SR 512 Corridor Study

June 2023

Olympic Region Multimodal Planning
7407 31st Avenue NE
Lacey, WA 98516

Prepared by

929 108th Avenue NE, Suite 1300
Bellevue, WA 98004

Washington State Department of Transportation
Olympic Region
Lacey, Washington

SR 512 Corridor Study

Approved by:

July 18, 2023

Steve Roark
Olympic Region, Regional Administrator

Date

Concurrence:

Karena Houser

August 1, 2023

Karena Houser
Director, Multimodal Planning and Data Division

Date

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Acronyms & Abbreviations

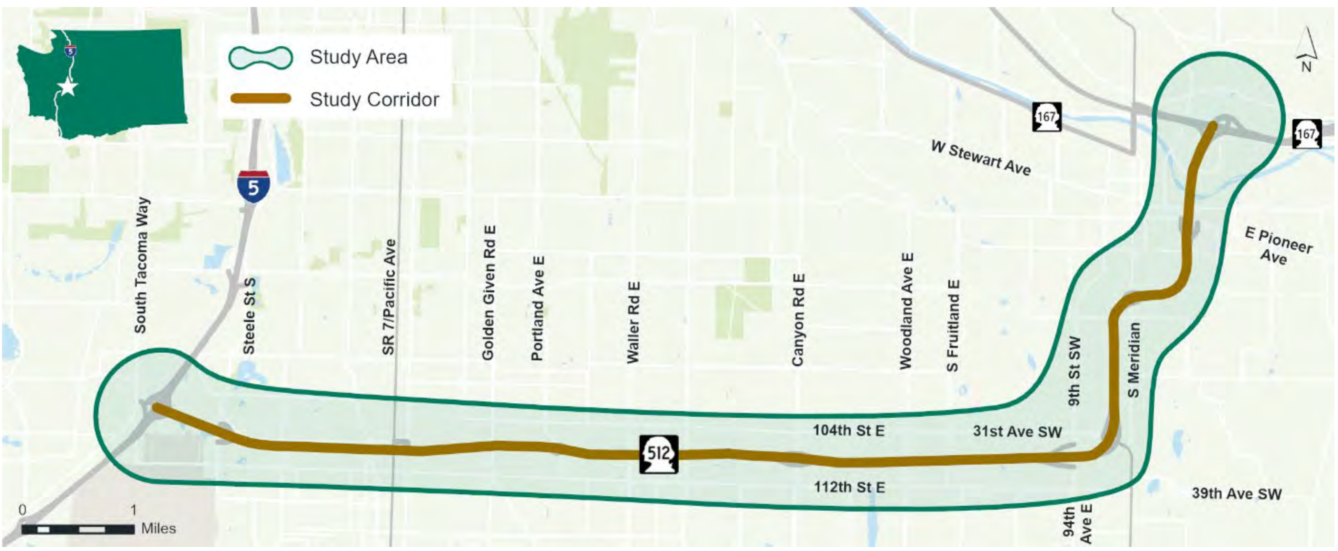
AWDT	average weekday traffic
BRT	bus rapid transit
CDR	compact-disc data recovery
DDI	diverging diamond interchange
ETL	express toll lane
FGTS	Freight and Goods Transportation System
FHWA	Federal Highway Administration
HCM	Highway Capacity Manual
HOV	high-occupancy vehicle
HSS	Highway of Statewide Significance
I	Interstate
LOS	level of service
LTS	level of traffic stress
MOE	measure of effectiveness
MPH	miles per hour
NHS	National Highway System
O-D	origin-destination
PTR	permanent traffic recorder
SR	State Route
SAG	Study Advisory Group
TC	transit center
TSMO	Transportation System Management and Operations
VMT	vehicle miles traveled
VPD	vehicles per day
VPH	vehicles per hour
WSDOT	Washington State Department of Transportation

Executive Summary

The State Route (SR) 512 Corridor Study identified strategies to address multimodal connectivity and operational performance gaps along and across the corridor. As shown in Figure ES- 1, SR 512 provides access across southern Pierce County from Lakewood to Puyallup. Through connections to SR 410, SR 167, and I-405, SR 512 is also a key element of an important regional alternate to I-5. It also serves as the primary connection for freight movement between I-5, the Port of Tacoma, and industrial and warehouse areas throughout central and south Pierce County.

Nearly all segments of the SR 512 corridor currently experience travel delays for several hours during both the morning and afternoon peak travel periods. Several of the interchanges and intersections that provide access to SR 512 regularly fail to meet WSDOT performance criteria for multiple hours of the day. The corridor also suffers from a general lack of transit service coverage and substantial discontinuities in active transportation infrastructure, especially serving people who want to cross SR 512. These performance gaps impact the economic vitality, safety performance, and resiliency of the highway itself and adjacent and connecting roadways. Multimodal travel forecasts for the corridor show increased demand for movement of people and freight, and future changes in travel patterns.

Figure ES-1. Study Corridor



Study Approach

WSDOT engages the community and local stakeholders at the earliest stages of need identification and strategy definition to be sure their input is included throughout the project development process. The SR 512 Corridor Study included three engagement elements:

Study Advisory Group – Leadership and staff from local jurisdictions and transportation agencies, non-governmental organizations, and tribes were invited to help guide the study. The group met five times during the study process to provide input on the study goals, evaluation criteria, and potential strategies.

Strategic Interviews – The project team conducted interviews with key leaders and constituents to gather information about how they use the corridor, specific observations and concerns, and desired study outcomes.

Virtual Public Open House – This online open house gave the public the opportunity to learn about the study and provide input via a survey.

Transportation Performance Gaps and Strategy Development. The study team developed Initial strategies from three sources that yielded valuable information regarding performance gaps in the study area: review of existing plans, input from the outreach and engagement process, and the travel demand forecasting conducted for this study.

Evaluation Process. Criteria were developed to evaluate strategies and were reviewed with the Study Advisory Group. These criteria included:

- Multimodal mobility and connectivity
- Safety performance
- Equity
- Economic vitality
- Resiliency
- Freight/goods movement
- Environment
- Reliability
- Practical solutions/state of good repair
- Implementation and partnerships

Each strategy was evaluated for each criterion to the degree it could provide an improvement over Baseline conditions, meaning if none of these strategies were implemented over projected future conditions. This led to some strategies being divided or combined. Strategies were then assigned an implementation timeframe using the intent of the WSDOT Practical Solutions paradigm: the right solution in the right place at the right time.

Key Findings

This evaluation process yielded 42 recommended strategies to address transportation performance gaps, both corridor-wide and location-specific, that will lead to the realization of a strong vision for integrated, sustainable, and equitable mobility in the SR 512 corridor. Summarized below, these strategies are shown in Figure ES- 2, Figure ES- 3, Table ES-1 through Table ES-5, and Table ES- 7 through Table ES- 10. Planned and programmed projects for the study region can be found in Table ES-6.

Corridor-Wide Strategies. Of the recommended strategies, nine are applicable throughout the corridor including Transportation System Management and Operations, Active Transportation and Crossings, Managed Lanes, and Transit. Most are identified as feasible for near-term implementation.

Location-Specific Strategies. Thirty-three of forty-two strategies are location-specific and span all five strategy types. Most of these fall within the Active Transportation and Crossings and Strategic Bottlenecks categories. These location-specific strategies trend toward mid- and long-term implementation.

Next Steps

The strategies identified here are recommended for consideration by WSDOT and other agencies going forward. The most important next step is to refine and reconcile them with local and regional plans and incorporate them as those plans are updated. Once these strategies are included in such planning documents, funding assistance can be sought and additional project definition, refinement, permitting, and design activities can begin. Some strategies identified here could be combined with others or broken down into smaller parts to assist in these pre-implementation activities.

Figure ES-2. Recommended Strategies: Western Corridor

Recommended Strategies

ID	Corridor-Wide Strategies	Implementation Term
C-1	Corridor-wide fiber optic connectivity: improve freeway management & driver information	Near
C-2	Metering of selected on-ramps	Near
C-3	Ramp merge/diverge upgrades: lengthen to modern standards	Near
C-4	Median access/turnaround(s): enforcement & incident response	Near
C-5	SR 512 Peak Use Shoulder Lane	Mid
C-6	Sidewalk improvements at existing SR 512 crossings	Near
C-7	Managed Lane (HOV/ETL) in each direction on SR 512	Long
C-8	SR 512 Bus on Shoulder program, if route(s) moved to SR 512	Mid
C-9	Transit access improvements for north-south bus routes	Near

Focus Area	ID	Location-Specific Strategies	Implementation Term
A	L-10	BRT: Downtown Tacoma to Lakewood TC via S Tacoma Way	Mid
B	L-11	Managed Lane direct connection to future I-5 HOV lanes	Long
C	L-12	116th /Steele - Spanaway Loop to Sales: curb, gutter, sidewalk	Near
	L-13	Interchange at Steele Street: Widen overpass & modify ramps	Long
D	L-14	SR 7, SR 512 to 96th St minor intersection channelization/widening	Near
	L-15	Interchange at SR 7/Pacific Ave S: Widen overpass & modify ramps	Mid
	L-42	Extend Parkland Community Trail under SR 512	Near
E	L-16	Auxiliary lanes from SR 7 to Portland Avenue E (both directions)	Mid

Focus Area	ID	Location-Specific Strategies, continued	Implementation Term
F	L-17	Portland Ave E - SR 512 to 72nd: curb, gutter, sidewalk	Near
	L-18	Portland Ave E - 112th St E to SR 512: sidewalks, turn lanes, capacity	Mid
G	L-19	Interchange at Portland Avenue S: Widen overpass & modify ramps	Long
H	L-20	New crossing of SR 512 at 46th Ave E	Long
	L-21	Service connection: mid-corridor direct access to/from Managed Lane	Long
	L-22	Interchange at Canyon Road E: Widen overpass & modify ramps	Mid
	L-23	New crossing of SR 512 at 59th Ave E	Long
K	L-26	Pipeline Trail - 72nd to South Hill area	Mid

Table ES-1. Corridor-Wide Strategies

ID	Corridor-Wide Strategies	Implementation Term
C-1	Corridor-wide fiber optic connectivity: improve freeway management & driver information	Near
C-2	Metering of selected on-ramps	Near
C-3	Ramp merge/diverge upgrades: lengthen to modern standards	Near
C-4	Median access/turnaround(s): enforcement & incident response	Near
C-5	SR 512 Peak Use Shoulder Lane	Mid
C-6	Sidewalk improvements at existing SR 512 crossings	Near
C-7	Managed Lane (HOV/ETL) in each direction on SR 512	Mid
C-8	SR 512 Bus on Shoulder program, if route(s) moved to SR 512	Mid
C-9	Transit access improvements for north-south bus routes	Near

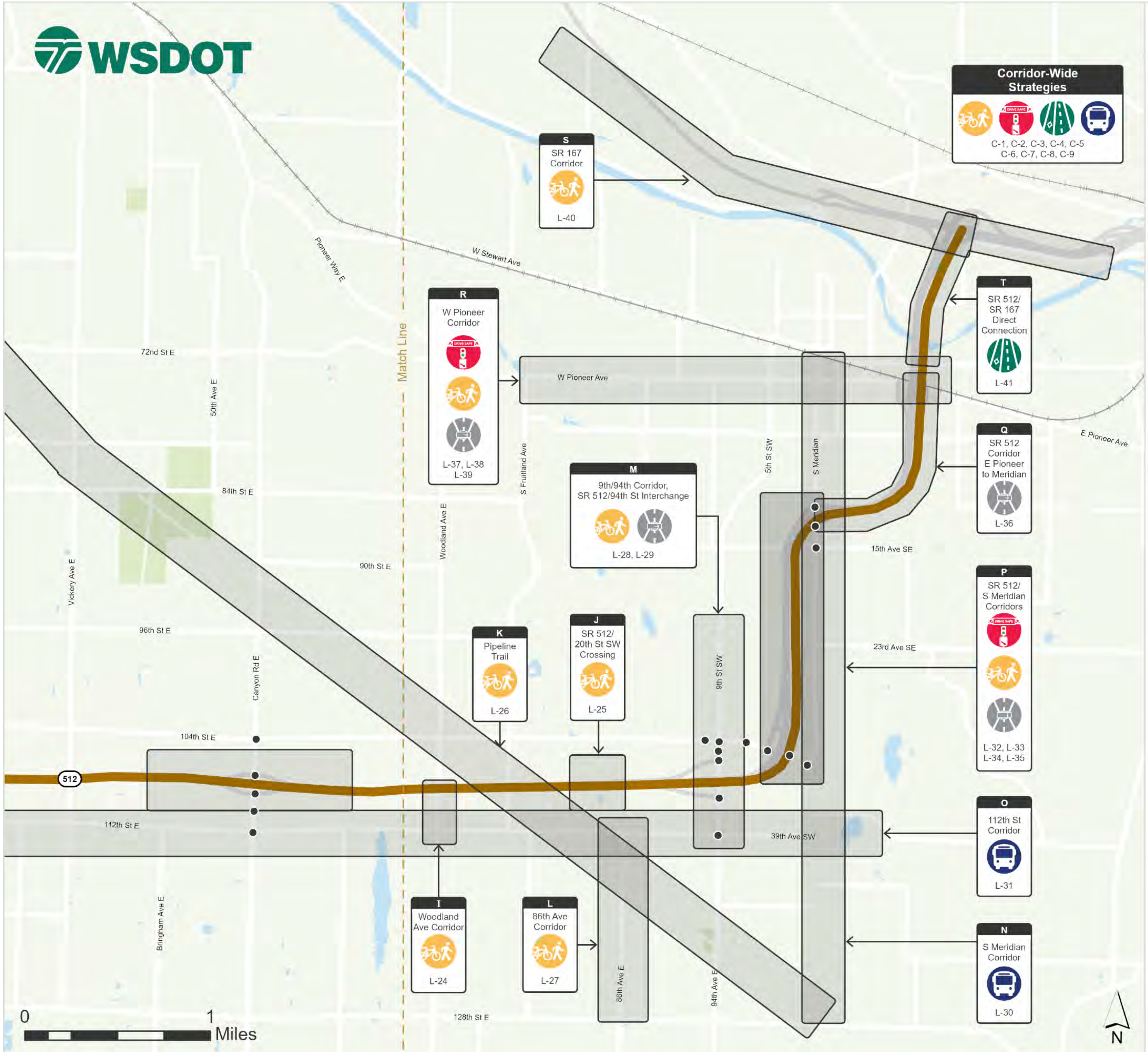
Table ES-2. Location-Specific Strategies

Focus Area	ID	Location-Specific Strategies	Implementation Term
A	L-10	BRT: Downtown Tacoma to Lakewood TC via S Tacoma Way	Mid
B	L-11	Managed Lane direct connection to future I-5 HOV lanes	Long
C	L-12	116th /Steele - Spanaway Loop to Sales: curb, gutter, sidewalk	Near
C	L-13	Interchange at Steele Street: Widen overpass & modify ramps	Long
D	L-14	SR 7, SR 512 to 96th St minor intersection channelization/widening	Near
D	L-15	Interchange at SR 7/Pacific Ave S: Widen overpass & modify ramps	Mid
D	L-42	Extend Parkland Community Trail under SR 512	Near
E	L-16	Auxiliary lanes from SR 7 to Portland Avenue E (both directions)	Mid

Table ES-3. Location-Specific Strategies, continued

Focus Area	ID	Location-Specific Strategies, continued	Implementation Term
F	L-17	Portland Ave E - SR 512 to 72nd: curb, gutter, sidewalk	Near
F	L-18	Portland Ave E - 112th St E to SR 512: sidewalks, turn lanes, capacity	Mid
G	L-19	Interchange at Portland Avenue S: Widen overpass & modify ramps	Long
H	L-20	New crossing of SR 512 at 46th Ave E	Long
H	L-21	Service connection: mid-corridor direct access to/from Managed Lane	Long
H	L-22	Interchange at Canyon Road E: Widen overpass & modify ramps	Mid
H	L-23	New crossing of SR 512 at 59th Ave E	Long
K	L-26	Pipeline Trail - 72nd to South Hill area	Mid

