th Ave./SW Haines St.	ISW 68th Ave./SW Dartmouth St./I-5 southbound ramps	SW Hall Blvd / Existing Rail Crossing (WES)
NB	Left		-	N/A	58/58		136	-
	Thru		420/985	N/A	668/672	20	205	306/626
	Right		-	N/A	3/4	-	48	-
SB	Left		-	N/A	21/21	-	409	-
	Thru		399/835	N/A	597/605	-	154	550/1,123
	Right		-	N/A	-	-	-	-
EB	Left		-	N/A	81/79	-	235	-
	Thru		-	N/A	47/45	10	210	-
	Right		-	N/A	-	5	-	-
WB	Left		-	N/A	373/357	-	-	-
	Thru		-	N/A	38/37	9	216	-
	Right		-	N/A	-	-	21	-

1. The light rail alternatives queuing analysis was performed for two different options: single train and two consecutive trains.

EB = eastbound; NB = northbound; SB = southbound; WB = westbound.

Table 5.3-32. Segment C 2035 Alternative C6 Wall PM Queuing Synchro Analysis – Tigard Subarea

Queuing Results for PM Peak Hour								
95th Percentile Queue – Single Train/Consecutive Trains[1]								
Study Intersection No.		C4	C5	C12	C15	C17	C19	C20a
Approach	Movement	SW Hall Blvd./SW Clinton St.	SW Hall Blvd./SW Ash Ave.	SW Hunziker St./SW Wall St.	SW 72nd Ave./SW Beveland St.	SW 65th Ave./SW Haines St.	SW 68th Ave./SW Dartmouth St./I-5 southbound ramps	SW Hall Blvd./existing railroad crossing (WES)
NB	Left			38/37	151/187	-	137	-
	Thru			26/26	410/439	20	213	326/667
	Right			-	19/21	-	35	-
SB	Left			7/7	34/37	-	361	-
	Thru			74/72	779/816	-	194	569/1,163
	Right			-	-	-	-	-
EB	Left			92/92	371/371	-	255	-
	Thru			57/57	76/76	10	212	-

Queuing Results for PM Peak Hour								
95th Percentile Queue – Single Train/Consecutive Trains[1]								
Study Intersection No.		C4	C5	C12	C15	C17	C19	C20a
Approach	Movement	SW Hall Blvd./SW Clinton St.	SW Hall Blvd./SW Ash Ave.	SW Hunziker St./SW Wall St.	SW 72nd Ave./SW Beveland St.	SW 65th Ave./SW Haines St.	SW 68th Ave./SW Dartmouth St./I-5 southbound ramps	SW Hall Blvd./existing railroad crossing (WES)
	Right			-	-	5	-	-
WB	Left			5/5	278/278	-	-	-
	Thru			232/249	104/104	9	256	-
	Right			-	-	-	22	-

1. The light rail alternatives queuing analysis was performed for two different options: single train and two consecutive trains.

EB = eastbound; NB = northbound; SB = southbound; WB = westbound.

SW Carman Drive/SW Upper Boones Ferry Road Subarea

Table 5.3-33 through Table 5.3-36 summarize the SimTraffic simulation for the 95th percentile queues for the AM and PM peak hours for the various light rail alignment alternatives. The addition of the park and ride lots would increase the demand along the routes serving the lot. Figure 5.3-9 through Figure 5.3-12 show the queues depicted in the tables as they compare to the No-Build Alternative.

Compared to the No-Build Alternative, Alternatives C2 and C4 (Railroad alignments) would increase queuing during the AM peak hour at the I-5 northbound ramp terminal for the northbound and westbound movements. The southbound right-turn movement and the westbound through movement at the southbound ramp terminal also would have increased queuing under Alternatives C2 and C4.

Compared to the No-Build Alternative, Alternatives C2 and C4 would increase queuing during the PM peak hour slightly in the eastbound direction between the park and ride access and the I-5 northbound ramp terminal, but the queuing would not be as significant as the queuing in the AM peak hour.

Table 5.3-33. Segment C 2035 Alternatives C2 and C4 Railroad AM Queuing SimTraffic Analysis – SW Carman Drive/SW Boones Ferry Road Subarea

Queuing Results for AM Peak Hour									
95th Percentile Queue									
Study Intersection No.		C23	C24	C25	C26	C27	C28	C29	C30a
Approach	Movement	I-5 northbound ramps/SW Carman Dr.	I-5 southbound ramps/ SW Upper Boones Ferry Rd.	Burgerville/Chevron/ SW Upper Boones Ferry Rd.	SW Sequoia Pkwy./SW Upper Boones Ferry Rd.	SW 72nd Ave. (north)/ SW Upper Boones Ferry Rd.	SW Upper Boones Ferry Rd./SW 72nd Ave. (south)	SW Durham Rd./SW Upper Boones Ferry Rd.	SW Upper Boones Ferry Rd./existing railroad crossing
NB	Left	1587	-		34				-
	Thru	-	-		36				-

Queuing Results for AM Peak Hour									
95th Percentile Queue									
Study Intersection No.		C23	C24	C25	C26	C27	C28	C29	C30a
Approach	Movement	I-5 northbound ramps/SW Carman Dr.	I-5 southbound ramps/ SW Upper Boones Ferry Rd.	Burgerville/Chevron/ SW Upper Boones Ferry Rd.	SW Sequoia Pkwy./SW Upper Boones Ferry Rd.	SW 72nd Ave. (north)/ SW Upper Boones Ferry Rd.	SW Upper Boones Ferry Rd./SW 72nd Ave. (south)	SW Durham Rd./SW Upper Boones Ferry Rd.	SW Upper Boones Ferry Rd./existing railroad crossing
	Right	438	-		-				-
SB	Left	-	121		82				-
	Thru	-	-		115				-
	Right	-	329		62				-
EB	Left	212	-		130				-
	Thru	257	248		192				132
	Right	-	-		-				-
WB	Left	-	86		67				-
	Thru	354	180		290				123
	Right	-	-		102				-

EB = eastbound; NB = northbound; SB = southbound; WB = westbound.

Table 5.3-34. Segment C 2035 Alternatives C2 and C4 Railroad PM Queuing SimTraffic Analysis – SW Carman Drive/SW Boones Ferry Road Subarea

Queuing Results for PM Peak Hour									
95th Percentile Queue									
Study Intersection No.		C23	C24	C25	C26	C27	C28	C29	C30a
Approach	Movement	I-5 northbound ramps/SW Carman Dr.	I-5 southbound ramps/ SW Upper Boones Ferry Rd.	Burgerville/Chevron/ SW Upper Boones Ferry Rd.	SW Sequoia Pkwy./SW Upper Boones Ferry Rd.	SW 72nd Ave. (north)/ SW Upper Boones Ferry Rd.	SW Upper Boones Ferry Rd./SW 72nd Ave. (south)	SW Durham Rd./SW Upper Boones Ferry Rd.	SW Upper Boones Ferry Rd./existing railroad crossing
NB	Left	396	-	-	83	104	-	77	-
	Thru	-	-	267	53	558	1,038	1,033	-
	Right	239	-	-	-	598	224	-	-
SB	Left	-	221	-	348	925	-	554	-
	Thru	-	-	-	459	936	161	857	-
	Right	-	226	-	296	-	-	276	-
EB	Left	459	-	-	145	-	53	531	-
	Thru	427	293	350	255	255	953	1558	340
	Right	-	-	-	-	-	-	-	-
WB	Left	-	223	131	109	298	235	216	-
	Thru	966	338	233	351	-	473	874	310

Queuing Results for PM Peak Hour									
95th Percentile Queue									
Study Intersection No.		C23	C24	C25	C26	C27	C28	C29	C30a
Approach	Movement	I-5 northbound ramps/SW Carman Dr.	I-5 southbound ramps/ SW Upper Boones Ferry Rd.	Burgerville/Chevron/ SW Upper Boones Ferry Rd.	SW Sequoia Pkwy./SW Upper Boones Ferry Rd.	SW 72nd Ave. (north)/ SW Upper Boones Ferry Rd.	SW Upper Boones Ferry Rd./SW 72nd Ave. (south)	SW Durham Rd./SW Upper Boones Ferry Rd.	SW Upper Boones Ferry Rd./existing railroad crossing
	Right	-	-	-	21	301	-	451	-

EB = eastbound; NB = northbound; SB = southbound; WB = westbound.

Alternatives C1, C3, C5 and C6 (I-5 alignments) would create different queuing and demand concerns than Alternative C2 and C4 because of the location and increased size of the assumed park and ride. During the AM peak hour, the northbound left queue at the northbound ramp terminal would be less than the same queue under the No-Build Alternative, but the eastbound movement would be longer. Otherwise, the queues would be comparable to those of the No-Build Alternative.

Compared to the No-Build Alternative, the queuing for the PM peak hour under Alternatives C1, C3, C5 and C6 would increase for the northbound left turn at the northbound ramp terminal, which be a greater increase than that under Alternatives C2 and C4. Queue lengths also would increase from the No-Build Alternative for movements heading to the park and ride access at the following intersections along SW Upper Boones Ferry Road: SW 72nd Avenue (north), SW Sequoia Parkway and the I-5 southbound ramp terminal.