Figure ES-3. Recommended Strategies: Eastern Corridor



Recommended Strategies

ID	Corridor-Wide Strategies	Implementation Term
C-1	Corridor-wide fiber optic connectivity: improve freeway management & driver information	Near
C-2	Metering of selected on-ramps	Near
C-3	Ramp merge/diverge upgrades: lengthen to modern standards	Near
C-4	Median access/turnaround(s): enforcement & incident response	Near
C-5	SR 512 Peak Use Shoulder Lane	Mid
C-6	Sidewalk improvements at existing SR 512 crossings	Near
C-7	Managed Lane (HOV/ETL) in each direction on SR 512	Long
C-8	SR 512 Bus on Shoulder program, if route(s) moved to SR 512	Mid
C-9	Transit access improvements for north-south bus routes	Near

Focus Area	ID	Location-Specific Strategies, continued	Implementation Term
I	L-24	Woodland Ave E - SR 512 to 160th St E: center turn lane, active transportation upgrades, access management	Mid
J	L-25	New crossing of SR 512 at 20th St SW	Long
K	L-26	Pipeline Trail - 72nd to South Hill area	Mid
L	L-27	86th Ave E - SR 512 to 176th St E: turn lanes & active transportation facilities	Near
M	L-28	94th Ave I - 39th Ave SW & north: bike lane	Mid
	L-29	Interchange at 94th Ave E: Widen overpass & modify ramps	Long
N	L-30	BRT: Pierce County Airport to South HIll TC & downtown Puyallup via SR 161/Meridian Ave	Long
O	L-31	BRT: Lakewood to South Hill Mall TC via 112th St E	Long
P	L-32	Interchange at 31st Ave SW: Widen overpass & modify ramps	Mid
	L-33	New crossing of SR 512 at 23rd Ave SE	Long
	L-34	Auxiliary lanes from 31st to Meridian (both directions)	Mid
	L-35	Interchange at S Meridian: Widen overpass & modify ramps	Long
Q	L-36	Auxiliary lanes from Meridian to Pioneer (Eastbound)	Mid
R	L-37	E Pioneer - SR 512 interchange & to the west: bike lane	Mid
	L-38	Interchange at E Pioneer: Widen overpass & modify ramps	Long
	L-39	Puyallup 5th St SE corridor operations improvements	Mid
S	L-40	Tacoma to Puyallup Regional Trail	Mid
T	L-41	Managed Lane direct connection ramps from SR 167 to SR 512 across the Puyallup River	Mid

Table ES-4. Corridor-Wide Strategies

ID	Corridor-Wide Strategies	Implementation Term
C-1	Corridor-wide fiber optic connectivity: improve freeway management & driver information	Near
C-2	Metering of selected on-ramps	Near
C-3	Ramp merge/diverge upgrades: lengthen to modern standards	Near
C-4	Median access/turnaround(s): enforcement & incident response	Near
C-5	SR 512 Peak Use Shoulder Lane	Mid
C-6	Sidewalk improvements at existing SR 512 crossings	Near
C-7	Managed Lane (HOV/ETL) in each direction on SR 512	Mid
C-8	SR 512 Bus on Shoulder program, if route(s) moved to SR 512	Mid
C-9	Transit access improvements for north-south bus routes	Near

Table ES-5. Location-Specific Strategies

Focus Area	ID	Location-Specific Strategies	Implementation Term
I	L-24	Woodland Ave E - SR 512 to 160th St E: center turn lane, active transportation upgrades, access management	Mid
J	L-25	New crossing of SR 512 at 20th St SW	Long
K	L-26	Pipeline Trail - 72nd to South Hill area	Mid
L	L-27	86th Ave E - SR 512 to 176th St E: turn lanes & active transportation facilities	Near
M	L-28	94th Ave I - 39th Ave SW & north: bike lane	Mid
M	L-29	Interchange at 94th Ave E: Widen overpass & modify ramps	Long
N	L-30	BRT: Pierce County Airport to South Hill TC & downtown Puyallup via SR 161/Meridian Ave	Long
O	L-31	BRT: Lakewood to South Hill Mall TC via 112th St E	Long
P	L-32	Interchange at 31st Ave SW: Widen overpass & modify ramps	Mid
P	L-33	New crossing of SR 512 at 23rd Ave SE	Long
P	L-34	Auxiliary lanes from 31st to Meridian (both directions)	Mid
P	L-35	Interchange at S Meridian: Widen overpass & modify ramps	Long
Q	L-36	Auxiliary lanes from Meridian to Pioneer (Eastbound)	Mid
R	L-37	E Pioneer - SR 512 interchange & to the west: bike lane	Mid
R	L-38	Interchange at E Pioneer: Widen overpass & modify ramps	Long
R	L-39	Puyallup 5th St SE corridor operations improvements	Mid
S	L-40	Tacoma to Puyallup Regional Trail	Mid
T	L-41	Managed Lane direct connection ramps from SR 167 to SR 512 across the Puyallup River	Mid

Table ES-6. Planned and Programmed Projects

Project	Lead	Project	Lead	Project	Lead
SR 167 Gateway Extension to I-5	WSDOT	ETL Direct Access Ramp to SR 167 ETL in Auburn	WSDOT	Canyon Road Extension	Partnerships
I-5/SR 512 Interchange Replacement	WSDOT	ETL Direct Access Ramp to SR 167 ETL in Sumner	WSDOT	SR 7 Improvements	WSDOT
Auxiliary Lane on SR 512 from E Pioneer to S Meridian (westbound)	WSDOT	BRT/Enhanced Transit on SR 167	WSDOT	SR 161 Improvements	WSDOT
Southbound Single ETL lane between Ellingson and SR 410	WSDOT	Missing SR 18 Ramps + Auxiliary Lane Capacity	WSDOT		
ETL Direct Access Ramp to SR 167 ETL in Kent	WSDOT	Complete Valley Ave interchange with SR 167 Extension	WSDOT		

Table ES-7. Corridor-Wide Managed Lanes

Near-Term Strategies	Lead	Mid-Term Strategies	Lead	Long-Term Strategies	Lead
C-1. Corridor-wide fiber optic connectivity: improve freeway management & driver information	WSDOT	C-5. SR 512 Peak Use Shoulder Lane	WSDOT	C-7. Managed Lane (HOV/ETL) in each direction on SR 512	WSDOT
C-4. Median access/turnaround(s): enforcement & incident response	WSDOT	L-41. Managed Lane direct connection ramps from SR 167 to SR 512	WSDOT	L-11. Managed Lane direct connection to future I-5 HOV lanes	WSDOT
				L-21. Service connection: mid-corridor direct access to/from Managed Lane	WSDOT

Table ES-8. TSMO & Strategic Bottlenecks

Near-Term Strategies	Lead	Mid-Term Strategies	Lead	Long-Term Strategies	Lead
C-2. Metering of selected on-ramps	WSDOT	L-15. Interchange at SR 7/Pacific Avenue S: Widen overpass & modify ramps	WSDOT	L-13. Interchange at Steele Street: Widen overpass & modify ramps	WSDOT
C-3. Ramp merge/diverge upgrades: lengthen to modern standards	WSDOT	L-22. Interchange at Canyon Road E: Widen overpass & modify ramps	WSDOT	L-19. Interchange at Portland Avenue S: Widen overpass & modify ramps	WSDOT
L-14. SR 7, SR 512 to 96th St minor intersection channelization/widening	WSDOT	L-32. Interchange at 31st Avenue SW: Widen overpass & modify ramps	WSDOT	L-29. Interchange at 94th Avenue E: Widen overpass & modify ramps	WSDOT
		L-16. Auxiliary lanes from SR 7 to Portland Avenue E (both directions)	WSDOT	L-35. Interchange at S Meridian: Widen overpass & modify ramps	WSDOT
		L-34. Auxiliary lanes from 31st Ave SW to Meridian (both directions)	WSDOT	L-38. Interchange at E Pioneer: Widen overpass & modify ramps	WSDOT
		L-36. Auxiliary lane from S Meridian to E Pioneer (eastbound)	WSDOT		
		L-39. Puyallup 5th St SE corridor operations improvements	WSDOT		

Table ES-9. Facilitate Transit

Near-Term Strategies	Lead	Mid-Term Strategies	Lead	Long-Term Strategies	Lead
C-9. Transit access improvements for north-south bus routes	Partnerships	C-8. SR 512 Bus on Shoulder program, if route(s) moved to SR 512	Partnerships	L-30. BRT: Pierce County Airport to South Hill TC & downtown Puyallup via SR 161/Meridian Avenue	Partnerships
		L-10. BRT: Downtown Tacoma to Lakewood TC via S Tacoma Way	Partnerships	L-31. BRT: Lakewood to South Hill Mall TC via 112th Street E	Partnerships

Table ES-10. Active Transportation

Near-Term Strategies	Lead	Mid-Term Strategies	Lead	Long-Term Strategies	Lead
C-6. Sidewalk improvements at existing SR 512 crossings	Partnerships	L-18. Portland Ave E - 112th St E to SR 512: sidewalks, turn lanes, capacity	Partnerships	L-20. New crossing of SR 512 at 46th Ave E	Partnerships
L-12. 116th /Steele - Spanaway Loop to Sales: curb, gutter, sidewalk	Partnerships	L-24. Woodland Ave E - SR 512 to 160th St E: center turn lane, active transportation upgrades, access management	Partnerships	L-23. New crossing of SR 512 at 59th Ave E	Partnerships
L-17. Portland Ave E - SR 512 to 72nd: curb, gutter, sidewalk	Partnerships	L-26. Pipeline Trail - 72nd to South Hill area	Partnerships	L-25. New crossing of SR 512 at 20th St SW	Partnerships
L-27. 86th Ave E - SR 512 to 176th St E: turn lanes & active transportation facilities	Partnerships	L-28. 94th Ave E - 39th Ave SW & north: bike lane	Partnerships	L-33. New crossing of SR 512 at 23rd Ave SE	Partnerships
L-42 Extend Parkland Community Trail under SR 512	Partnerships	L-37. E Pioneer - SR 512 interchange & to the west: bike lane	Partnerships		
		L-40. Tacoma to Puyallup Regional Trail	Partnerships		

Chapter 1 Introduction

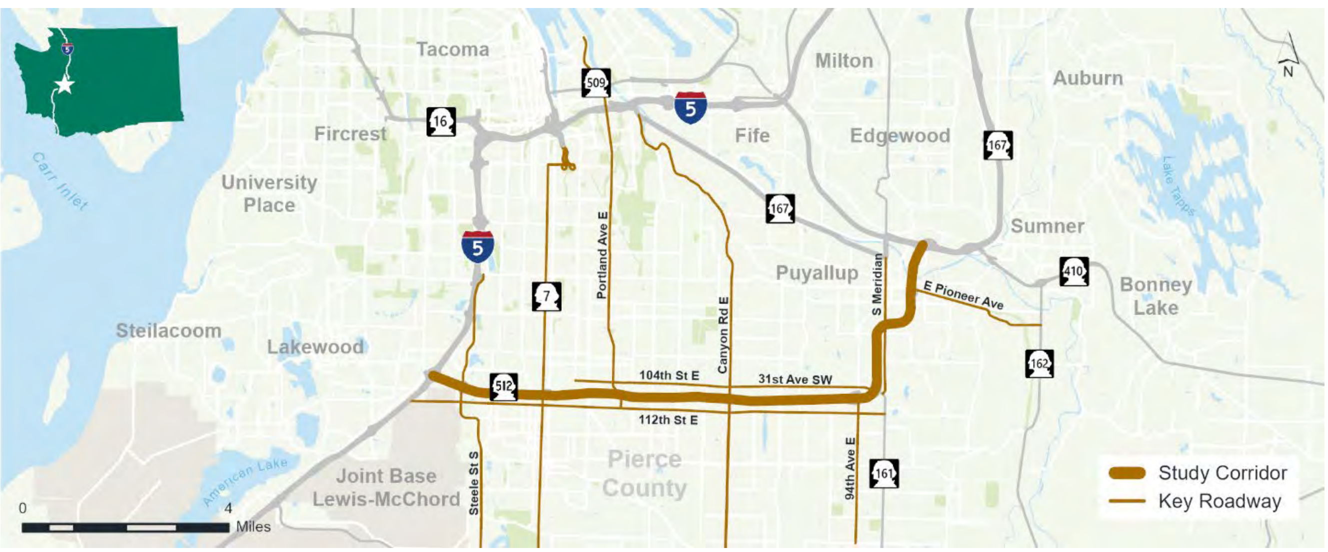
State Route (SR) 512 is an important east-west link through Pierce County that connects the cities of Lakewood and Puyallup. This highway provides a vital connection between Interstate 5 (I-5) and SR 167 for residents, businesses, and visitors. Travelers using SR 512 often experience congestion and delays while commuting, transporting freight, or traveling locally for goods and services. This study identified potential near-, mid-, and long-term alternatives to improve operations, safety, and mobility for all users. Recommendations published in the study report will be used to pursue future funding for highway design and construction improvements.

The study corridor traverses several cities and communities, and includes medical facilities, businesses, schools, and social services. WSDOT consulted area stakeholders and communities to understand their experiences on SR 512 and gather feedback on potential strategies.

1.1 Study Area

The SR 512 Corridor Study focuses on freeway operations between I-5 and SR 167 with specific consideration of interchanges, ramp terminal intersections, and other intersections that could impact SR 512 operations. Many of these other intersections are located along 104th Street E and 112th Street E, which are adjacent parallel arterials north and south of SR 512, respectively. WSDOT analyzed a total of 37 intersections in addition to the SR 512 freeway as part of the study. The study area is shown in Figure 1-1.

Figure 1-1. Study Area Map



1.2 Need Statement

In 2021, the legislature passed Substitute Bill 1137, amending Revised Code of Washington (RCW) 47.04.280, to reprioritize the State's six transportation system planning goals for making investments in public transportation. The bill elevated the policy goal of "Preservation" to the top of the list directing the State to, first and foremost, "maintain, preserve, and extend the life and utility of prior investments in transportation systems and services, including the state ferry system." Safety remains the second goal among priorities, defined as "To provide for and improve the safety and security of transportation customers and the transportation system." This bill further emphasized in its legislative intent that preservation and safety are to be the main priorities among the State's six transportation system planning goals. These goals are the foundation of WSDOT system planning efforts.

Consistent with this direction, this SR 512 Corridor Study seeks first to identify strategies to maintain and improve the performance of the existing investments in SR 512 and its connecting and supporting facilities in terms of safety, equity, and other important measures. The study also examines needs over the longer term for the purpose of identifying additional strategies that close performance gaps.

To help guide the definition of performance gaps, and the development of improvement strategies, WSDOT developed the following statement in coordination with the Study Advisory Group:

> WSDOT Transportation System Planning Goals:
>
> 1. Preservation
> 2. Safety
> 3. Stewardship
> 4. Mobility
> 5. Economic Vitality
> 6. Environment

> "The corridor currently exhibits recurring travel delays that impact the safety performance and resiliency of the SR 512 freeway and adjacent facilities. People who drive and those using active transportation modes experience different transportation benefits and challenges. Forecasts show increased demand for movement of people and freight as well as future changes in travel patterns. SR 512 is also part of an important regional alternate to I-5."

This statement of need led to the development of the following study goals:

- Hear a broad range of voices
- Meet the mobility needs of future users
- Improve safety, access, and travel times
- Identify potential strategies for implementation in:
  - Near term
  - Mid-term
  - Long-term

1.3 Study Process

The study team began by collecting a range of data for use in studying the existing and future Baseline conditions. The team also reviewed local and regional planning documents to help set the context for this work and identify potential strategies for inclusion. The following studies were referenced to help identify performance gaps. The study team examined these studies with respect to the performance and function of SR 512 and nearby facilities, and identified high-level strategies based on their findings.