Table 5.3-35. Segment C 2035 Alternatives C1, C3, C5 and C6 I-5 AM Queuing SimTraffic Analysis – SW Carman Drive/SW Boones Ferry Road Subarea

Queuing Results for AM Peak Hour									
95th Percentile Queue									
Study Intersection No.		C23	C24	C25	C26	C27	C28	C29	C30a
Approach	Movement	I-5 northbound ramps/ SW Carman Dr.	I-5 southbound ramps/SW Upper Boones Ferry Rd.	Burgerville/Chevron/ SW Upper Boones Ferry Rd.	SW Sequoia Pkwy./SW Upper Boones Ferry Rd.	SW 72nd Ave. (north)/ SW Upper Boones Ferry Rd.	SW Upper Boones Ferry Rd./SW 72nd Ave. (south)	SW Durham Rd./SW Upper Boones Ferry Rd.	SW Upper Boones Ferry Rd./existing railroad crossing
NB	Left	1,403	-		41				-
	Thru	-	-		170				-
	Right	433	-		-				-
SB	Left	-	-		88				-
	Thru	-	141		172				-
	Right	-	342		71				-
EB	Left	239	-		182				-
	Thru	288	297		240				112

Queuing Results for AM Peak Hour									
95th Percentile Queue									
Study Intersection No.		C23	C24	C25	C26	C27	C28	C29	C30a
Approach	Movement	I-5 northbound ramps/ SW Carman Dr.	I-5 southbound ramps/SW Upper Boones Ferry Rd.	Burgerville/Chevron/ SW Upper Boones Ferry Rd.	SW Sequoia Pkwy./SW Upper Boones Ferry Rd.	SW 72nd Ave. (north)/ SW Upper Boones Ferry Rd.	SW Upper Boones Ferry Rd./SW 72nd Ave. (south)	SW Durham Rd./SW Upper Boones Ferry Rd.	SW Upper Boones Ferry Rd./existing railroad crossing
	Right	-	-		-				-
WB	Left	-	61		245				-
	Thru	825	233		307				163
	Right	-	-		103				-

EB = eastbound; NB = northbound; SB = southbound; WB = westbound.

Table 5.3-36. Segment C 2035 Alternatives C1, C3, C5 and C6 I-5 PM Queuing SimTraffic Analysis – SW Carman Drive/SW Boones Ferry Road Subarea

Queuing Results for PM Peak Hour									
95th Percentile Queue									
Study Intersection No.		C23	C24	C25	C26	C27	C28	C29	C30a
Approach	Movement	I-5 northbound ramps/SW Carman Dr.	I-5 southbound ramps/SW Upper Boones Ferry Rd.	Burgerville/Chevron/ SW Upper Boones Ferry Rd.	SW Sequoia Pkwy./SW Upper Boones Ferry Rd.	SW 72nd Ave. (north)/ SW Upper Boones Ferry Rd.	SW Upper Boones Ferry Rd./SW 72nd Ave. (south)	SW Durham Rd./SW Upper Boones Ferry Rd.	SW Upper Boones Ferry Rd./existing railroad crossing
NB	Left	763	-	-	237	88	-	59	-
	Thru	-	-	277	316	573	965	1,163	-
	Right	343	-	-	-	533	210	-	-
SB	Left	-	241	-	418	1,224	-	557	-
	Thru	-	-	-	1,071	1,520	233	839	-
	Right	-	346	-	330	-	-	253	-
EB	Left	322	-	-	152	-	45	592	-
	Thru	307	282	326	231	301	988	2,255	319
	Right	-	-	-	-	-	-	-	-
WB	Left	-	185	124	282	299	234	225	-

Queuing Results for PM Peak Hour									
95th Percentile Queue									
Study Intersection No.		C23	C24	C25	C26	C27	C28	C29	C30a
Approach	Movement	I-5 northbound ramps/SW Carman Dr.	I-5 southbound ramps/SW Upper Boones Ferry Rd.	Burgerville/Chevron/ SW Upper Boones Ferry Rd.	SW Sequoia Pkwy./SW Upper Boones Ferry Rd.	SW 72nd Ave. (north)/ SW Upper Boones Ferry Rd.	SW Upper Boones Ferry Rd./SW 72nd Ave. (south)	SW Durham Rd./SW Upper Boones Ferry Rd.	SW Upper Boones Ferry Rd./existing railroad crossing
	Thru	1,822	499	284	347	-	446	674	295
	Right	-	-	-	57	309	-	419	-

EB = eastbound; NB = northbound; SB = southbound; WB = westbound.