- South Pierce Multimodal Connectivity Study (in progress)
- SR 167 Master Plan (in progress)
- SR 167 Corridor Improvements Project (in progress)
- Puget Sound Gateway Program (in progress)
- Pierce Transit Bus Rapid Transit Expansion Study (in progress)
- I-5/SR 512 Interchange Improvement Project (2022)

- Long-range plans for Pierce County, Tacoma, Lakewood, Puyallup, Sumner, Sound Transit, and Pierce Transit (2015–2022)
- SR 512: Tacoma to SR 167 (Puyallup) Corridor Sketch (2018)
- SR 161 and 31st Avenue SW Corridor Study (2018)
- HOV Feasibility for I-5: JBLM to S 38th Street (2017)

The study team focused on early and consistent community engagement through interviewing stakeholders, convening the Study Advisory Group, and conducting an online open house. These activities resulted in meaningful and actionable input that fed directly into the study process.

The Practical Solutions approach formed the foundation of strategy development throughout, with a focus on system improvement for all users. Strategies were developed and evaluated using a range of criteria to identify the best candidates to recommend for near-, mid-, and long-term implementation.

Chapter 2 Community and Stakeholder Involvement

2.1 Community Engagement

This study employed the Federal Highway Administration (FHWA) and WSDOT Practical Solutions approach to planning, a key feature of which is to engage the community and local stakeholders at the earliest stages to ensure their input is included throughout the project development process.

The SR 512 corridor traverses several cities and communities, and includes medical facilities, businesses, schools, and social services. WSDOT consulted with area stakeholders and communities to understand their experiences on SR 512 and gather feedback on potential improvement strategies.

WSDOT's approach to engagement had three components:

- Form an advisory group with representation from area jurisdictions, transit agencies, community organizations, schools, social services, and emergency services.
- Conduct interviews with organizations that represent and/or serve vulnerable populations and overburdened communities in the study area and/or different travel modes.
- Gather broad public input on SR 512 issues and potential improvements through an online open house and survey.

2.2 Study Advisory Group

WSDOT convened the SR 512 Corridor Study Advisory Group (SAG) to review and comment on study data and to provide strategic advice on near-, mid-, and long-term improvements to the highway. The project team invited representation from tribes, federal and state agencies, local jurisdictions, community organizations, schools, and emergency service providers. Members of the SAG are listed in Table 2-1.

Table 2-1. Study Advisory Group

Organization	Name	Position
City of Edgewood	Jeremy Metzler	Public Works Director
City of Edgewood	Morgan Dorner	Senior Planner
City of Lakewood	David Bugher	Asst. City Manager/Community Development Director
City of Puyallup	Ken Davies	Public Works Director
City of Puyallup	Meredith Neal	Economic Development Manager
City of Sumner	Michael Kosa	City Engineer
City of Sumner	Ryan Windish	Community Development Director
City of Tacoma	Jennifer Kammerzell	Interim Division Manager
City of Tacoma	Wesley Rhodes	Sr. Planner - Comp Plan
FHWA	Matt Pahs	Freight Transportation Planner
Franklin Pierce School District	Tim Bridgeman	Director of Transportation
Freight Mobility Strategic Investment Board	Temple Lentz	Board Chair
JBLM	Darryl C. Abe	JBLM Public Works
Korean Women's Association	Mi-Yeoung Lee	Director of Social Services
Pierce County	Jennifer Tetatzin	Director of Planning and Public Works
Pierce County	Jesse Hamashima	Planning & Public Works
Pierce County	Roxanne Miles	Director, Parks & Recreation
Pierce Transit	Tina Lee	Principal Planner
Port of Tacoma	Christine Wolf	Senior Planner
Sound Transit	Eric Chipps	Senior Transportation Planner
Tacoma School District	Raymond Williams Jr.	Director of Transportation
Washington State Patrol	Stephanie Bjorkman	Trooper
Washington Trucking Association	Sheri Call	President/CEO

Table 2-2. SAG Meetings

Meeting Date	Agenda/Objective(s)
January 12, 2023	Review the draft Problem Statement
February 16, 2023	Review existing conditions results
March 22, 2023	• Review future conditions results • Review draft screening criteria and strategies
April 20, 2023	• Travel demand model comparisons • Strategy evaluation results
May 18, 2023	• Review operations analysis results and evaluation updates • Establish recommended near-, mid-, and long-term strategies

The Muckleshoot, Nisqually, and Puyallup Tribe of Indians, the Squaxin Island Tribe, and the Yakama Nation were invited to participate in the SAG but did not attend any meetings. Individual meetings with tribes were set up separately later in the study process.

SAG members provided availability for five meetings that represented key information-sharing and input milestones in the study process. Dates and topics are shown in Table 2-2.

2.3 Key Stakeholder Interviews

As part of study community engagement, WSDOT conducted interviews with organizations that represent and/or serve historically marginalized communities in the study area and/or advocacy for mobility, active transportation, and transit programs. The objectives of the interviews were to:

- Validate and build on the study problem statement
- Gather input on potential improvement strategies
- Engage those less likely to participate in broad-based outreach

The study team conducted a demographic analysis of the study area (within a 1-mile radius of SR 512) using information from the United States Census Bureau (2020 American Community Survey) to identify eight key population characteristics, including sex, age, race/ethnicity, household income, vehicle ownership, home ownership, household computer use and internet subscription, and language spoken at home/Limited English Proficiency. Based on the findings of the demographic analysis, WSDOT prioritized outreach to groups representing people who are Black, African American, and Filipino and translated information into Spanish and Korean.

The study team conducted 12 interviews in early 2023 with organizations representing multi-cultural groups, low-income groups, people of color, people with disabilities, seniors, active transportation advocates, schools and youth, freight and trucking, emergency services, and business. These key stakeholders and their interview dates are indicated in Table 2-3.

The interviews yielded several common themes. Most stakeholders expressed that the study should:

- Consider how SR 512 and connecting roads act as a barrier to mobility for those reliant on or desiring to travel via active transportation. This includes school-aged children.
- Address the SR 512/I-5 interchange, especially in the merge to southbound I-5. Most interviewees described the merge and use of the shoulder as unsafe.
- Add lanes along the corridor, including the consideration for managed lanes that transit and trucks can access.

Table 2-3. Key Stakeholder Interviews

Stakeholder	Date
Asian Pacific Cultural Center	February 13, 2023
Central Pierce Fire and Rescue	January 18, 2023
ForeverGreen Trails	January 9, 2023
Franklin Pierce School District	February 22, 2023
Korean Women's Association	February 15, 2023
Pierce College	February 21, 2023
Pierce County Coordinated Transportation Coalition	January 4, 2023
Puyallup School District	January 10, 2023
Tacoma Pierce County Chamber	February 28, 2023
Tacoma Public Schools	February 27, 2023
Tacoma Urban League	February 28, 2023
WTA (Washington Trucking Association)	February 8, 2023

2.4 Online Open House

WSDOT hosted an SR 512 Corridor Study online open house from February 27 to March 14, 2023, at engage.wsdot.wa.gov/sr-512-corridor-study. The goal of the online open house was to gather input on the SR 512 user experiences and priorities for improvements. The website content explained the scope of the SR 512 Corridor Study and asked visitors to complete a survey on their use of SR 512, challenges, and ideas for improvements. Content was provided in English, Korean, and Spanish. The site informed a broad group of the public about the SR 512 Corridor Study, as seen by the online open house web traffic shown in Table 2-4.

WSDOT received 805 completed surveys within the online open house, and 39 comments through the online open house comment form. Some questions allowed for multiple responses. Of those that completed surveys:

- Most respondents either live in the study area (57%) or use SR 512 to get to other places/pass through (87%).
- Most use the corridor frequently: daily (50%) or at least once a week (33%).
- The top three reasons for SR 512 travel were: shopping errands (84%), recreational activities (78%), and to visit family and friends (94%).
- Most drive (97%); we also heard from freight operators (11%) and active transportation users (9%).
- 10% of respondents reported having some form of disability.
- Most identified as White (70%), and while the survey was not designed to be statistically valid, the demographic characteristics of respondents generally matched those of the study area in general.

Most survey responses and comments revealed that people think traffic back-ups are the biggest challenge and that more lanes and better intersections/interchanges could improve traffic flow. Managed lanes, specifically HOV lanes, were also popular. Regarding active transportation, participant selections highlighted the need for safety improvements like lighting and separation from vehicles. Safety was also a theme when it came to transit improvements, while more frequent service and new routes were also named improvements.

Table 2-4. Online Open House Website Visits

Metric	English site	Korean site	Spanish site
Unique visitors	3,832	22	28
Total site views	5,111	31	30
Average time on each page (minutes)	2:15	0:14	1:51

Chapter 3 Transportation Performance Gaps

This chapter documents the existing and future Baseline conditions on SR 512 between the I-5/SR 512 interchange vicinity in Lakewood, Washington, and the SR 167/SR 512 interchange vicinity in Puyallup, Washington. The SR 512 corridor experiences peak period congestion in both directions and in several locations within the corridor and will continue to do so without additional attention.

3.1 Existing Transportation Facilities

3.1.1 Study Roadways

SR 512 is a four to eight lane, east-west route classified as Urban Other Freeway/Expressway and is both a National Highway System (NHS) route and Highway of Statewide Significance (HSS) route. SR 512 connects the cities of Lakewood to the west and Puyallup to the east. SR 512 has four lanes each direction between I-5 and the Steele Street S interchange, and three lanes each direction between the Steele Street S and SR 7 interchanges. Between SR 7 and SR 167, SR 512 has two lanes in each direction, except for an auxiliary truck climbing lane in the westbound direction between the Meridian and 31st Avenue SW interchanges. At the I-5/SR 512 system interchange, all ramp movements are free-flow except for the southbound I-5 to eastbound SR 512 ramp, which is controlled by a signal. The speed limit on SR 512 is 60 mph except at the I-5 interchange, where the speed limit is 45 mph near the signalized intersection with the I-5 southbound off-ramp. Other key roadways in the study corridor are listed in Table 3-1.

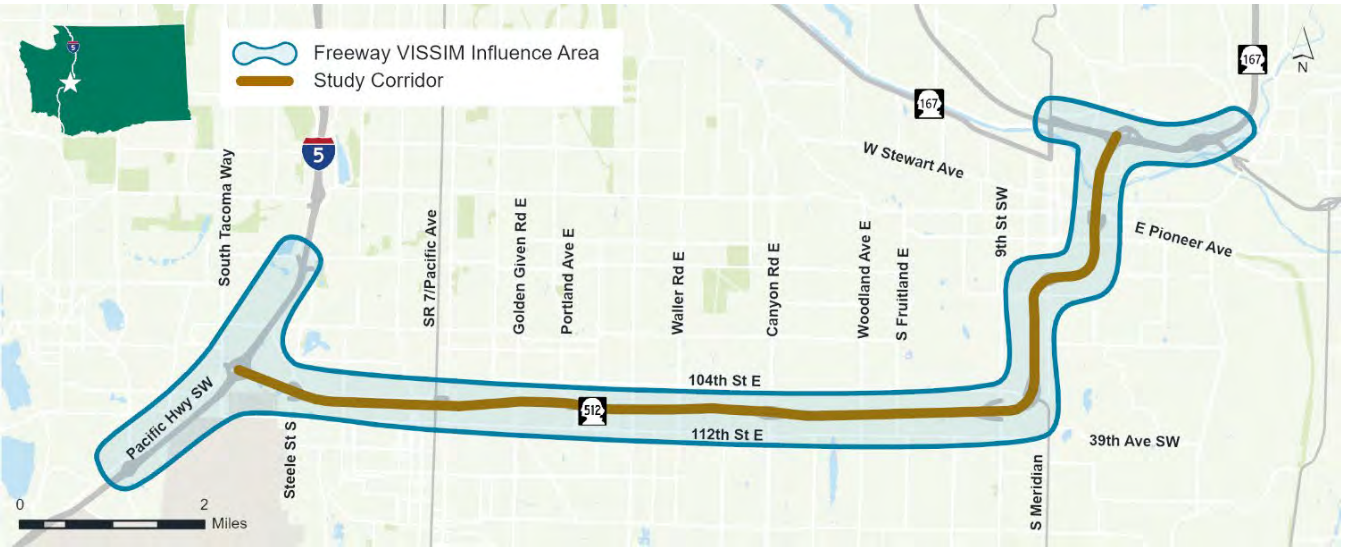
Table 3-1. Corridor Streets

Street	Functional Classification	Lanes	Speed Limit (mph)	Orientation
Steele Street S	Urban Principal Arterial	5	35	N/S
SR 7/Pacific Avenue S	Urban Principal Arterial	5	35	N/S
Portland Avenue E	Urban Minor Arterial	2-3	35	N/S
Canyon Road E	Urban Principal Arterial	5	35	N/S
94th Avenue E	Urban Minor Arterial	4	30	N/S
31st Avenue SW	Urban Minor Arterial	2-4	35	E/W
S Meridian	Urban Principal Arterial	4	30	N/S
112th Street E	Urban Principal Arterial	5	35	E/W
E Pioneer	Urban Minor Arterial	4	34	E/W

3.1.2 Freeway Study Area

The freeway study area is in the northwest region of Pierce County and involves the cities of Lakewood, Tacoma, and Puyallup, and unincorporated Pierce County. The study area along SR 512 is bound between the western terminus at I-5 and the eastern terminus at the SR 167/SR 512 interchange. Portions of I-5 and SR 167 are included in the modelling limits because the congestion experienced at these locations has a direct impact on the traffic demands and operations influencing the SR 512 corridor. Within the study area, the SR 512 mainline and interchanges listed below were analyzed and performance metrics were collected using the Vissim microsimulation analysis tool. Figure 3-1 outlines the freeway modeling influence area.

Figure 3-1. Freeway Vissim Model Area



The freeway study area includes only SR 512 from I-5 to SR 167. Ramps at the following interchanges were analyzed as part of this study:

1. I-5/SR 512/S Tacoma Way
2. SR 512/Steele Street S
3. SR 512/SR 7/Pacific Avenue E
4. SR 512/Portland Avenue E
5. SR 512/Canyon Road E
6. SR 512/SR 161/31st Avenue SW
7. SR 512/94th Avenue E/9th Street SW
8. SR 512/S Meridian
9. SR 512/E Pioneer
10. SR 512/SR 167

The Vissim model area was expanded to include the three additional interchanges listed below to better capture congestion, queueing, and weaving operations that influence operations. For the purposes of volume development, origin-destination (O-D) estimation, and to facilitate comparisons, the project team chose to leave them within the influence area of this model.

1. I-5/84th Street
2. I-5/Bridgeport Way
3. SR 167/SR 410 Interchange

The Vissim model is intended to analyze freeway mainline and ramp operations only for the 6-hour AM and PM time periods, which are 5–11 a.m. and 2–8 p.m. Ramp terminal intersections on SR 512 that are anticipated to be affected by the study were modeled in Synchro/Simtraffic for both the AM and PM peak hours, as discussed below.

3.1.3 Intersection Study Area

Thirty-seven ramp terminal and arterial intersections have been identified for the study and are listed in Table 3-2 and displayed in Figure 3-2 and Figure 3-3. These intersections are either ramp terminals at the interchange or are within the vicinity and could experience a change in operations within this study and were chosen with WSDOT direction and local stakeholder coordination.

Table 3-2. SR 512 Corridor Study intersections

ID	Intersection	Jurisdiction	Control Type
1	Southbound I-5 Off-ramp/SR 512	WSDOT	Signal
2	SR 512/S Tacoma Way	WSDOT	Signal
3	100th Street SW/S Tacoma Way	City/County	Signal
4	Pacific Hwy SW/S Tacoma Way	City/County	Signal
5	Eastbound SR 512/Steele Street S	WSDOT	Signal
6	Westbound SR 512/Steele Street S	WSDOT	Signal
7	Sales Road South/Steele Street S	City/County	Signal
8	109th Street South/Steele Street S	City/County	Stop
9	112th Street South/Steele Street S	City/County	Signal
10	112th Street S/SR 7	WSDOT	Signal
11	Eastbound SR 512 Ramps/SR 7	WSDOT	Signal
12	108th Street S/SR 7	WSDOT	Signal
13	108th Street E/Westbound SR 512 Off-ramp	WSDOT	Stop
14	112th Street E/A Street S	City/County	Signal
15	112th Street E/C Street S	City/County	Signal
16	112th Street E/Portland Avenue E	City/County	Signal
17	Eastbound SR 512 Ramps/Portland Avenue E	WSDOT	Signal
18	Westbound SR 512 Ramps/Portland Avenue E	WSDOT	Signal
19	104th Street E/Portland Avenue E	City/County	Signal
20	112th Street E/Canyon Road E	City/County	Signal
21	Eastbound SR 512 Ramps/Canyon Road E	WSDOT	Signal
22	Westbound SR 512 Ramps/Canyon Road E	WSDOT	Signal
23	104th Street E/Canyon Road E	City/County	Signal
24	39th Avenue SW/94th Avenue E	City/County	Signal
25	SR 512 Eastbound Off-ramp/94th Avenue E	WSDOT	Signal
26	SR 512 Westbound On-ramp/94th Avenue E	WSDOT	Signal
27	31st Avenue SW/9th Street SW/94th Avenue E	City/County	Signal
28	31st Avenue SW/Westbound SR 512 Ramps	WSDOT	Signal
29	31st Avenue SW/Eastbound SR 512 Ramps	WSDOT	Signal
30	31st Avenue SW/South Meridian	WSDOT	Signal
31	Eastbound SR 512 Ramps/South Meridian	WSDOT	Signal
32	Westbound SR 512 Ramps/South Meridian	WSDOT	Signal
33	Summit Country Center/Canyon Road E	City/County	Signal
34	South Hill Park and Ride/94th Avenue E	City/County	Signal
35	31st Avenue SW/South Hill Park and Ride	City/County	Stop
36	31st Avenue SW/South Hill Park Drive	City/County	Stop
37	15th Avenue SW/South Meridian	City/County	Signal

Figure 3-2. Study Intersections – I-5 to Portland Avenue E

Figure 3-3. Study Intersections – Canyon Road E to S. Meridian

All study intersections were included in the AM and PM peak hour Synchro/Simtraffic model. Queues at the off-ramp terminals were modeled with the Simtraffic simulation model. East Pioneer intersections are not included as a part of this study because East Pioneer was analyzed as a part of previous studies of SR 167.

3.1.4 Bus Transit Services

Pierce Transit, Sound Transit, and Intercity Transit offer commuter rail and/or bus service near and through the study area. Sound Transit offers connections to destinations including Tacoma and Seattle via Sounder Commuter Rail and express bus service to multiple destinations. Pierce Transit facilitates regional and local transit trips while Intercity Transit provides express service between Olympia and Lakewood. It should be noted transit services only cross SR 512 and no transit routes currently use the SR 512 freeway. Table 3-3 provides a summary of bus routes that serve the corridor and which study area roadways those services use. Figure 3-4 shows those routes.

Figure 3-4. Transit Service

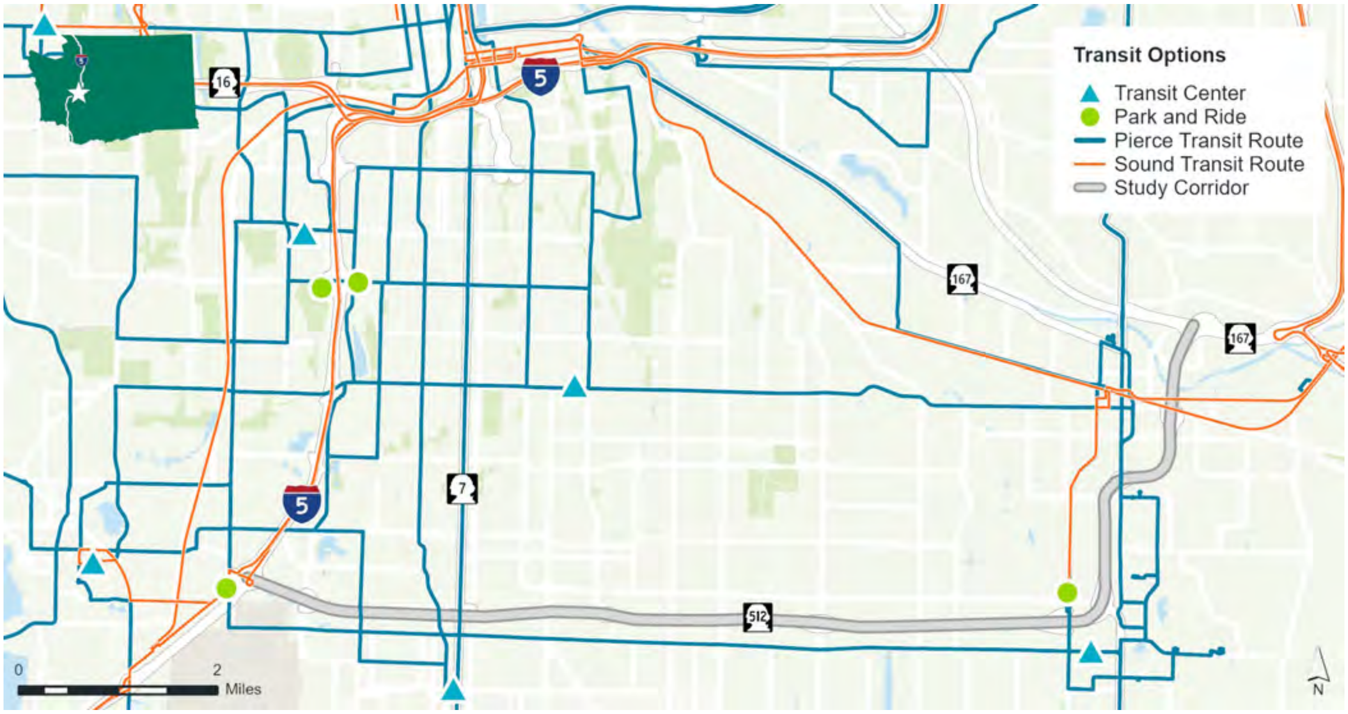


Table 3-3. Transit Service within Study Area

Route	Study Area Roadway(s) Used	Transit Agency	Service	Type	Frequency
1	Pacific Ave S (SR 7)	Pierce Transit	All Days	Daily	30 minutes
3	S Tacoma Way	Pierce Transit	All Days	Daily	30 minutes
4	112th St from S Tacoma Way to 94th Ave E	Pierce Transit	All Days	Daily	30 minutes
45	Park Ave S/C St S	Pierce Transit	All Days	Daily	30 minutes
400	94th Ave E/31st Ave SW	Pierce Transit	Weekday	Peak	30 minutes
402	S Meridian	Pierce Transit	All Days	Peak	1 hour
425	94th Ave E/31st Ave SW; S Meridian	Pierce Transit	Weekday and Saturday	Peak	6 runs
574	SR 512/S Tacoma Way	Sound Transit	All Days	Daily	30 minutes
580	9th Ave E from 31st Ave SW to Puyallup Station	Sound Transit	Weekday	Peak	3 runs
592	SR 512/S Tacoma Way	Sound Transit	Weekday	Peak	30 minutes
594	SR 512/S Tacoma Way	Sound Transit	All Days	Daily	30 minutes
620IT	Olympia/512 P&R Express	Intercity Transit	All Days	Daily	1 hour

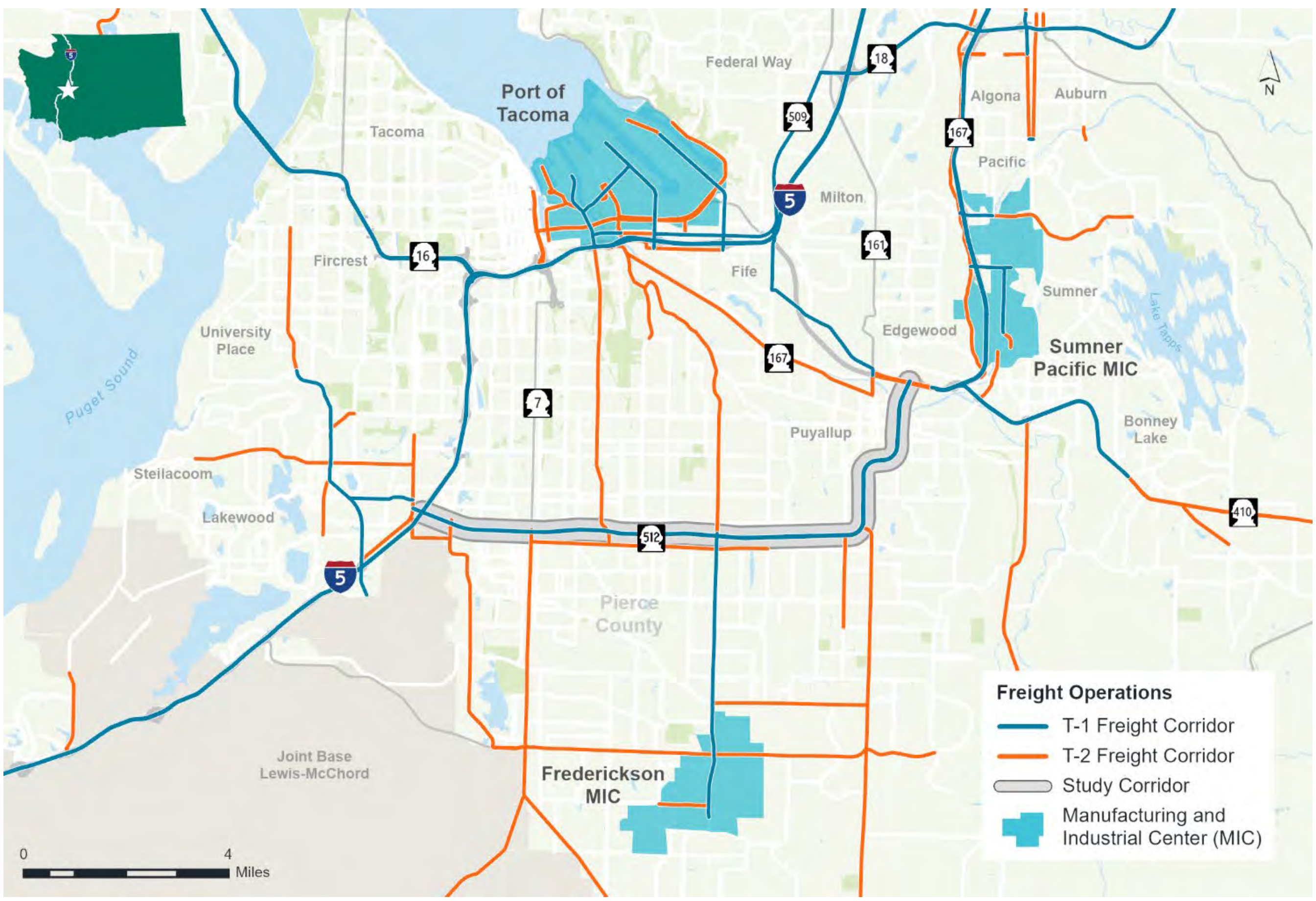
The I-5/SR 512 Park and Ride facility off South Tacoma Way serves multiple transit agencies and serves as a hub for local and regional transit service within the region. There are two commuter rail lots near the corridor: Lakewood Station and Puyallup Station. The South Hill Mall Transit Center Park and Ride facility at the South Hill Mall offer connection to lines not within the study area.

3.1.5 Freight

Freight mobility within the study area is supported by a system of designated freight routes connecting streets to major freight designations. WSDOT uses the Freight and Goods Transportation System (FGTS) to classify roadways based on freight tonnage. Corridors are classified into categories, T-1 through T-5, based on annual tonnage. Those that carry greater than 10 million tons of freight per year are designated as T-1 corridors.

Freight corridors are highlighted in Figure 3-5. SR 512 is a major carrier of freight traffic within the study area, carrying 30.85 million tons in 2019 and is designated as a T-1 corridor. Approximately 7.8 percent of all vehicles are trucks on SR 512. Other roadways in the study area that carry a T-1 designation are I-5, SR 167, and the portion of Canyon Road E from SR 512 to 192nd Street E (nearly 25 million tons in 2019). All other roadways that have interchanges along SR 512, aside from South Meridian and E Pioneer, are also considered freight corridors and have a designation of T-2, indicating 4 to 10 million tons of freight in 2019.

Figure 3-5. Freight Operations



3.1.6 Active Transportation Facilities

The study area has both pedestrian and bicycle facilities at interchanges, overpasses, and underpasses. The evaluation of sidewalks and bicycle lanes was limited to these crossing locations and are listed in Appendix A.

SR 512 can serve as a barrier to communities, schools, and key regional destinations on either side of the facility due to limited crossing opportunities at interchanges and cross streets. Many of these facilities have limited or no sidewalks or bicycle lanes and create an uninviting environment for active transportation modes. Connections across the corridor are also limited, in particular in the middle of the corridor near Canyon Road where the spacing between cross streets can exceed a mile. Barriers suppress active transportation because convenient, comfortable, and direct pedestrian and bicycle facilities are limited. More information about these SR 512 crossings is provided later in this chapter.

3.1.7 Maintenance

The corridor experiences maintenance challenges and performance gaps including:

- At least once per week, there is a vehicular crash involving the median cable on SR 512 which requires hours to repair. Replacing the cable barrier with a concrete barrier could reduce repair time, allowing traffic flow to return to normal more quickly.
- Existing grass median areas require debris removal, posing safety concerns for maintenance crews performing this work next to the highway.
- Access has been lost to an existing pond in the vicinity of the north side of the 94th Avenue interchange, preventing it from being maintained.
- Another median crossover west of 94th Avenue, which was suggested by the Washington State Patrol at the beginning of this study, would facilitate easier access for maintenance activities.
- Overall, WSDOT Maintenance is concerned about the difficulty in responding to emergency situations.

3.2 Existing Data

The existing year, serving as a basis of analysis, is 2019. The year 2019 represents traffic conditions prior to the COVID-19 pandemic and historically had the highest traffic volumes. Any recent traffic counts collected during COVID-19 pandemic conditions between March 2020 and October 2022 were factored to 2019 pre-COVID-19 pandemic conditions based on historic counts, volume trends from permanent traffic recorders (PTRs) on SR 512, aggregated mobile-device location data (referred to as cell phone data for this study), and/or other supplemental data sources.

3.2.1 Data Sources

Freeways and Intersections

All traffic data for the traffic operational analysis was provided by WSDOT, Pierce County, the City of Puyallup, and the City of Lakewood. Data not available from these sources was collected in 2022.

Freeway traffic counts from WSDOT Olympic Region tube counts and/or compact-disc data recovery (CDR) system loop detector data was used to develop existing freeway mainline and ramp volumes on SR 512, SR 167, and I-5 for all mainline and ramps within the study area. When data was unavailable or erroneous, data was used from other sources or cell phone data with calibrated volume estimation tools was applied to known field volumes.

Intersection turning movement counts were collected, compiled, and summarized for the AM and PM peak hours. Older counts were factored to pre-COVID-19 pandemic conditions using growth factors specific to the year of each source data set.

Congestion contour plots from cell phone data were created to calibrate/validate the AM and PM peak period Vissim freeway models. These contour plots were created for both directions of SR 512 between the I-5/SR 512 and SR 167/SR 512 interchanges and are provided in Appendix B.

Time Periods

The AM and PM periods were analyzed for this assessment study. This Vissim model has 6-hour AM and PM periods (5 to 11 a.m. and 2 to 8 p.m.). The intersection analysis focused only on the 1-hour AM (7 to 8 a.m.) and PM (4 to 5 p.m.) peak hours, as these periods represent conditions with the highest volumes and queues at ramp terminal intersections.

3.2.2 Traffic Volumes

Daily

The existing average weekday traffic (AWDT) volumes were compiled from available data from WSDOT in 2019 (WSDOT Traffic Geoportal, https://www.wsdot.wa.gov/data/tools/geoportal/?config=traffic).

SR 512 has the highest volumes of any east-west road within the study area, with approximately 112,000 vehicles per day (vpd) just east of I-5. At the east end of the study area near SR 167, SR 512 carries approximately 98,000 vpd. Daily traffic volumes are lowest inside of the Canyon Road interchange, with approximately 64,000 vpd.