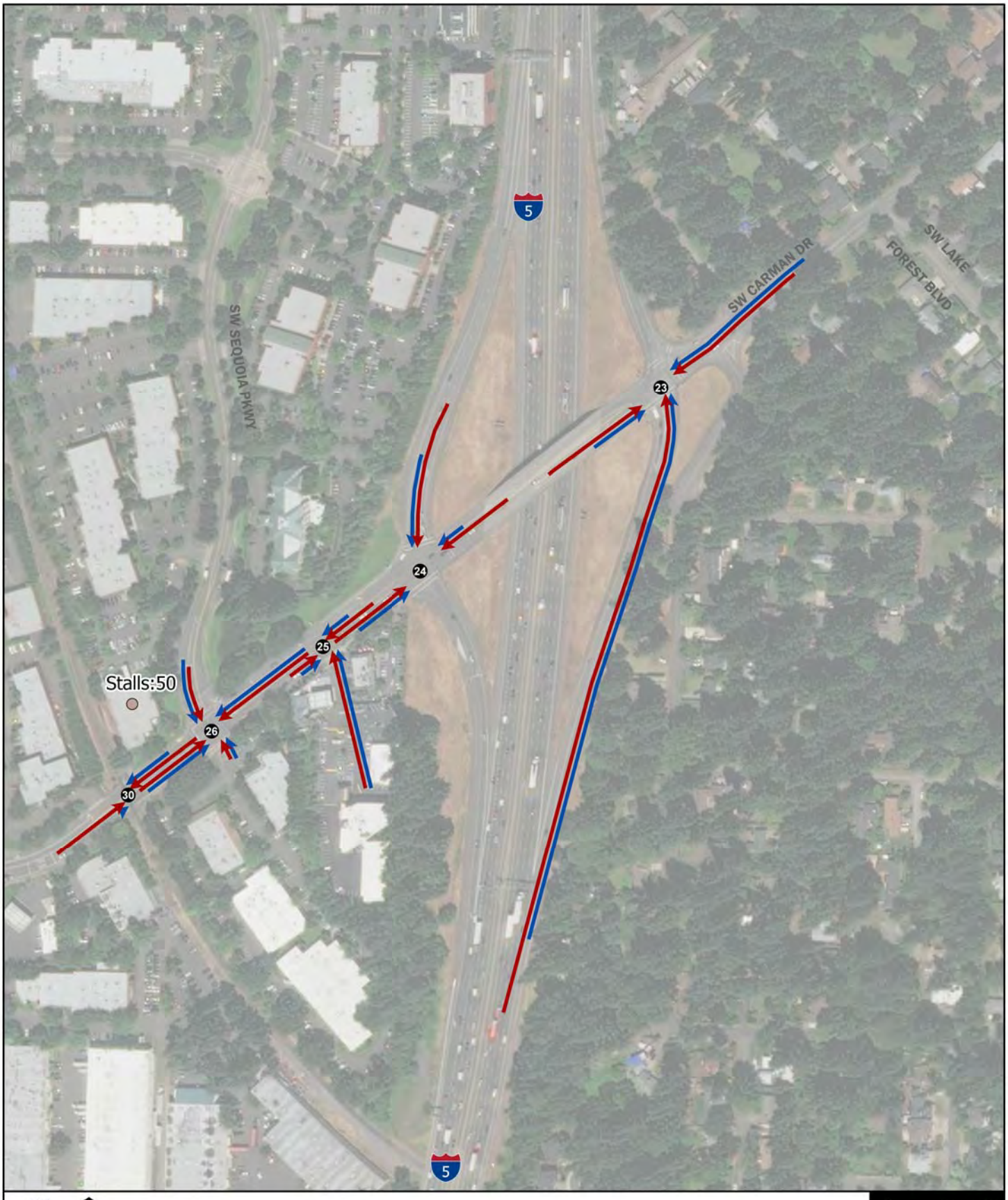


figure **5.3-9**

2035 No-Build, C2 and C4 Alternatives
7:30 AM - 8:30 AM Queues

Segment C: SW Carman Drive/SW Upper Boones Ferry Road Subarea

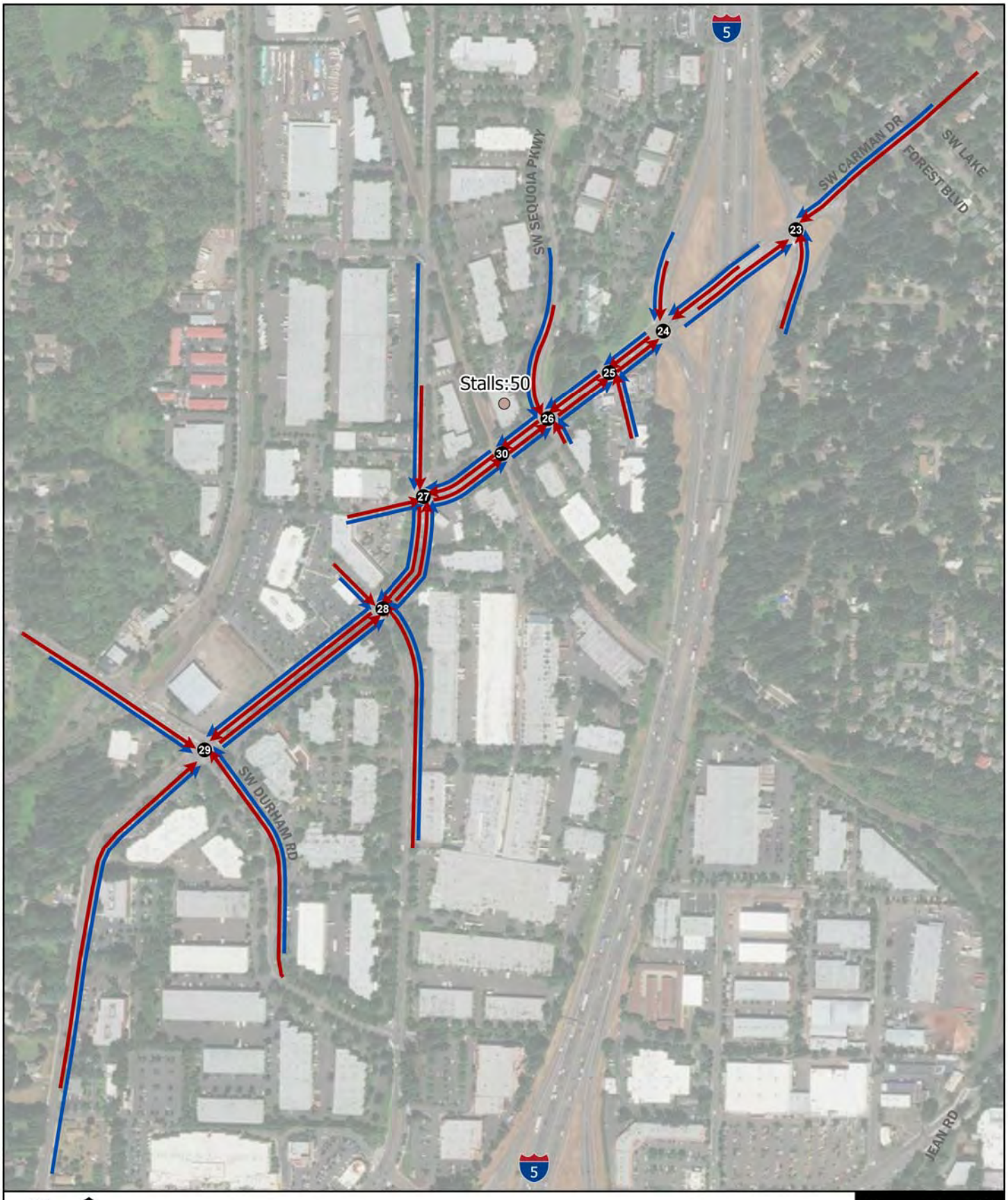


figure **5.3-10**

2035 No-Build, C2 and C4 Alternatives
4:30 PM - 5:30 PM Queues

Segment C: SW Carman Drive/SW Upper Boones Ferry Road Subarea

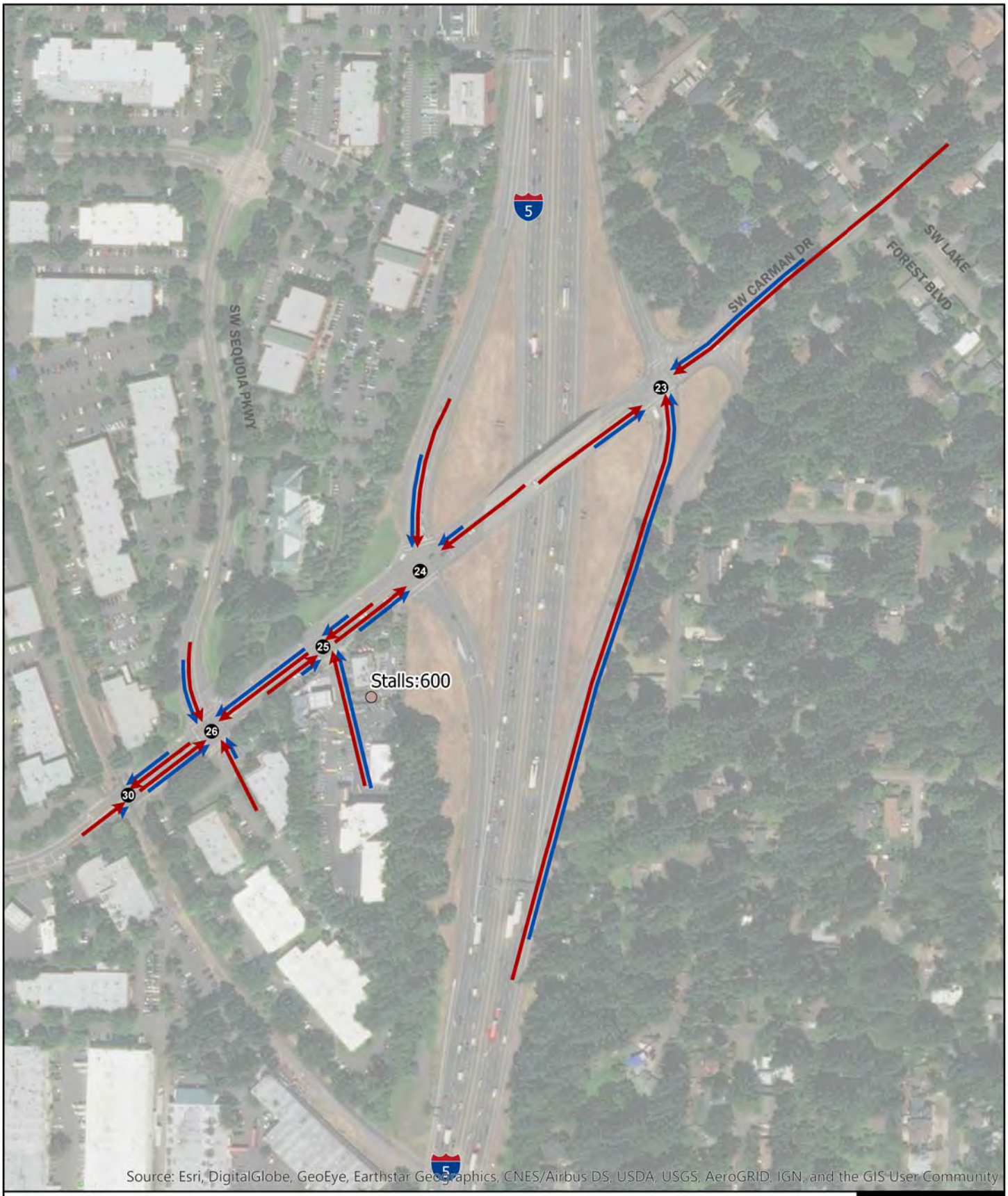


figure **5.3-11**

2035 No-Build, C1, C3, C5, and C6 Alternatives
7:30 AM - 8:30 AM Queues

Segment C: SW Carman Drive/SW Upper Boones Ferry Road Subarea

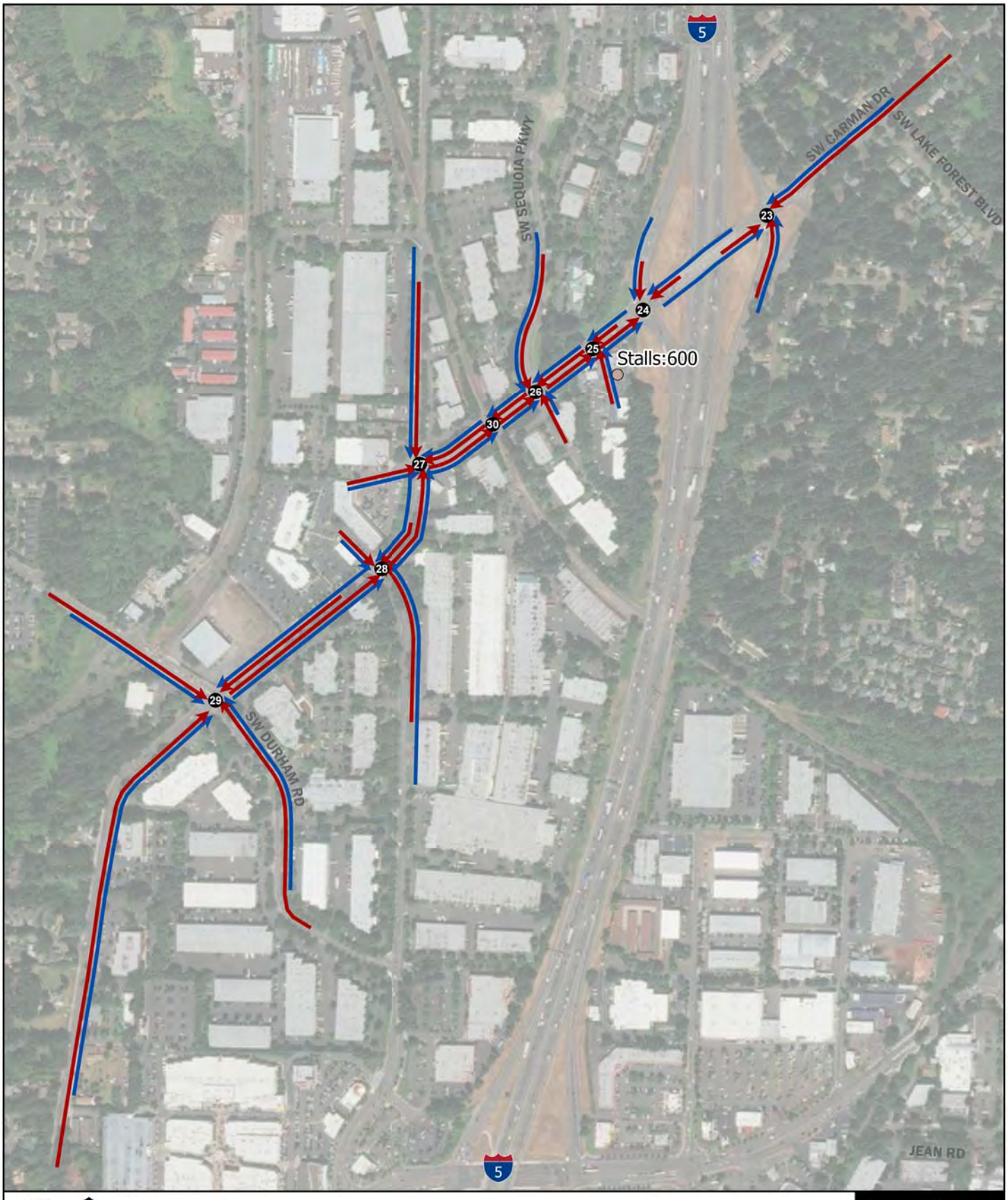


figure **5.3-12**

2035 No-Build, C1, C3, C5, and C6 Alternatives
4:30 PM - 5:30 PM Queues

Segment C: SW Carman Drive/SW Upper Boones Ferry Road Subarea

Bridgeport Subarea

Table 5.3-37 and Table 5.3-38 summarize the SimTraffic simulation for the 95th percentile queues in the Bridgeport subarea for the light rail alternatives in the AM and PM peak periods. In the AM peak period, only the intersection of SW 72nd Avenue/SW Lower Boones Ferry Road was analyzed; compared to the No-Build Alternative, the westbound left-turn queue is expected spill out of the storage bay. Figure 5.3-13 and Figure 5.3-14 show the queues depicted in the tables as they compare to the No-Build Alternative.

Compared to the No-Build Alternative in the PM peak period, the light rail alternatives would cause increased queuing at the I-5 northbound ramp terminal for the northbound approach, SW 72nd Avenue/SW Durham Road, as well as for movements entering the proposed park and ride access at SW Lower Boones Ferry Road.

Table 5.3-37. Segment C 2035 Alternatives C1 through C6 AM Queuing SimTraffic Analysis – Bridgeport Subarea

Queuing Results for AM Peak Hour											
95th Percentile Queue											
Study Intersection No.		C30b	C31	C32	C33	C34	C35	C36	C37	C38	C39