Peak Period

Existing conditions peak period traffic volumes were compiled and averaged for the peak 3-hour AM period (6 a.m. to 9 a.m.) and PM period (3:30 p.m. to 6:30 p.m.). Most notably, eastbound SR 512 carries between 2,000 and 4,100 vehicles per hour in the AM peak and between 2,400 and 4,400 vehicles per hour during the PM peak. Average traffic volumes on all study segments are presented graphically in Appendix C.

3.3 Freeway Operations Analysis

3.3.1 Methodology

Vissim, a traffic modeling software, was used for the freeway analysis. The Vissim model replicates the weekday AM and PM commute periods, including the buildup and dissipation of congestion using a 6-hour period in the AM period (5 a.m. to 11 a.m.) and PM period (2 p.m. to 8 p.m.).

The Vissim model developed from the I-5/SR 512 Interchange Project used validation criteria and accepted tolerances from the *Guidelines for Applying Traffic Microsimulation Modeling Software, Vol. 3* (FWHA July 2004) and *Protocol for VISSIM Simulation* (WSDOT September 2014). While this model was previously calibrated to confirm that it can replicate field conditions, the calibration for this study was enhanced with additional focus on the eastern portion of the study area to better capture traffic interactions with SR 167.

Analysis Measures

The following measures of effectiveness (MOEs) are reported for freeway operations:

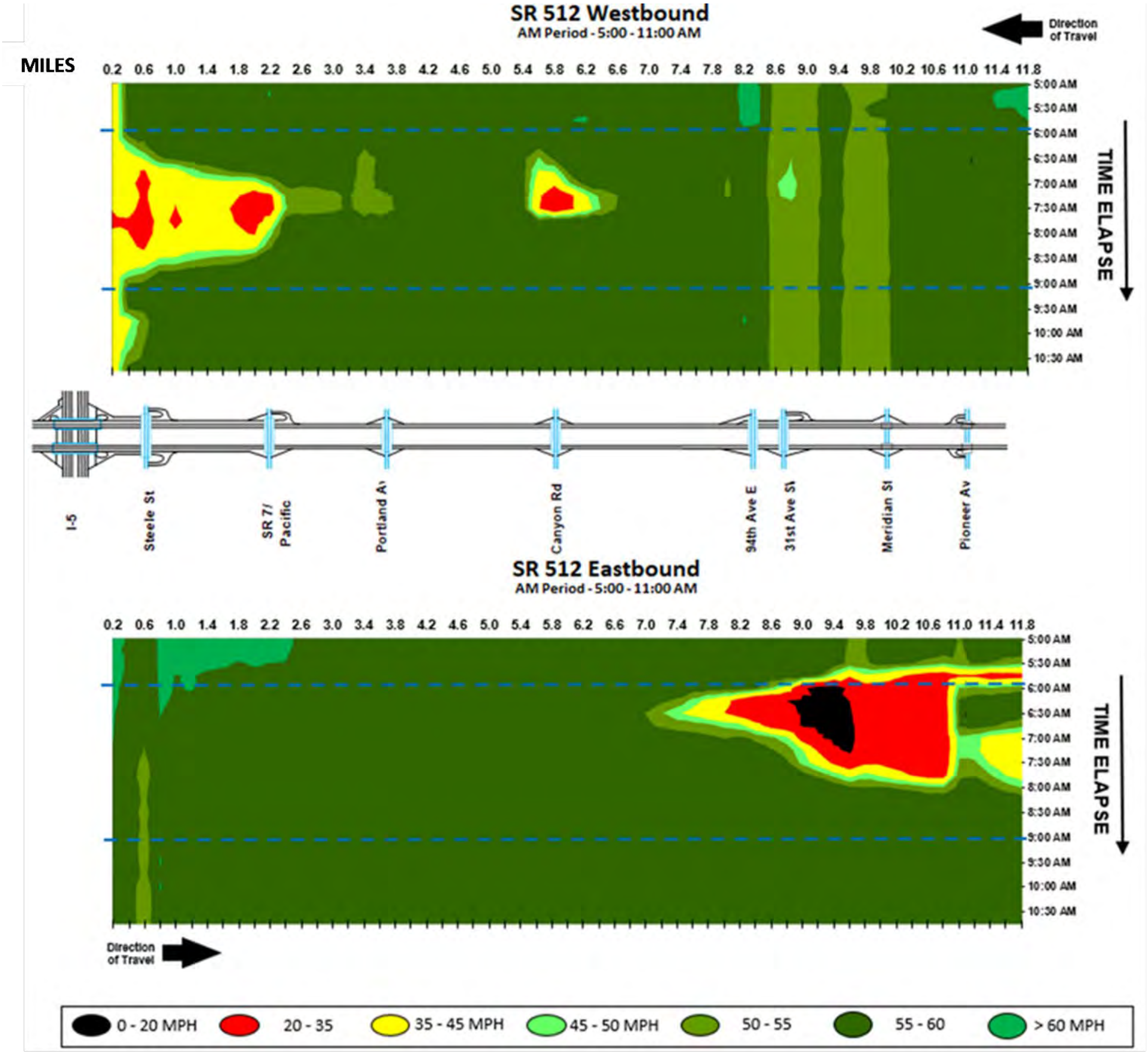
- Vehicle throughput in vehicles per hour (vph)
- Travel time in minutes
- Speed in miles per hour (mph)
- Duration of congestion

Vehicle throughput and travel time was reported for a 3-hour period (6 a.m. to 9 a.m. in the AM period and 3:30 p.m. to 6:30 p.m. in the PM period). The 3-hour period represents the period with the most congestion in the study area. Speed and duration of congestion are reported for the entire 6-hour reporting period (5 a.m. to 11 a.m. in the AM period and 2 p.m. to 8 p.m. in the PM period) with temporal speed charts or heat maps. The heat maps report the average speed across all lanes at 15-minute intervals and 0.2-mile spacing along the entire freeway study area.

3.3.2 Operations, Speeds, and Congestion

Heat maps showing 2019 Existing Conditions AM and PM peak period freeway speeds and congestion in the study area are provided for SR 512 in Figure 3-6 and Figure 3-7.

Figure 3-6. 2019 AM Period Existing Conditions SR 512 Heat Maps

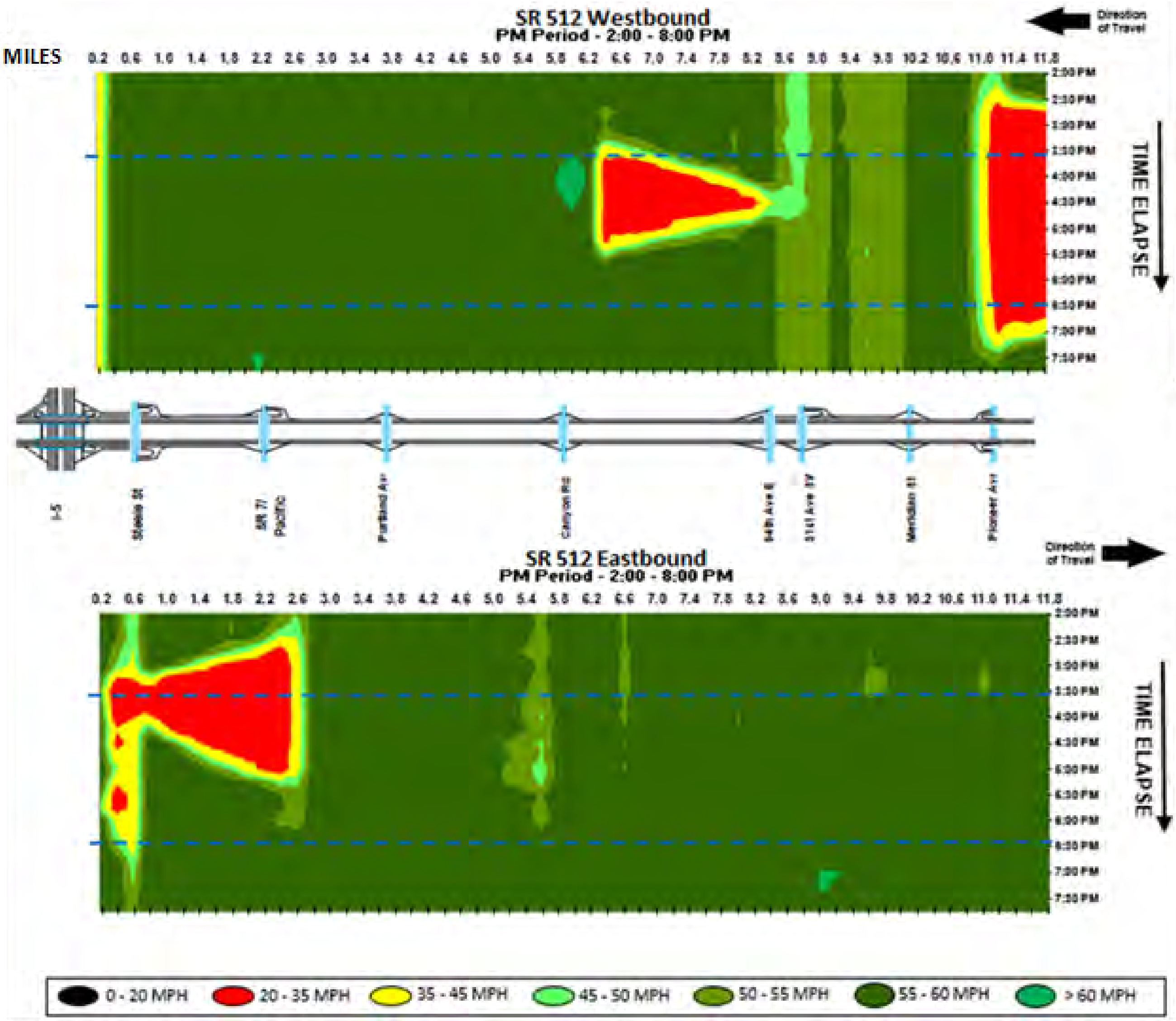


AM Peak Period

There are two major bottlenecks during the AM peak period on westbound SR 512. The first location is approaching the Canyon Road interchange, where high volume exiting and queuing back to the end of the ramp causes congestion on SR 512. The congestion occurs between 6:30 a.m. and 7:30 a.m. The second bottleneck on westbound SR 512 occurs at the I-5 interchange, where high volume is exiting to northbound and southbound I-5 utilizing only the outside lanes. The congestion occurs from 6:30 a.m. until 8:30 a.m. and spills back to SR 7. The signal at SR 512 and southbound I-5 offramp terminal also causes congestion for the heavy volumes lined up for both southbound and northbound I-5 ramps.

Eastbound SR 512 experiences congestion in the eastern end of the study area, caused by a combination of spillback from congestion on SR 167 outside of the study area and congestion related to the 31st Avenue S and S Meridian interchanges. Eastbound SR 512 also experiences slowdowns near the Steele Street interchange due to the short weaving distance between the on-ramp from northbound I-5 and the Steele Street off-ramp.

Figure 3-7. 2019 PM Period Existing Conditions SR 512 Heat Maps



PM Peak Period

There are two major bottlenecks during the PM peak period on westbound SR 512. The first location is approaching the Pioneer Avenue interchange, where high westbound volume on SR 512 causes congestion with the Pioneer Avenue westbound on-ramp. This congestion occurs from 2:30 p.m. until 7 p.m. The second bottleneck on westbound SR 512 occurs at the Canyon Road interchange, where the SR 512 westbound off-ramp terminal at Canyon Road experiences queues that spill back to the westbound SR 512 mainline and vehicles prepositioning to exit at Canyon Road and 31st Avenue SW causes the corridor to experience congestion. This congestion occurs from 3 p.m. until 5 p.m. and spills back to the 31st Avenue SW interchange.

Eastbound SR 512 experiences congestion in the western end of the study area, caused by a combination of spillback from congestion on SR 7 and the short merge from the SR 7 on-ramp. Additional slowing is related to the congestion at the I-5 to Steele Street weave.

3.3.3 Travel Times

Freeway travel times were used to assess freeway operations and were determined from the Vissim model. Travel times were measured during the peak 3-hour AM period (6 a.m. to 9 a.m.) and PM period (3:30 p.m. to 6:30 p.m.) for three primary routes described below, results summarized, and shown graphically in Figure 3-8 and in tabular form in Table 3-4:

- Eastbound and westbound SR 512 from Steele Street S to Waller Road S (3.9 miles)
- Eastbound and westbound SR 512 from Waller Road S to Puyallup River Bridge (7.0 miles)
- Eastbound and westbound SR 512 from Steele Street S to Puyallup River Bridge (10.9 miles)

Figure 3-8. 2019 Existing 3-Hour AM and PM Peak Freeway Travel Time Paths and Results

Table 3-4. 2019 Existing 3-Hour AM and PM Peak Freeway Travel Time Paths and Results

Path	Travel Time Path	Distance (mi)	AM EB	AM WB	AM EB	PM EB
1	Steele St S to Waller Road S	3.94	4.1	7.8	7.3	10.4
2	Waller Road S to Puyallup River Bridge	6.99	13.2	6.4	7.4	4.1
3	Steele St S to Puyallup River Bridge	10.93	17.3	14.2	14.7	14.5

AM Period

Drivers on travel time path 1 experience near free flow conditions because there is little to no congestion along this path during the AM period in the eastbound direction. However, the westbound direction for this path experiences delay from Steele Street to the SR 512 to I-5 northbound ramp. This congestion spills back to this path and affects operations upstream as far as SR 7. Along travel time path 2 in the eastbound direction, drivers experience delays between Canyon Road and the end of the study area at SR 167. The congestion outside of the study area along SR 167 queues to the SR 512 corridor which can influence the severity of congestion between 94th Avenue and Pioneer. The westbound direction experiences near free flow conditions because there is little to no congestion along this path during the AM period except for the heavy diverge that occurs at Canyon Road.

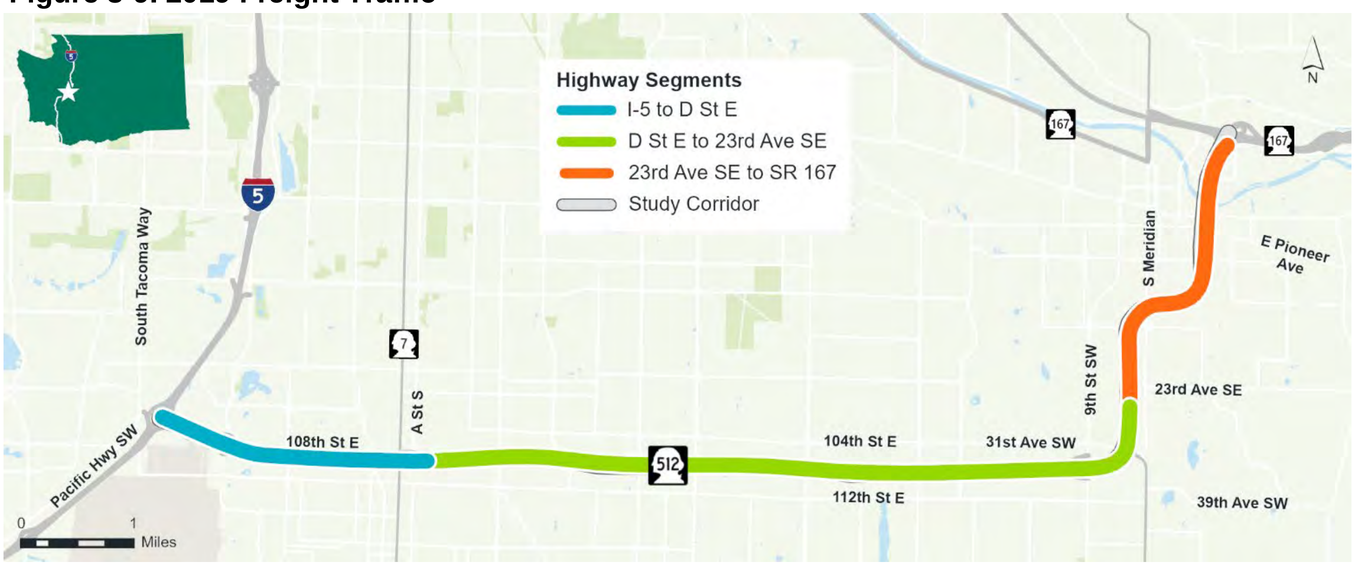
PM Period

Drivers on travel time path 1 in the eastbound direction experience congestion due to the movements to and from SR 7 and the merging operations from Steele Street. For the westbound direction, drivers on this travel path experience near free flow conditions. For travel time path 2, the eastbound direction experiences near free flow conditions because there is little to no congestion. However, the westbound direction experiences heavy congestion and delays from the heavy merge of the SR 167 and SR 512 interchange and the Pioneer Avenue merge. The operations at Canyon Road E create congestion that affects the upstream roadways as far back as the 94th Avenue/31st Avenue interchange area.