Approach	Movement	SW 65th Ave./SW Lower Boones Ferry Rd.	I-5 northbound ramps/SW Lower Boones Ferry Rd.	I-5 southbound ramps/SW Lower Boones Ferry Rd.	SW 72nd Ave./SW Lower Boones Ferry Rd.	SW 72nd Ave./Bridgeport Village/Terminal Station	SW 72nd Ave./SW Durham Rd.	Park and Ride access/SW Lower Boones Ferry Rd.	SW Travelers Ln./Park and Ride access/SW Lower Boones Ferry Rd.	SW Hazel Fern Rd./SW Bridgeport Rd.	REI/Bridgeport Village/SW Bridgeport Rd.
NB	Left				29						
	Thru				353						
	Right				332						
SB	Left				550						
	Thru				383						
	Right				-						
EB	Left				97						
	Thru				166						
	Right				-						
WB	Left				447						
	Thru				202						
	Right				153						

EB = eastbound; NB = northbound; SB = southbound; WB = westbound.

Table 5.3-38. Segment C 2035 Alternatives C1through C6 PM Queuing SimTraffic Analysis – Bridgeport Subarea

Queuing Results for PM Peak Hour											
95th Percentile Queue											
Study Intersection No.		C30b	C31	C32	C33	C34	C35	C36	C37	C38	C39
Approach	Movement	SW 65th Ave./SW Lower Boones Ferry Rd.	I-5 northbound ramps/SW Lower Boones Ferry Rd.	I-5 southbound ramps/SW Lower Boones Ferry Rd.	SW 72nd Ave./SW Lower Boones Ferry Rd.	SW 72nd Ave./Bridgeport Village/Terminal Station	SW 72nd Ave./SW Durham Rd.	Park and Ride access/SW Lower Boones Ferry Rd.	SW Travelers Ln./Park and Ride access/SW Lower Boones Ferry Rd.	SW Hazel Fern Rd./SW Bridgeport Rd.	REI/Bridgeport Village/SW Bridgeport Rd.
NB	Left	150	1,546	-	93	132	480	-	218	152	-
	Thru	142	1,560	-	341	237	280	462	5,952	413	133
	Right	-	788	-	347	-	-	-	-	-	64
SB	Left	-	-	140	551	66	75	78	227	246	189
	Thru	802	-	158	586	476	688	139	298	292	99
	Right	239	-	164	-	-	-	-	-	64	-
EB	Left	407	230	-	196	103	-	-	-	128	51
	Thru	504	242	336	564	72	319	-	278	334	99
	Right	447	-	352	-	-	1533	-	-	-	-
WB	Left	432	-	374	499	105	-	-	-	182	55
	Thru	799	314	449	453	61	109	-	400	191	117
	Right	-	222	-	383	-	-	310	-	-	59

EB = eastbound; NB = northbound; SB = southbound; WB = westbound.

figure **5.3-13**

2035 No-Build, C1-C6 Alternatives
7:30 AM - 8:30 AM Queues
Segment C: Bridgeport Subarea

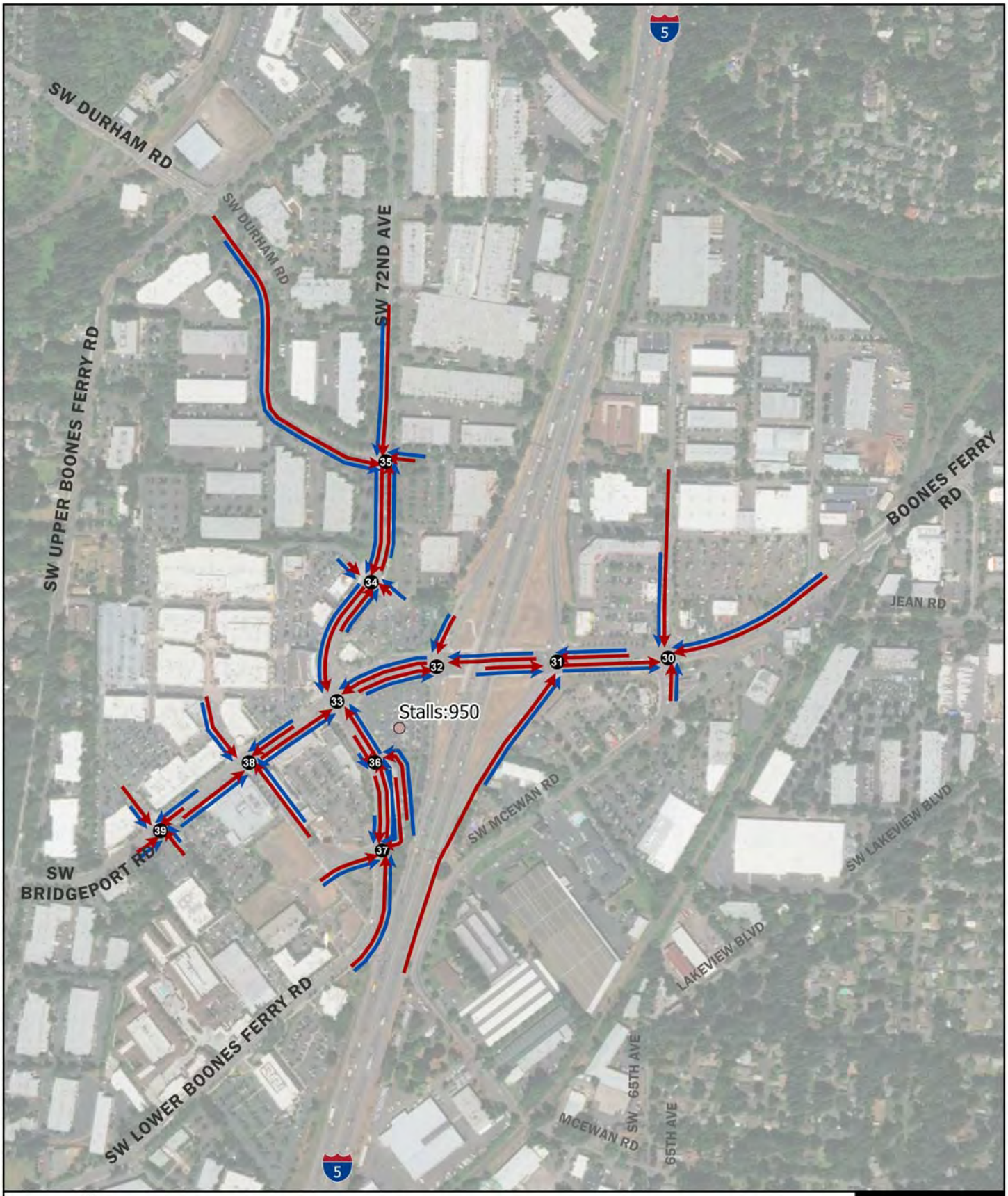


figure **5.3-14**

2035 No-Build, C1-C6 Alternatives
4:30 PM - 5:30 PM Queues

Segment C: Bridgeport Subarea

2045 Light Rail Alternatives

Tigard Subarea

Table 5.3-39 summarizes the Synchro analysis for the 95th percentile queues in the Tigard subarea for the 2045 light rail alternatives. The addition of light rail through study area intersections is expected to create more delay than the 2045 No-Build Alternative, causing queuing to increase where vehicles must wait for trains to pass.

Table 5.3-39. Segment C 2045 Alternatives C1-C6 PM Queuing Synchro Analysis – Tigard Subarea

Queuing Results for PM Peak Hour								
95th Percentile Queue – Single Train/Consecutive Trains[1]								
Study Intersection No.		C4	C5	C12	C15	C17	C19	C20a
Approach	Movement	SW Hall Blvd./SW Clinton St.	SW Hall Blvd./SW Ash Ave.	SW Hunziker St./SW Wall St.	SW 72nd Ave./SW Beveland St.	SW 65th Ave./SW Haines St.	SW 68th Ave./SW Dartmouth St./I-5 southbound ramps	SW Hall Blvd./existing railroad crossing (WES)
NB	Left					-	120	
	Thru					19	216	
	Right					-	47	
SB	Left					-	165	
	Thru					-	213	
	Right					-	-	
EB	Left					-	232	
	Thru					11	225	
	Right					5	-	
WB	Left					-	-	
	Thru					8	263	
	Right					-	22	

1. The light rail alternatives queuing analysis was performed for two different options: single train/two consecutive trains.

EB = eastbound; NB = northbound; SB = southbound; WB = westbound.

SW Carman Drive/SW Upper Boones Ferry Road Subarea

Table 5.3-40 summarizes the SimTraffic simulation for the 95th percentile queues under Alternatives C1, C3, C5 and C6 (I-5 alignments) in this subarea for the PM peak period in year 2045. Queuing would be similar to the 2035 condition but with slightly longer queues for most movements. Figure 5.3-15 shows the queues depicted in the tables as they compare to the No-Build Alternative.

Table 5.3-40. Segment C 2045 Alternatives C1, C3, C5 and C6 I-5 PM Queuing SimTraffic Analysis – SW Carman Drive/SW Upper Boones Ferry Road Subarea

Queuing Results for PM Peak Hour									
95th Percentile Queue									
Study Intersection No.		C23	C24	C25	C26	C27	C28	C29	C30a
Approach	Movement	I-5 northbound ramps/SW Carman Dr.	I-5 southbound ramps/SW Upper Boones Ferry Rd.	Burgerville/Chevron /SW Upper Boones Ferry Rd.	SW Sequoia Pkwy./ SW Upper Boones Ferry Rd.	SW 72nd Ave. (north)/SW Upper Boones Ferry Rd.	SW Upper Boones Ferry Rd./SW 72nd Ave. (south)	SW Durham Rd./SW Upper Boones Ferry Rd.	SW Upper Boones Ferry Rd./existing railroad crossing
NB	Left	513	-						
	Thru	327	-						
	Right	-	-						
SB	Left	-	-						
	Thru	-	247						
	Right	-	125						
EB	Left	373	-						
	Thru	359	285						
	Right	-	-						
WB	Left	-	180						
	Thru	1,440	21						
	Right	-	-						

EB = eastbound; NB = northbound; SB = southbound; WB = westbound.

figure **5.3-15**

2045 No-Build, C1, C3, C5, and C6 Alternatives
4:30 PM - 5:30 PM Queues

Segment C: SW Carman Drive/SW Upper Boones Ferry Road Subarea

Bridgeport Subarea

Table 5.3-41 summarizes the SimTraffic simulation for the 95th percentile queues under the light rail alternatives in the Bridgeport subarea for the PM peak period in year 2045. Queuing would be similar to what it would be in the 2035 condition but with longer queues for the off-ramp movements. Figure 5.3-16 shows the queues depicted in the tables as they compare to the No-Build Alternative.

Table 5.3-41. Segment C 2045 Alternatives C1–C6 PM SimTraffic Queuing Analysis – Bridgeport Subarea

Queuing Results for PM Peak Hour												
95th Percentile Queue												
Study Intersection No.		C30b	C31	C32	C33	C34	C35	C36	C37	C38	C39	
Approach	Movement	SW 65th Ave./SW Lower Boones Ferry Rd.	I-5 northbound ramps/SW Lower Boones Ferry Rd.	I-5 southbound ramps/SW Lower Boones Ferry Rd.	SW 72nd Ave./SW Lower Boones Ferry Rd.	SW 72nd Ave./Bridgeport Village/Terminal Station	SW 72nd Ave./SW Durham Rd.	Park and Ride access/SW Lower Boones Ferry Rd.	SW Travelers Ln./Park and Ride access/SW Lower Boones Ferry Rd.	SW Hazel Fern Rd./SW Bridgeport Rd.	REI/Bridgeport Village/SW Bridgeport Rd.	
NB	Left		4,385	-								
	Thru		4,354	-								
	Right		4,234	-								
SB	Left		-	114								
	Thru		-	130								
	Right		-	78								
EB	Left		251	-								
	Thru		297	430								
	Right		-	396								
WB	Left		-	445								
	Thru		368	246								
	Right		282	-								

EB = eastbound; NB = northbound; SB = southbound; WB = westbound.

figure **5.3-16**

2045 No-Build, C1-C6 Alternatives
4:30 PM - 5:30 PM Queues

Segment C: Bridgeport Subarea

5.3.6. Segment C Preliminary Signal Warrant Analysis

Signal warrant analysis was completed for future year 2035 operations at the following study area intersections in Segment C:

- C4: SW Hall Boulevard/SW Clinton Street
- C5: SW Hall Boulevard/SW Knoll Drive
- C12: SW Hunziker Street/SW Wall Street
- C16: SW 70th Avenue/SW Beveland Street

Of these intersections, only the SW Hunziker Street and SW Wall Street intersection meets signal warrants for the future year 2035. Details of the warrants analysis can be found in Appendix D.

5.3.7. Segment C Access Spacing

All of the new proposed intersections in Segment C would be within Tigard city limits. Two proposed signals are located on SW Hall Boulevard, which is part of the OHS and is classified as a District Highway by ODOT.

Table 5.3-42 shows ODOT spacing standards for intersections in Segment C that have a newly proposed signal under the denoted alignment alternatives.

Table 5.3-42. Segment C: Access Spacing, ODOT Standards

Int.	Name	Alignment Alternative	Distance to Nearest Ramp or Int. (feet)	Along Road	Class/Area	Speed Limit (mph)	Spacing Standard (feet)	Standard Met?
C4	SW Hall Blvd./ SW Clinton St.	C3, C4	90	SW Hall Blvd.	District Highway	30	350	No
C5	SW Hall Blvd./ SW Knoll Dr.	C1, C2, C5	70	SW Hall Blvd.	District Highway	30	350	No

The relevant spacing standards for OHS District Highways is found in OAR 734-051-4020, in Table 6. The text regarding Table 6 reads, "The spacing standards in Tables 3 through 6 apply to the distance measured along the highway from the center of an existing or proposed private approach to the center of the nearest existing private connection, proposed approach, or public approach on the same side of the highway in both directions."