3.3.4 Freight Operations

The Federal Highway Administration's (FHWA) online Workbook Bottleneck tool was used to analyze freight volumes, delay, emissions, and congestion costs. The tool shows the study corridor in three segments, with values for each travel direction. Data for 2019 is shown in Figure 3-9 and Table 3-5.

Figure 3-9. 2019 Freight Traffic



Source: Workbook: FHWA FMM Bottlenecks 5.1 , accessed May, 2023.

Table 3-5. Freight Traffic

Corridor Section	Length (mi)	AADT (Trucks)	Delay (mi)	Delay/ Mile	CO2/ Mile	Congestion Cost
1. Eastbound	2.6	3,096	23,238	8,912	16 mt	$1.3M
1. Westbound	2.6	3,082	19,498	7,586	16 mt	$1.1M
2. Eastbound	6.6	2,822	27,889	4,212	14 mt	$1.6M
2. Westbound	6.7	2,828	22,177	3,323	14 mt	$1.3M
3. Eastbound	2.6	3,254	15,263	5,971	16 mt	$0.9M
3. Westbound	2.6	3,254	11,481	4,509	16 mt	$0.6M

Source: Workbook: FHWA FMM Bottlenecks 5.1 , accessed May, 2023.

Eastbound traffic for each segment shows significantly more delay than westbound traffic. Segment 1 between I-5 and D St E has higher levels of delay per mile than the other segments.

3.4 Intersection Operations Analysis

3.4.1 Methodology

Intersection operations analysis used the Synchro/Simtraffic (version 11.1.1.6) software package to calculate signalized intersection delay and level of service (LOS) and calculate 95th percentile queue lengths. Geometric layouts, volume, and signal timing information from WSDOT was used for this analysis. Intersections were evaluated using the *Highway Capacity Manual, Sixth Edition: A Guide for Multimodal Mobility Analysis* (HCM) methodologies (TRB 2016). At locations where HCM 6 methodologies are not valid, the HCM 2000 methodology was used, consistent with policy from *WSDOT Synchro and Simtraffic Protocol* (WSDOT, August 2018). Simtraffic is the microsimulation component of the Synchro software package and was used to calculate 95th percentile queue results. Simtraffic was run for five random seeds with the results averaged.

Analysis Measures

The MOEs used for intersection analysis include:

- LOS
- Delay (seconds per vehicle)
- 95th percentile queue lengths

Synchro calculates intersection LOS and average delay, while Simtraffic calculates 95th percentile queue lengths. LOS refers to the degree of congestion measured in average delay per vehicle. LOS A is the best operating condition, with motorists experiencing minimal delays. LOS F is the worst condition, with motorists experiencing extremely high delays, and at signal, often waiting through multiple signal cycles. Table 3-6 shows the LOS and vehicle delay criteria for signalized intersections.

Table 3-6. Intersection LOS Criteria and Descriptions

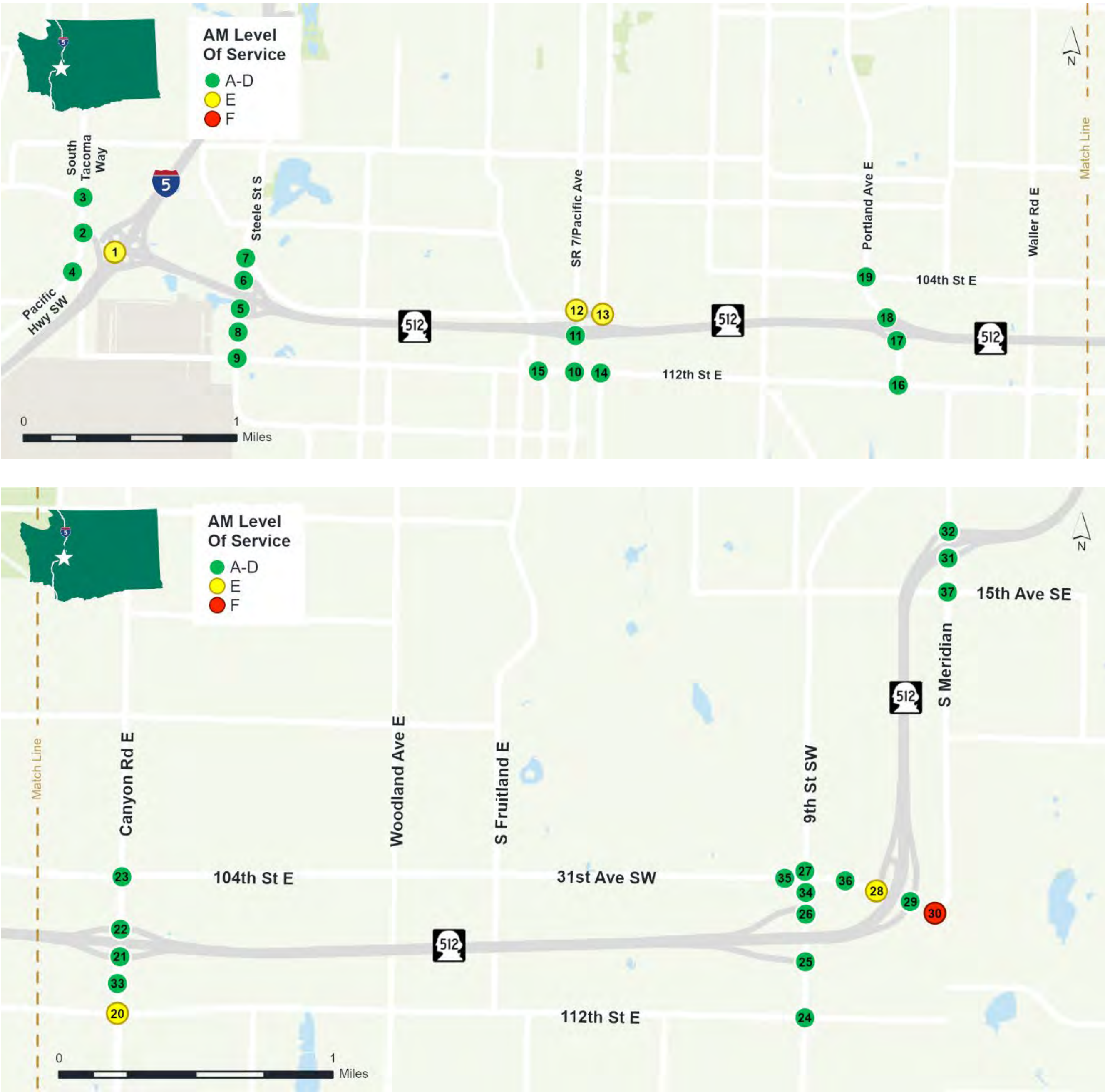
LOS	Average Delay (seconds/vehicle	Description
A	0 to 10.0	Little or no delay
B	10.1 to 20	Short delays
C	20.1 to 35.0	Moderate delays
D	35.1 to 55.0	Long delays
E	55.1 to 80.0	Very long delays
F	80.1 or more	Failure – extreme congestion

Intersection delays were estimated for the overall intersection for the purpose of assigning LOS grades using the criteria in Table 3-6. The overall delay is a volume-weighted average of the delays on the approach legs that make up the intersection.

3.4.2 Level of Service

Existing Conditions AM peak hour intersection LOS results are presented in Figure 3-10. Detailed intersection tables and reports from Synchro are provided in Appendix D.

Figure 3-10. 2019 Existing Conditions AM Peak Hour Intersection LOS



The AM peak has six intersections that operate at LOS E or F, which also may affect the mainline SR 512 traffic flow. During the AM peak hour, six intersections operated at LOS E or F which accounts for 16 percent of the total study area intersections. Three ramp terminal intersections operate at LOS E or F: I-5 and SR 512, SR 7 westbound terminal, and the 31st Avenue SW westbound ramp terminal. Of these three, the 31st Avenue SW interchange has multiple intersections operating at LOS E or F. Existing Conditions PM peak hour intersection LOS results are presented in Figure 3-11.

Figure 3-11. 2019 Existing Conditions PM Peak Hour Intersection LOS

The PM peak hour has significant failures and intersections that operate at LOS E or F, which also may affect the mainline SR 512 traffic flow. During the PM peak hour, fifteen intersections operated at LOS E or F which accounts for 40 percent of the total study area intersections. Seven ramp terminal intersections operate at LOS E or F: I-5 and SR 512, SR 7 westbound terminal, Portland Avenue westbound terminal, both ramp terminals at 94th Avenue E, and both ramp terminals at 31st Avenue SW. Of these seven interchanges, SR 7, Canyon Road E, 94th Avenue E, and 31st Avenue SW have multiple intersections operating at LOS E or F.

3.4.3 95th Percentile Queues

Existing Conditions AM and PM peak hour intersection 95th percentile queue results for the intersections with a focus on the interchanges are presented in Appendix E. The 95th percentile queue lengths were generated using SimTraffic.

At the Canyon Road E and 112th Street E intersection, the 95th percentile queues for all southbound movements in the PM peak hour exceed the storage length, spilling back into the Canyon Road E and Summit Country Center/110th Street E intersection. The spillback causes other southbound through movements 95th percentile queues to also exceed the storage length such as Canyon Road E and eastbound SR 512 Ramps and the Canyon Road E and westbound SR 512 Ramps.

At the eastbound SR 512 and Steele Street S intersection, the 95th percentile queues of all westbound movements exceed the storage length, causing a backup on the loop ramp. The loop ramp queue extends close to SR 512. The 94th Avenue E corridor also exhibits substantial intersection queuing issues in the PM peak hour.

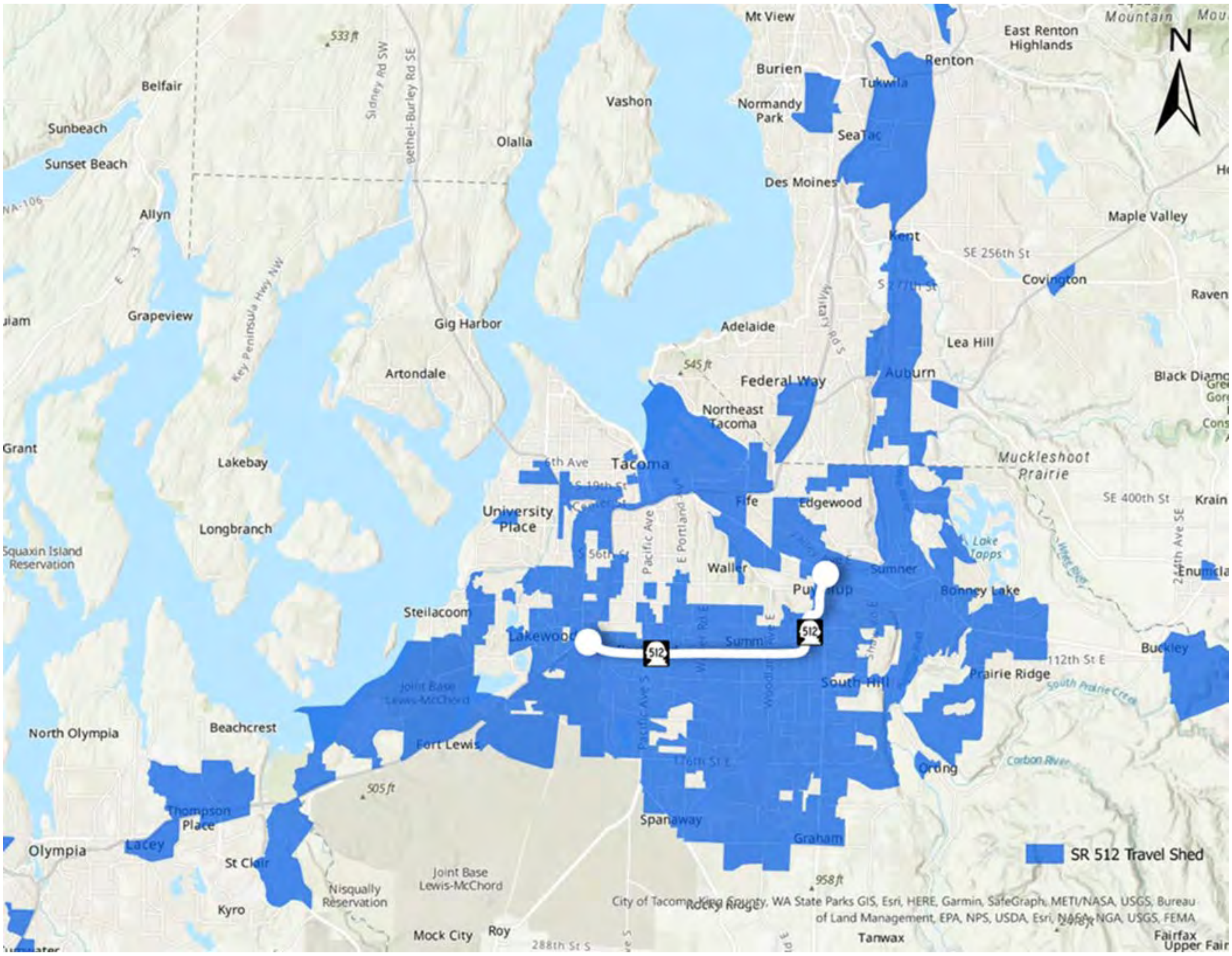
3.5 Multimodal Travel Patterns and Activity Levels

Corridor mobility and activity level was assessed using cell phone data from a software as a service platform. This is a type of service that is collected from many anonymized devices - notably smart phones, but also internet-connected vehicles, in-vehicle GPS services, and fleet management systems. The data is collected, blended, and transformed into travel patterns for cars, trucks, and active (pedestrian and bicycle) modes. WSDOT utilized this cell phone data to understand the travel shed of SR 512 users, vehicle and truck travel patterns, and multimodal activity of people adjacent to the SR 512 corridor the study area.

3.5.1 Travel Shed

Figure 3-12 shows where most SR 512 corridor users are traveling. The graphic represents approximately 70 percent of all daily weekday travelers that begin on SR 512 and have a destination in the areas shown in blue.

Figure 3-12. Travel Shed of SR 512 Corridor



Most users are destined to the south and east of the corridor with many of these users traveling through interchanges such as Portland Avenue E, Canyon Road E and 94th Avenue E. Fewer trips are destined immediately to the north of the corridor, indicating many people living or working in these communities use other facilities such as I-5 instead of SR 512.

Outside of the immediate corridor, destinations along the east of SR 167 include Kent and Auburn and several of the largest manufacturing and industrial land uses in the region. Other notable destinations include the Port of Tacoma, SeaTac Airport, and along the I-5 corridor to the west of Joint Base Lewis McChord-.

3.5.2 Origin-Destination Trends

Daily weekday regional travel patterns of SR 512 users were also assessed using cell phone data, available in Appendix F. They were classified based on where their trips begin and end, as follows:

- **Internal only:** trips that begin and end within the SR 512 corridor
- **Internal to/from external:** trips that start or end inside the study area, going to or coming from outside the study area.
- **External only or pass-through:** trips that both begin and end outside the study area.

As shown in Table 3-7, most SR 512 trips have at least one end outside of the study area. This is true for all vehicles and for trucks in particular. Most through trucks on SR 512 use it as a bypass around downtown Tacoma. Considering the size of the study area, this suggests most of the trips along SR 512 are not short or local. It also highlights the importance of SR 512 as a corridor for through-movement of freight and goods.

Table 3-7. SR 512 Trip Type

Type of Trip	All Vehicles	Trucks
Internal Only	30%	10%
Internal to/from External	53%	36%
External Only (Pass through)	17%	54%

3.5.3 Active Transportation

Active transportation data was collected from March through August 2019 for hexagonal areas within a 1-mile buffer of the SR 512 corridor. Activity was classified into different levels, from negligible through very high, relative to the rest of the study area.

The highest concentrations of walking and bicycle trips in the study area are shown in Figure 3-13 and Figure 3-14, respectively. The greatest proportion of pedestrian activity occurs near retail centers, adjacent to transit hubs, hospitals, schools and universities, and the area surrounding the Washington State Fairgrounds. Many portions of the study area have very low levels of pedestrian activity in the middle of the study area due to lower population density, few desirable walkable destinations, and poor pedestrian facilities.

Figure 3-13. Pedestrian Activity

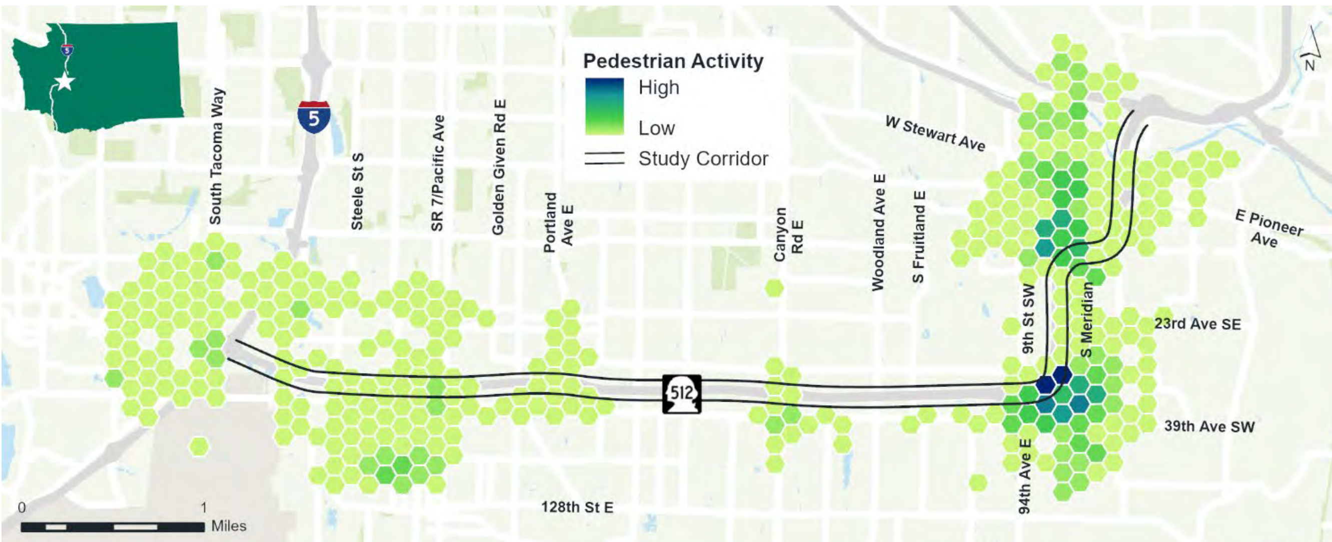
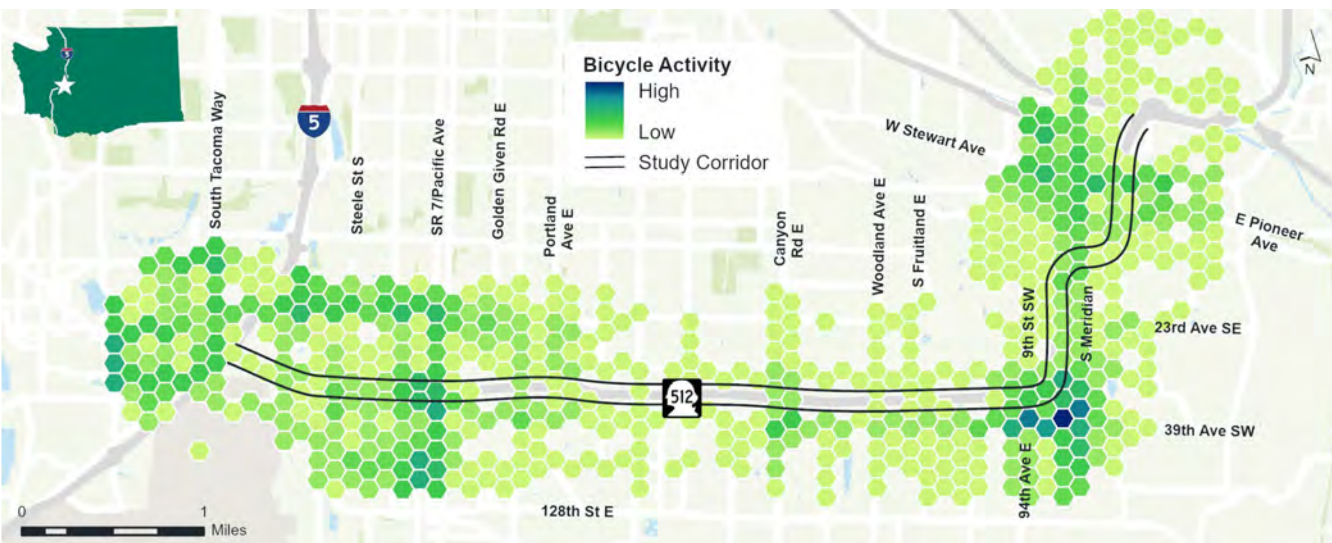


Figure 3-14. Bicycle Activity



Bicycles also show higher areas of activity along roadways with bicycle facilities, regional trails, and schools. Corridors such as SR 7, 96th Street S and S Meridian have the highest concentrations of bicycles near SR 512.

3.6 Existing and Future Active Transportation Performance

Pedestrian crossings of SR 512 were identified in the public involvement process as being generally inadequate and a source of concern with respect to vulnerable road users, including those who use sidewalks for lower-speed cycling and use of mobility assistance devices or smaller transportation aids.

3.6.1 Active Transportation Facilities

Existing Crossings

Fewer than half of the 22 existing crossings of SR 512 have full sidewalks present. The rest have either sidewalks present for only part of the crossing or no sidewalks present at all. Crossings are shown in Figure 3-15.

Figure 3-15. Existing SR 512 Crossings

3.6.2 Existing Conditions for Active System Users

The quality of service provided for active transportation users is described using a four-level system termed Level of Traffic Stress (LTS). LTS is based on the environment experienced by active transportation users and is based on such factors as prevailing speed of adjacent traffic, degree of separation from traffic, and facility width. WSDOT strives to achieve an LTS of 1 or 2 (indicating high performance levels) while LTS values of 3 or 4 indicate that roadway characteristics negatively influence the performance and relative comfort of active transportation users. Pedestrian LTS and Bicycle LTS for existing crossings of SR 512 are indicated in Figure 3-16 and Figure 3-17, respectively.

Figure 3-16. Pedestrian Level of Traffic Stress

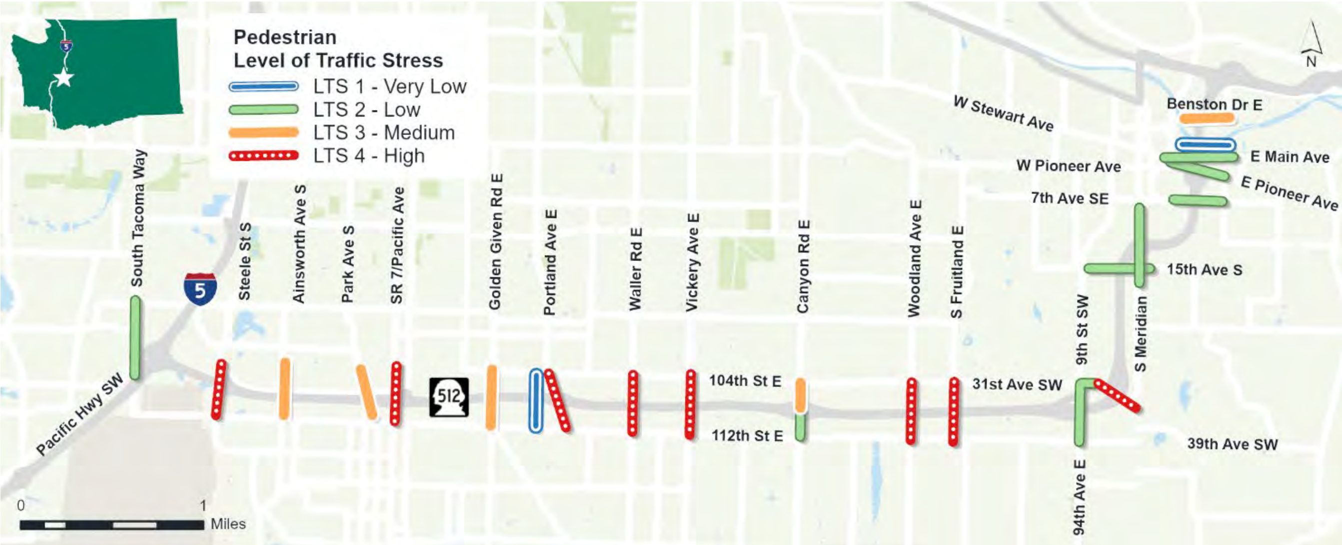
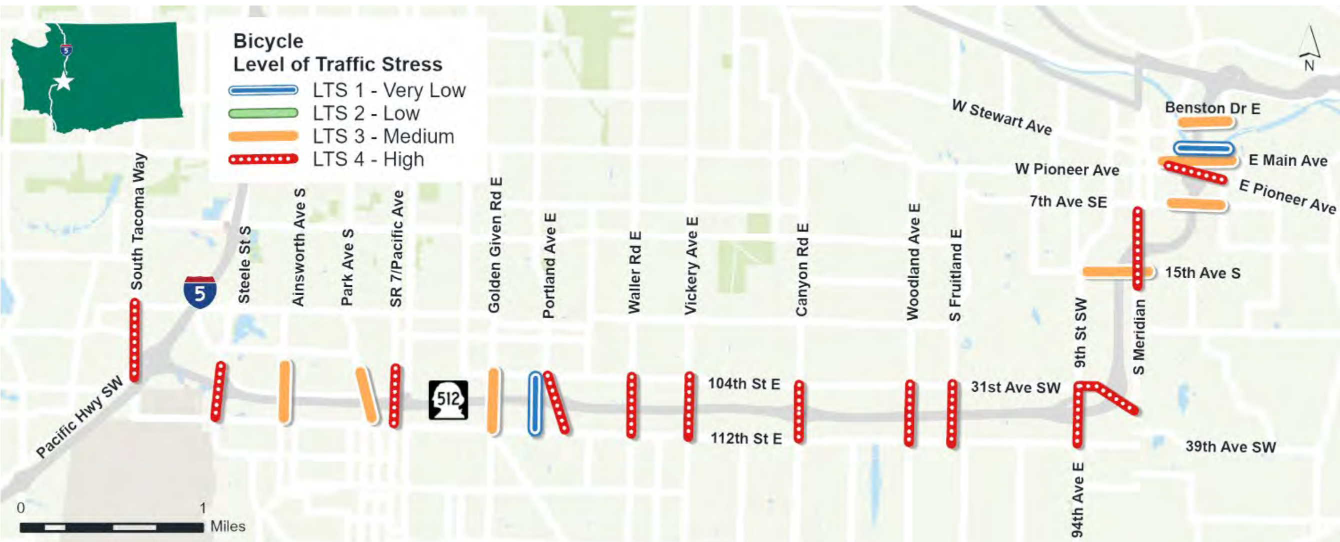


Figure 3-17. Bicycle Level of Traffic Stress



3.6.3 Distance Between SR 512 Crossings

The significant number of streets, especially north-south ones, cut by the construction of SR 512 has resulted in gaps between crossings that result in substantial out-of-direction travel for both drivers and active users whose trips require a crossing. Some of these active mode users are students. The following gaps between SR 512 crossings are approximately one mile or more:

- Vickery Avenue to Canyon Road E
- Canyon Road E to Woodland Avenue E
- S Fruitland to 94th Avenue E
- 31st Avenue SW to 15th Avenue SW

Several other intervals between crossings of SR 512 are less than a mile but greater than three quarters of a mile.

3.6.4 Future Conditions Related to SR 512 as a Local Mobility Barrier

While local plans have some unfunded projects to address individual deficiencies, they are generally spot projects rather than a strategic investment. No new crossings of SR 512 are currently funded, as of the start of this study.

3.7 Safety Performance

This study is intended to assess strategies which would improve traffic operations and safety performance along the SR 512 corridor over a near-term and long-term timeframe. This section documents the existing safety analysis for the SR 512 corridor.

The SR 512 study area spans the extent of the SR 512 corridor (12 miles) from the South Tacoma Way intersection/I-5 interchange to the SR 167 interchange. In addition to the SR 512 mainline, the study area includes the ramps, ramp terminals, adjacent intersections, and cross street segments between the ramp terminals and adjacent intersections (where applicable).

3.7.1 Methodology

The study area was analyzed by facility (mainline, ramp, intersection, and local/cross street). The analysis focused on fatal and severe injury crashes and those involving pedestrians and bicyclists.

The primary analysis period was assumed to be the five-year period from 2015 to 2019. The 2020 and 2021 crash data were also analyzed to examine overall trends, but not included within the primary analysis.

3.7.2 Crash History Results

The existing safety analysis focused on the five-year period from 2015 to 2019, which comprised 4,555 total crashes. The study area encompasses the 12-mile corridor along the SR 512 mainline, ramps, 39 study intersections, and cross street segments between the intersections. During the 5-year analysis period an average of 911 crashes were observed per year.

Table 3-8 highlights the crash types by facility type for the 2015 to 2019 study period. As shown in this table, the most common crash types were rear-end and angle/sideswipe crashes. The rear-end crashes were primarily occurring on either the SR 512 mainline or at study intersections, while the majority of the angle crashes occurred at intersections.

Crash severities were also examined for all crashes within the study area. There was a total of eight fatal crashes and 49 serious injury crashes that occurred. The majority of the fatal crashes occurred on the SR 512 mainline (six), while the others were at study intersection locations. The serious injury crashes were divided amongst the facility types, with the majority occurring at study intersections. A breakdown of crashes by location, type, and time of day is available in Appendix G.

Table 3-8. Crash Type by Facility Type

Facility	Rear End	Sideswipe	Fixed Object	Angle/Sideswipe	Other	Total
Mainline	1,201	313	412	65	130	**2,121**
Ramp	177	60	137	20	95	**489**
Local/Cross	210	67	27	14	13	**331**
Intersection	724	102	68	658	62	**1,614**
Total	2,312	542	644	757	300	**4,555**

SR 512 Mainline Crashes

The SR 512 mainline crashes accounted for 2,121 of the 4,555 crashes (46.6 percent of the total study area crashes). Of the six fatal crashes that occurred on the mainline, five were in the eastbound direction and one in the westbound direction. Two thirds of the fatal crashes (four) occurred in 2017. The SR 512 mainline crashes were primarily crashes most often related to congestion (rear-end or same direction sideswipe) or single vehicle, fixed-object crashes.

Intersection Crashes

The 37 study intersections within the safety analysis area accounted for 1,614 crashes (35.4 percent of total crashes) during the 5-year analysis period. Two fatal and 17 serious injury crashes occurred. The primary crash types at intersections were rear-end and angle/sideswipe crashes, which are commonly associated with intersections due to the introduction of delay on roadway segments and the potential presence of visual cue challenges.

Local Roadway Crashes

The local roadway network represents the cross-street connections between the SR 512 mainline, ramps, and intersections within the study area network. These roadway segments accounted for 331 crashes (7.3 percent of total crashes). These crashes were primarily rear-end collisions (63.4 percent), likely due to congestion and/or access point density along the segments.