Additionally, OAR 734-051-4020 (8) (c) allows spacing exceptions to be made if the approach was originally constructed before January 1, 2012. Some conditions apply, most importantly subsection (C), which prescribes increasing spacing when a highway project occurs, given that doing so would improve spacing or safety. Exceptions to the ODOT spacing requirements can be submitted through a General Design Exception Request Form.

Washington County's spacing standards are based on functional classification, as described in the Community Development Code Article V: Public Facilities and Services, under chapter 501-8.5 B. The County's functional classifications are available in an interactive GIS map online, which includes

classifications within Tigard city limits. The analysis of proposed spacing in Segment C under Washington County standards is shown in Table 5.3-43.

Table 5.3-43. Segment C: Access Spacing, Washington County Standards

Int.	Name	Alignment Alternative	Distance to Nearest Driveway or Int. (feet)	Along Road	Classification	Spacing Standard (feet)	Standard Met?
C4	SW Hall Blvd./SW Clinton St.	C3, C4	10	SW Hall Blvd.	Arterial	600	No
C5	SW Hall Blvd./SW Knoll Dr.	C1, C2, C5	65	SW Hall Blvd.	Arterial	600	No
C12	SW Hunziker St./ SW Wall St.	C6	150	SW Hunziker St.	Collector	100	Yes
C16	SW 70th Ave./SW Beveland St.	C1, C2, C5, C6	85	SW Beveland St.	Neighborhood Route	50	Yes
-	SW 70th Ave./SW Atlanta St.	All	205	SW Atlanta St.	Collector	100	Yes
-	SW 70th Ave./SW Baylor St.	C1, C2, C5, C6	5	SW Baylor St.	Local Street	10	No
		C3, C4	25	SW Baylor St.	Local Street	10	Yes
-	SW 70th Ave./SW Clinton St.	C1, C2, C5, C6	25	SW Clinton St.	Local Street	10	Yes
		C3, C4	220	SW 70th Ave.	Local Street	10	Yes
-	SW 70th Ave./SW Elmhurst St.	C1, C2, C5, C6	45	SW Elmhurst St.	Local Street	10	Yes
-	SW Beveland St./ SW Hermoso Way	C1, C2, C5	40	SW Beveland St.	Neighborhood Route	50	No
		C6	370	SW Beveland St.	Neighborhood Route	50	Yes
-	SW Ash Ave./SW Scoffins St.	C1, C2, C5	35	SW Ash Ave.	Collector	100	No
-	SW Ash Ave./SW Commercial St.	C1, C2, C5	25	SW Commercial St.	Local Street	10	Yes
-	SW Scoffins St./SW Clinton St. (extension)	C3, C4	65	SW Scoffins St.	Collector	100	No
-	SW Commercial St./SW Clinton St. (extension)	C3, C4	20	SW Clinton St. (extension)	Local Street (assumed)	10	Yes
-	SW Wall St./Station 4069+00	C6	610	SW Wall St.	Collector	100	Yes
-	SW Wall St./SW Tech Center Roadway	C6	610	SW Wall St.	Collector	100	Yes
-	SW Commercial St./SW Ash Ave. (approx.)	C6	75	SW Commercial St.	Local Street	10	Yes

Washington County provides guidance for exceptions to access criteria under chapter 501-8.5 C. This policy recommends strategies such as alternative access points and Access Management Plans, and also outlines what an Access Management Plan should cover in order to justify the modification.

Additionally, chapter 501-8.5 D. states that access points in a Transit Oriented District need not comply with access spacing requirements. However, these access points must be identified, and safety impacts must be mitigated.

The City of Tigard uses functional classifications to determine applicable access spacing rules. An interactive map of Tigard's roadway network, including a functional classification layer, is available online. The access spacing standards are outlined in the city's Development Code, Chapter 18.705.030, Section H. The code does not specify a standard for roadways designated as Neighborhood class, so the standard for the Local class was used for all Neighborhood roadways. Proposed spacings in Segment C for the City of Tigard standards are shown in Table 5.3-44.

Table 5.3-44. Segment C: Access Spacing, City of Tigard Standards

Int.	Name	Alignment Alternative	Distance to Nearest Driveway or Int. (feet)	Along Road	Classification	Spacing Standard (feet)	Standard Met?
C4	SW Hall Blvd./SW Clinton St.	C3, C4	35	SW Hall Blvd.	Arterial	150	No
C5	SW Hall Blvd./SW Knoll Dr.	C1, C2, C5	60	SW Hall Blvd.	Arterial	150	No
C12	SW Hunziker St./SW Wall St.	C6	170	SW Hunziker St.	Collector	150	Yes
C16	SW 70th Ave./SW Beveland St.	C1, C2, C5, C6	115	SW Beveland St.	Neighborhood	125	No
-	SW 70th Ave./SW Atlanta St.	All	285	SW Atlanta St.	Collector	200	Yes
-	SW 70th Ave./SW Baylor St.	C1, C2, C5, C6	280	SW Baylor St.	Local	125	Yes
		C3, C4	260	SW Baylor St.	Local	125	Yes
-	SW 70th Ave./SW Clinton St.	C1, C2, C5, C6	270	SW Clinton St.	Local	125	Yes
		C3, C4	470	SW 70th Ave.	Local	125	Yes
-	SW 70th Ave./SW Elmhurst St.	C1, C2, C5, C6	280	SW Elmhurst St.	Local	125	Yes
-	SW Beveland St./SW Hermoso Way	C1, C2, C5, C6	750	SW Beveland St.	Neighborhood	125	Yes
-	SW Ash Ave./SW Scoffins St.	C1, C2, C5	55	SW Ash Ave.	Collector	150	No
-	SW Ash Ave./SW Commercial St.	C1, C2, C5	590	SW Ash Ave.	Collector	200	Yes
-	SW Scoffins St./SW Clinton St. (extension)	C3, C4	85	SW Scoffins St.	Collector	150	No
-	SW Commercial St./SW Clinton St. (extension)	C3, C4	350	SW Commercial St.	Local	125	Yes
-	SW Wall St./Station 4069+00	C6	715	SW Wall St.	Private	N/A	
-	SW Wall St./SW Tech Center Roadway	C6	715	SW Wall St.	Private	N/A	
-	SW Commercial St./SW Ash Ave. (approx.)	C6	440	SW Commercial St.	Local	125	Yes

Exceptions to the City of Tigard's spacing standards can be requested, but there is no formal waiver form. It is assumed that a safety and circulation analysis should be submitted in order to gain approval.

5.3.8. Segment C Freight Impacts

Under Alternatives C1, C2, C5 and C6 (Ash and Wall alignments), the light rail alignment would be in the median of SW Beveland Street between SW 69th Avenue and immediately west of SW Hermoso Way. The median operation would eliminate left turns at the primary truck access for the Lowe's Home Improvement store. Under these alternatives, a traffic signal would be added at the westernmost Lowe's access to SW Beveland Street (at SW Hermoso Way). Rerouting truck traffic to utilize this new signal would necessitate revising the internal site circulation at the Lowe's. Mitigation could include on-site modifications to improve truck circulation using the remaining access points on SW 72nd Avenue and/or SW Beveland Street, truck routing changes via SW Hermoso Way or the proposed SW Beveland Street overcrossing of OR-217, or modifications to the configuration of the light rail alignment.

Under Alternatives C1 and C3 (Through/I-5 alignments), the light rail alignment would eliminate existing access to three properties on the north side of SW Landmark Lane. Mitigation for these removed truck access points could include elevating the light rail alignment from the freight railroad tracks to a location west of I-5 where the alignment turns south. This mitigation would include a grade separation of the light rail tracks crossing SW 72nd Avenue. Another mitigation could include a new access road that would connect SW 72nd Avenue to the north side of the three properties.

The analysis included a detailed review of businesses with designated loading areas and docks that use large trucks for deliveries, as described below.

- **Lowe's Home Improvement store, 12615 SW 72nd Avenue (affected by Alternatives C1, C2, C5 and C6)**
    1. The loading docks at the Lowe's are off SW Beveland Street, with access points on both SW Beveland Street and SW 72nd Avenue. Trucks are able to circulate on-site. Trucks can enter from either street, but they are more likely to enter via SW Beveland Street and egress is via SW Beveland Street.
    2. LRT designs for alternatives C-1, C-2, C-5 and C-6 would use median-running LRT along SW Beveland Street. These alternatives eliminate left turns at the primary truck access on SW Beveland Street, while adding a traffic signal at the westernmost Lowe's access to SW Hermoso Way), which would require revisions to the site circulation. Mitigation to the truck access should be examined, but it could include on-site modifications to improve truck circulation using the remaining access points on SW 72nd Avenue and/or SW Beveland Street, truck routing changes via SW Hermoso Way or the proposed Beveland Street overcrossing of OR-217, or modifications to the LRT configuration.
- **Industrial sites at SW Landmark Lane (affected by Alternatives C1 and C3)**
    1. The industrial sites along SW Landmark Lane to the west of SW 72nd Avenue, and to the east of 72nd Avenue adjacent to SW Landmark Lane, are accessed by larger trucks with multiple loading docks in the industrial buildings. Truck access is currently via driveways on SW Landmark Lane for buildings to the west of SW 72nd Avenue and via driveways on SW 72nd Avenue for buildings to the east.

LRT designs for the Alternatives C1 through C4 (Through alignments) include multiple property and access impacts to properties. Appropriate access, including for trucks, to properties that will remain in operation will need to be addressed by the LRT design. A potential mitigation to the freight access impacts would be to elevate this alignment of LRT from freight railroad tracks to a location west of I-5

where the alignment turns south. This mitigation would include a grade separation of the LRT tracks as they cross SW 72nd Avenue.

5.3.9. Segment C On-Street Parking Impacts

In Segment C: Tigard and Tualatin, under Alternatives C1, C2, C5, and C6 (Ash and Wall alignments) in the vicinity of SW Dartmouth Street and SW 70th Avenue, 29 on-street parking spaces would be eliminated and replaced with 21 angled parking spaces for a net reduction of 8 spaces. The utilization survey found that these spaces were heavily used during the daytime, likely as employee parking for nearby businesses.

Under Alternatives C1, C2, C5 and C6, on SW Beveland Street west of SW 69th Avenue, 63 on-street parking spaces would be eliminated. The utilization survey found that the spaces were moderately used during the day, with heavier usage in the vicinity of commercial and retail businesses west of SW 72nd Avenue.

Under Alternatives C1, C2 and C5 (Ash alignments), on SW Ash Avenue between SW Scoffins Street and SW Commercial Street, 18 on-street parking spaces would be eliminated. The utilization survey found that these spaces were moderately used during the daytime and more heavily used during the evening. The parking on SW Ash Avenue is primarily associated with the single-family and multifamily residences in the area.

Parking impacts could also result if demand for parking exceeds supply provided by the park and ride facilities or if transit riders opt to "hide and ride" on neighborhood streets. Indirect impacts of spillover parking are shown in Table 5.3-45.

Table 5.3-45. Segment C – Hide and Ride Assessment

Station	Alignment Alternative	Notes
Baylor	C1, C2, C5, C6	New park and ride capacity provided. Likely to be a low demand park and ride lot. Streets in the area tend to not have curbs or sidewalks, and only limited on-street parking is available.
Clinton	C3, C4	Same as Baylor.
Beveland	C1, C2, C5, C6	Very limited on-street parking in station vicinity. Existing on-street parking on SW Beveland St. would be eliminated with project.
TTC Ash	C1, C2, C5, C6	New park and ride capacity provided. Time restricted parking on SW Commercial and SW Main streets in downtown Tigard. Existing on-street parking on SW Ash Ave. would be eliminated.
TTC Clinton	C3, C4	New park and ride capacity provided. Time-restricted parking on SW Commercial and SW Main streets in downtown Tigard. Limited on-street parking on SW Ash Ave. could be used for park and ride.
Bonita I-5	C1, C3, C5, C6	New park and ride capacity provided. No on-street parking on SW Bonita Rd. or SW 72nd Ave. Some limited parking across the freeway on SW Bangy Rd.
Bonita RR	C2, C4	New park and ride capacity provided. No on-street parking on SW Bonita Rd. or SW 72nd Ave. Some on-street parking on SW 74th Ave. and on SW Milton Ct.
UBF I-5	C1, C3, C5, C6	New park and ride capacity provided. No on-street parking on SW Upper Boones Ferry Rd. or SW Sequoia Pkwy. Some limited on-street parking across freeway on SW Carman Dr.
UBF RR	C2, C4	New park and ride capacity provided. No on-street parking on SW Upper Boones Ferry Rd. or SW Sequoia Pkwy. Some limited on-street parking across freeway on SW Carman Dr.
Bridgeport	All	Increased park and ride capacity provided. No on-street parking available in vicinity.

Note: TTC = Tigard Town Center; UBF = Upper Boones Ferry.

5.3.10. Segment C Light Rail Station Vehicular Access

Circulation through neighborhood streets surrounding the station areas was evaluated to determine the local impact of transit-related vehicle trips. There could be some resulting redistribution of trips near light rail stations due to pick-ups and drop-offs, but this impact would be minor. The analysis of surrounding local streets shows that those pick-up/drop-off trips can be accommodated. At park and rides, the intersection analysis described above includes the traffic volumes associated with park and ride access and egress.

High capacity transit systems have traditionally been accessed by some passengers being picked up and dropped off, and this trend has expanded in recent years thanks to commercial mobility services such as Lyft and Uber. Shared mobility is expected to expand significantly in the future, including ride-hailing, car-sharing, bike-sharing, micro-transit and other services. By 2035 (the project's future year), a significant percentage of vehicles will likely operate autonomously, potentially reducing the demand for parking but increasing the need for curb space for passenger pick-up and drop-off. To address this change, transit stations should be full-service mobility hubs that facilitate shared mobility, including ample convenient and accessible pick-up and drop-off zones for cars, shuttles and busses, car and bike share, and other shared mobility infrastructure designed to expedite passenger transfer and facilitate traffic flow.

Segment C Park and Ride Lots

Tigard Transit Center Park and Ride (Downtown Tigard)

The Tigard Transit Center Park and Ride in downtown Tigard is included with all of the Segment C alignment alternatives. It is included as a 300-space park and ride near the intersection of SW Commercial Street and SW Hall Boulevard with access off of SW Commercial Street. The station is forecast to be one of the busiest in the corridor, with the majority of trips (50 to 60 percent) anticipated to transfer from another transit route. In addition, approximately 30 percent of the riders would walk to the station and a little more than 10 percent would drive.

Based on the regional travel demand model, approximately 85 percent of the vehicle trips using this park and ride would access it via SW Commercial Street from the north and 15 percent via SW Commercial Street and SW Hall Boulevard from the south.

Baylor Park and Ride (Tigard Triangle)

The Baylor Park and Ride in the Tigard Triangle area is included with all of the Segment C alignment alternatives. It is located near the intersection of SW Baylor Street and SW 70th Avenue in an area that the City of Tigard is planning to redevelop into a pedestrian-oriented mixed use development. Approximately 68 percent of the riders are expected to walk to the Baylor Station and 30 percent are expected to drive.

The park and ride is planned for a capacity of 425 vehicle spaces with access off of SW Baylor Street. Based on the regional travel demand model, approximately 36 percent of the vehicle trips using this park and ride will go to and from the east on SW Haines Street, and 20 percent to and from I-5 at the SW Haines Street interchange. Approximately 30 percent of trips will come to and from the south on SW 72nd Avenue, and 4 percent to and from the north. The remaining 10 percent come to and from the west.

Bonita Park and Ride (I-5 or Railroad alignments)

There are two locations for a park and ride at SW Bonita Road. One would be located immediately south of SW Bonita Road, just west of I-5, and would have 150 spaces. This Bonita I-5 Park and Ride is included in Alternatives C1, C3, C5 and C6 (I-5 alignments). The other location for Alternatives C2 and C4 includes 100 spaces and would be located south of SW Bonita Road adjacent to the Union Pacific Railroad tracks, just east of SW 74th Avenue (Bonita Railroad Park and Ride).

Based on the regional travel demand model, with either location, approximately 88 percent of the vehicle trips using this park and ride will go to and from the west on SW Bonita Road, and 12 percent will go to and from the east.

Upper Boones Ferry Park and Ride (I-5 or Railroad alignments)

There are also two possible locations for the park and ride at SW Upper Boones Ferry Road. For the alignment alternatives that would be next to I-5 (Alternatives C1, C3, C5 and C6), the park and ride is planned to be a parking structure with a capacity of 600 vehicle spaces and access off of SW Upper Boones Ferry Road at SW Sequoia Parkway. The regional travel demand model shows a variation in distribution for vehicle trips to and from the station. Approximately 60 percent of vehicle trips exiting the park and ride will use the SW Carman Drive intersection to go south on I-5, while 9 percent will use SW 72nd Avenue. Fourteen percent will go east on SW Carman Drive, 5 percent will go west on SW Durham Road and 12 percent will go north on SW 72nd Avenue and SW Sequoia Parkway. Inbound trips will be 23 percent from the east on SW Carman Drive, 34 percent from the north on SW Sequoia Parkway and SW 72nd Avenue, 6 percent from the west on SW Durham Road, 32 percent from the south on I-5 and 5 percent from SW 72nd Avenue. The vehicle demand generated by the larger parking capacity will require mitigation at the SW Carman Drive/Upper Boones Ferry Road interchange with I-5 to meet mobility targets.

For the alignment alternatives that would be next to railroad tracks (Alternatives C2 and C4), the park and ride is planned to be a surface lot with a capacity of 50 vehicle spaces and access off of SW Upper Boones Ferry Road. The distribution of trips for this option is the same as for the larger structure, but the traffic impacts are minimal due to its smaller size.

Bridgeport Park and Ride (Bridgeport Village)

The Bridgeport Park and Ride structure is adjacent to the Bridgeport Village shopping center, just west of I-5, under all of the Segment C alignment alternatives. The park and ride is planned as a parking structure with a capacity of 950 vehicle spaces and access off of SW Lower Boones Ferry Road at SW Travelers Lane. This location has the potential to serve both local users and regional users because of its proximity to I-5. The Bridgeport Station is anticipated to have approximately 30 percent of the riders walk to the station and 32 percent drive. Approximately 40 percent are anticipated to transfer at the station from another transit route.

Based on the regional travel demand model, approximately 30 percent of vehicle trips to the Bridgeport Park and Ride will use I-5 to go to and from the south, while 40 percent will use SW Lower Boones Ferry to go to and from the south. Approximately 16 percent will go to and from the north on SE 72nd Avenue, 12 percent will go to and from the east on SW Lower Boones Ferry Road, and 2 percent will go to and from the west on SW Bridgeport Road.

5.3.11. Segment C Construction Impacts

Table 5.3-46 summarizes the construction impacts in Segment C.

Table 5.3-46: Construction Impacts Summary, Segment C: Tigard and Tualatin

Location	Alignment Alternative(s)	Issue	Major Assumption	Approximate Time Frame
SW 68th Pkwy./SW Atlanta St.	All	Undercrossing requires construction of new bridge	SW 68th Ave.: closed	3–6 months
SW Clinton St. – OR-217 Overcrossing	C3: Clinton-I-5 C4: Clinton-Railroad	New structure from SW 72nd Ave. over OR-217 to SW Hall Blvd.	OR-217: temporary nighttime closures SW Dartmouth St.: intermittent closures SW 72nd Ave.: intermittent closures	2 years
SW Ash Ave. – OR-217 Overcrossing	C1: Ash-I-5 C2: Ash-Railroad C5: Ash-I-5 Branched	New LRT structure from SW Beveland St. cul-de-sac over OR-217 to business park area west of SW Hall Blvd.	OR-217: temporary nighttime closures	2 years
SW Wall St. – OR-217 Overcrossing	C6: Wall-I-5 Branched	New LRT and roadway structure from SW Beveland St. cul-de-sac over OR-217 near intersection with SW Hunziker St.	OR-217: temporary nighttime closures	2 years
SW Hunziker St. and SW Wall St. intersection	C6: Wall-I-5 Branched	Intersection is raised up 12 feet to accommodate LRT crossing	SW Hunziker St.: closed intermittently; local access for SW Wall St.	6 months
OR-217 Branch Crossing SW 70th Ave. alignment south of SW Hampton St.	C5: Ash-I-5 Branched C6: Wall-I-5 Branched	New LRT structure over OR-217	OR-217: temporary nighttime closures	2 years
Sound walls along west side of OR-217 near SW 72nd Ave. on-ramp	C5: Ash-I-5 Branched C6: Wall-I-5 Branched	Existing walls need to be reconstructed and new walls built	OR-217: use of shoulder	1 year
SW Upper Boones Ferry Rd.	C1: Ash-I-5 C3: Clinton-I-5 C5: Ash-I-5 Branched C6: Wall-I-5 Branched	Undercrossing requires construction of new structure	SW Upper Boones Ferry Rd.: reduce lanes to one lane in each direction to stage construction Southbound on-ramp to I-5: one right-turn lane closed	6 months to 1 year
SW Bonita Rd.	C1: Ash-I-5 C3: Clinton-I-5 C5: Ash-I-5 Branched C6: Wall-I-5 Branched	Undercrossing requires construction of new structure	SW Bonita Rd.: closed	3–6 months
Ped. structure over SW Lower Boones Ferry Rd.	All	New pedestrian crossing connecting Bridgeport Park and Ride to Bridgeport Village Station	SW Lower Boones Ferry Rd.: temporary intermittent lane closures; temporary nighttime closures	3–6 months
General – entire study area	All	Construct LRT	intermittent lane closures; night work; weekend closures SW Barbur Blvd.: one lane in each direction	Full duration

5.4. Segment C Mitigation

The following section addresses potential improvement measures based on the previously outlined impacts for both the No-Build Alternative and the light rail alternatives within the Segment C study area by mode. The recommendations have been divided into two categories: project-related mitigation and non-project-related improvements. Project-related mitigation would be specifically aimed at impacts associated with the implementation of a transit alternative. Non-project related improvements are improvements that would likely be necessary even without the project.

5.4.1. Potential Mitigation

Proposed measures to mitigate project-related traffic impacts to intersections within the study area in Segment C are summarized in Table 5.4-1. The mitigation measures identified address intersections that fail to meet mobility targets and to address queues that extend to the freeway. Because of the complexity of the impacts and because many of the traffic problems are projected to occur with or without the project, further review may be required in order to identify final mitigation measures in some cases.

Table 5.4-1. Potential Mitigation for Segment C: Tigard and Tualatin

	Location	Alignment Alternative	Impact	Potential Mitigation
C4	SW Hall St./SW Clinton light rail crossing	C3, C4	Southbound queue spills back to Pacific Hwy. (OR 99W).	Grade separate light rail at Hall Blvd.
C6	SW Commercial St./SW Main St.	C6	Queue on intersection approaches. Northbound approach over capacity.	Signalize
C10	SW Hall Blvd./SW Commercial St.	All	Queue on intersection approaches. Eastbound approach over capacity.	Signalize
C17	SW 65th Ave./SW Haines St./I-5 northbound ramps	All	Traffic exiting I-5 northbound queues at the stop sign waiting to turn. Queue may extend onto freeway.	Signalize or Roundabout
C18	SW 68th Pkwy./SW Atlanta St.	All	All-way STOP controlled intersection exceeds mobility targets, with queuing on intersection approaches	Signalize
C23	I-5 northbound ramps/SW Carman Dr.	All	Signalized intersection exceeds mobility targets, with queuing on the westbound approach and I-5 northbound exit ramp.	Add westbound right turn lane (C2, C4) Add northbound lane to off-ramp, stripe as NBL, NBLT and NBR (C1, C3, C5, C6)
C24	I-5 southbound ramps/SW Upper Boones Ferry Rd.	All	Signalized intersection exceeds mobility targets, with queuing on the eastbound approach and I-5 southbound exit ramp.	Modify AM signal timing (cycle length) (C2, C4) Add EBR lane, and Re-stripe westbound movements to shared WBL/T and WBT, and Convert to split signal phasing (C1, C3, C5, C6) Or reduce size of park and ride lot (All)
C30a	SW Upper Boones Ferry Rd./existing railroad crossing	C3, C4	Delay and queue across existing at-grade crossing.	Manage queue with signal preemption and timing optimization; or Grade separation of existing at-grade railroad crossing

	Location	Alignment Alternative	Impact	Potential Mitigation
C31	I-5 northbound ramps/SW Lower Boones Ferry Rd.	All	Signalized intersection exceeds mobility targets, with queuing on the I-5 northbound exit ramp.	Modify signal timing (cycle length) and add coordination to signal at SW Lower Boones Ferry Rd. & SW 65th Ave. (see Appendix CC)
C37	SW Travelers Ln./Park and Ride access/SW Lower Boones Ferry Rd.	All	Exit of park and ride is over capacity	Signalize

A. APPENDICES

Appendix A: Transportation Analysis Methods

Appendix B: Turning Movement Counts

Appendix C: Preliminary Progression Analysis Time-Space Diagrams

Appendix D: Preliminary Signal Warrant Analysis

Appendix E: Segment A – Existing Vissim Analysis

Appendix F: Segment A – Existing Synchro Analysis

Appendix G: Segment B – Existing Vissim Analysis

Appendix H: Segment B – Existing Synchro Analysis

Appendix I: Segment C – Existing SimTraffic Analysis

Appendix J: Segment C – Existing Synchro Analysis

Appendix K: Segment A – No-Build Vissim Analysis

Appendix L: Segment A – No-Build Synchro Analysis

Appendix M: Segment B – No-Build and Build Vissim Analysis

Appendix N: Segment B – No-Build SimTraffic Analysis

Appendix O: Segment B – No-Build Synchro Analysis

Appendix P: Segment C – No-Build SimTraffic Analysis

Appendix Q: Segment C – No-Build Synchro Analysis

Appendix R: Segment A – 2035 Build Vissim Analysis

Appendix S: Segment A – 2035 Build Synchro Analysis

Appendix T: Segment B – 2035 Build Synchro Analysis

Appendix U: Segment C – 2035 Build SimTraffic Analysis

Appendix V: Segment C – 2035 Build Synchro Analysis

Appendix W: Segment A – 2045 Build Synchro Analysis

Appendix X: Segment B – 2045 Build SimTraffic Analysis

Appendix Y: Segment B – 2045 Build Synchro Analysis

Appendix Z: Segment C – 2045 Build SimTraffic Analysis

Appendix AA: Segment C – 2045 Build Synchro Analysis

Appendix BB: Crash History Maps

Appendix CC: I-5 Northbound Ramps with SW Lower Boones Ferry Road Mitigation Analysis