Ramp Crashes

Ramp facilities connect between the SR 512 mainline to intersections and local roadway network. The ramps account for 489 crashes (10.7 percent of total crashes) within the study period. Rear-end and fixed-object crashes were the most commonly occurring crash types on ramps through the study network, likely due to congestion and the geometry of the ramps.

Pedestrian and Bicycle Crashes

There were 25 pedestrian crashes and 6 bicycle crashes during the study period in the study area. The pedestrian crashes consisted of one fatal crash and three serious injury crashes. The fatal pedestrian crash occurred along SR 512 mainline, where pedestrians are prohibited. There were no fatal or serious injury bicycle crashes. Aside from the fatal pedestrian crash, the remainder of the pedestrian and bicycle crashes occurred at intersections or along local street segments. The majority of the pedestrian and bicycle crashes were at the intersections along SR 7. There were seven (six pedestrian, one bicycle) crashes at the SR 7 and 112th Street E intersection and five (four pedestrian, one bicycle) at the SR 7 and 108th Street E intersection.

Crash Clusters

The crash data was analyzed spatially to examine the overall frequency distribution of crashes by location throughout the study area. Figure 3-18 shows the heatmap of all crashes, while Figure 3-19 displays only the fatal and serious injury crashes. The color scales on both heatmaps represent the change in density of crashes from the sparse (green) to dense (red) crashes. The locations with higher crash density include three main junctions on the western end of the SR 512 corridor: South Tacoma Way/I-5, Steele Street, and SR 7, and the South Hill Mall area.

Figure 3-18. Crash Clusters for All Crashes

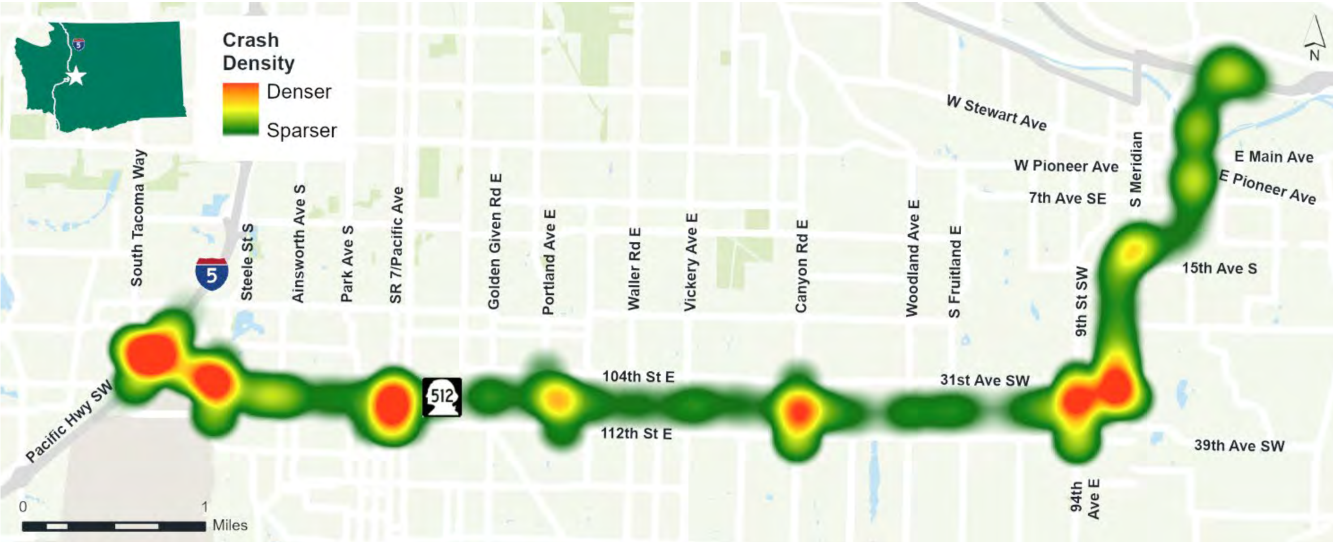
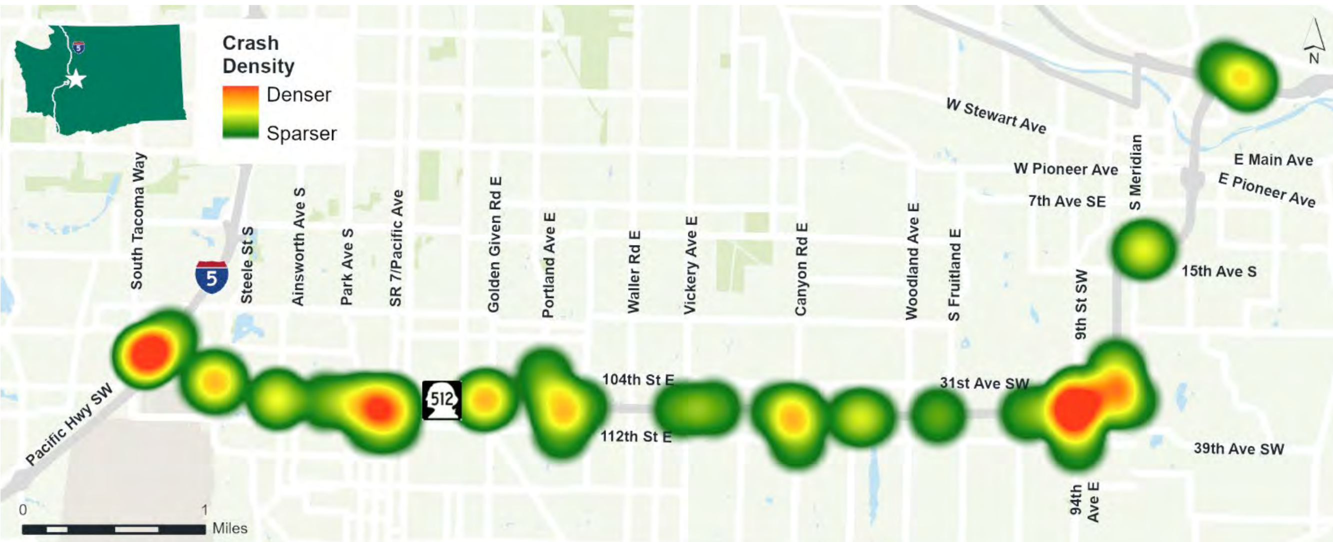


Figure 3-19. Crash Clusters for Fatal and Serious Injury Crashes



3.8 Future Baseline Travel Demand

Land use and socioeconomic data from the Puget Sound Regional Council's travel demand model was examined for 2050 to establish a travel demand basis for identifying quantitative gaps in transportation network performance. Peak-hour SR 512 vehicle miles traveled (VMT) are forecasted for the 2050 Baseline condition to be approximately 71,000 in the AM peak hour and 81,500 in the PM peak hour. Each of these represents an increase of less than 10% over estimated existing totals. The relatively limited growth indicates that the freeway operates at or near capacity during the peak hours today, so there is simply not much room for vehicle demand to grow on SR 512.

The study team also examined traffic volume per hour at interchange areas along the freeway. Table 3-9 and Table 3-10 show traffic volume for existing and 2050 Baseline conditions in both peak hours.

Traffic volume forecasts indicate an expectation that by 2050, traffic growth will be modest at most locations, and in a few cases, could even drop slightly as a result of increased congestion. This finding is consistent with the observation that only modest growth is forecast for overall SR 512 VMT.

Table 3-9. AM Existing and 2050 Peak Hour Traffic Volume on SR 512

Direction	Scenario	Steele	SR 7	Portland	Canyon	SHM*	Meridian
Westbound	Existing	3,700	3,118	3,199	2,257	2,271	2,319
Westbound	2050 Baseline	4,211	3,491	3,555	2,665	2,781	3,028
Eastbound	Existing	2,450	2,111	2,251	1,878	2,438	2,742
Eastbound	2050 Baseline	2,455	2,081	2,221	1,847	2,262	2,549

* South Hill Mall

Table 3-10. PM Existing and 2050 Peak Hour Traffic Volume on SR 512

Direction	Scenario	Steele	SR 7	Portland	Canyon	SHM*	Meridian
Westbound	Existing	31,08	2,489	2,713	2,405	2,888	3,652
Westbound	2050 Baseline	3,909	3,178	3,378	3,061	3,530	4,293
Eastbound	Existing	3,592	2,994	3,202	2,498	2,710	2,931
Eastbound	2050 Baseline	3,683	3,004	3,166	2,526	2,685	2,975

* South Hill Mall

3.9 Future Baseline Operating Conditions

The Baseline condition against which future scenarios are compared contains projects that are not yet complete but are either funded or have a reasonable expectation of being funded by 2050. These projects are shown in Figure 3-20 and listed in Table 3-11.

Figure 3-20. Planned and Programmed Projects

Table 3-11. Planned and Programmed Projects

Number	Project	Lead
1	SR 167 Gateway	WSDOT
2	I-5/SR 512 Interchange Replacement (I-5 HOV DDI Recommendation)	WSDOT
3	Southbound SR 512 Pioneer to Meridian Aux Lane	WSDOT
4	Southbound Single ETL lane between Ellingson and SR 410	WSDOT
5	ETL Direct Access Ramp to SR 167 ETL in Kent	WSDOT
6	ETL Direct Access Ramp to SR 167 ETL in Auburn	WSDOT
7	ETL Direct Access Ramp to SR 167 ETL in Sumner	WSDOT
8	BRT/Enhanced Transit on SR 167	WSDOT
9	Missing SR 18 Ramps + Aux Lane Capacity	WSDOT
10	Complete Valley Ave I/C with SR 167 Extension	WSDOT
11	Canyon Road Ext.	Partnerships
12	SR 7 Improvements	WSDOT
13	SR 161 Improvements	WSDOT

An auxiliary lane on westbound SR 512 is a Baseline need related to travel demand changes influenced by the SR 167 Completion Project. While the auxiliary lane is currently unapproved, unfunded and unprogrammed, analysis shows that its need and timing are integrally connected to the SR 167 Completion Project.

Future traffic forecasts were analyzed and the resulting operating conditions were simulated to determine the estimated future 2050 Baseline performance. Three measures were used to indicate the quality of future Baseline transportation operations in the study corridor using Vissim: travel time, delay, and intersection LOS. LOS information is provided in a slightly more aggregate form than was previously shown for Existing Conditions. Table 3-12 and Table 3-13 indicate Existing and 2050 Baseline scenario travel time on SR 512.

Table 3-12. AM Existing and 2050 Baseline Freeway Travel Time by Segment (minutes)

Direction	Scenario	Steele to SR 7	SR 7 to Portland	Portland to Canyon	Canyon to SHM	SHM* to Meridian	Meridian to Pioneer	Steele to Pioneer
Westbound	Existing	2.9	1.8	3.1	2.8	2.4	1.0	14.0
Westbound	2050 Baseline	1.9	1.7	4.0	4.8	2.8	1.0	16.1
Eastbound	Existing	1.8	1.7	2.7	2.7	4.2	1.7	14.8
Eastbound	2050 Baseline	1.8	1.7	5.9	10.5	11.0	3.3	34.2

* South Hill Mall

Table 3-13. PM Existing and 2050 Baseline Freeway Travel Time by Segment (minutes)

Direction	Scenario	Steele to SR 7	SR 7 to Portland	Portland to Canyon	Canyon to SHM	SHM* to Meridian	Meridian to Pioneer	Steele to Pioneer
Westbound	Existing	1.8	1.7	2.7	4.0	2.5	1.6	14.3
Westbound	2050 Baseline	1.8	1.7	2.7	2.8	2.6	2.3	13.9
Eastbound	Existing	2.6	2.0	2.8	2.7	2.3	1.0	13.3
Eastbound	2050 Baseline	14.0	9.3	12.1	8.7	7.0	1.7	52.7

* South Hill Mall

Travel time information indicates that existing bottlenecks are likely to worsen by 2050 if no changes are made in the SR 512 corridor. In some cases, these bottlenecks can have a metering effect, whereby lower speeds and congestion-impacted volumes result in better performance downstream of the bottleneck. An example of this effect is westbound in the morning peak between Steele Street E and Portland Avenue E, and this could be due to mid-corridor increases in congestion, particularly in the Canyon to South Hill Mall segment. Here the 2050 Baseline travel time is forecasted to be lower than the existing condition. In the Eastbound direction travel times could grow in most segments in both peak hours, with the full Steele to Pioneer travel time approximately quadrupling from the Existing condition to the 2050 Baseline.

Peak hour LOS is summarized here for all 37 intersections by interchange area for easier identification of performance gaps. The measure of effectiveness for this comparison and subsequent analysis is the number of intersections that operate at LOS D or better. Table 3-14 and Table 3-15 show Existing and 2050 Baseline intersection LOS by interchange area.

Aggregated intersection LOS results for the PM peak hour are equal to or worse than for the AM peak hour at all six interchange areas examined for this study. The most opportunity to close performance gaps was identified at the SR 7, Canyon Road E, and South Hill Mall interchange areas, where half or fewer of the intersections were shown to meet the general peak hour LOS D standard.

One important finding regarding Baseline conditions is that the SR 512 operations analysis suggests the Diverging Diamond Interchange (DDI) recommended for the I-5/SR 512 interchange in previous study work, and assumed for this planning study, could have difficulty accommodating projected traffic volumes. The version tested here, and included in all future scenarios, was only configured for this SR 512 corridor study; more detailed supplemental analysis is needed to confirm whether a DDI is the appropriate configuration for the I-5/SR 512 interchange.

Table 3-14. AM Existing and 2050 Baseline LOS: % of Intersections at LOS D or Better

Scenario	Steele	SR 7	Portland	Canyon	SHM*	Meridian	Corridor-Wide
Existing	100%	67%	100%	80%	80%	100%	85%
2050 Baseline	80%	83%	100%	80%	70%	67%	79%

* South Hill Mall

Table 3-15. PM Existing and 2050 Baseline LOS: % of Intersections at LOS D or Better

Scenario	Steele	SR 7	Portland	Canyon	SHM*	Meridian	Corridor-Wide
Existing	80%	50%	75%	60%	30%	100%	58%
2050 Baseline	80%	50%	100%	40%	40%	67%	58%

* South Hill Mall

Chapter 4 Strategy Development and Evaluation

4.1 Strategy Development

Initial strategies were developed from three sources that yielded valuable information regarding performance gaps in the study area, including a review of existing plans, input from the community engagement process, stakeholder input, the consultant team, and information from the existing and future Baseline analysis conducted for this project. Only strategies that would clearly address performance gaps were considered. The focus was on Practical Solutions to address near-term and mid-term needs and on detailed analysis results for long-term needs.

Some strategies span the entire 12-mile corridor, while others address a more localized or sub-corridor need. The strategies were organized into five types, although several have elements that could make them multiple strategy types. Strategies were also organized by geography and numbered from west to east, with the first nine in this numerical sequence identified as corridor-wide (C) and the remaining 33 as location-specific (L). The maps in the Executive Summary section of this report identify the locations of these strategies along with implementation recommendations that are described later.

4.1.1 Transportation System Management and Operations

Transportation System Management and Operations (TSMO) strategies best represent the WSDOT Practical Solutions goal of “doing the most with the infrastructure we already have.” Strategies in this group use minimal new capital investment through simple efforts that upgrade communications, smooth traffic flow, and address lower-level spot needs.

C-1. Corridor-wide fiber optic connectivity for freeway management/information

C-2. Metering of selected on-ramps

C-3. Ramp merge/diverge upgrades

C-4. Median access turnaround(s) for incident management and enforcement

C-5. SR 512 peak-use shoulder lane

L-14. SR 7, SR 512 to 96th Street: Add sidewalks and upgrade intersections

L-39. 5th Street SE Corridor: Signal improvements and lane arrangement changes

4.1.2 Active Transportation and Crossings

For active transportation users to access local destinations and/or transit, this type of strategy seeks to address infrastructure shortcomings, such as a lack of crossings on SR 512. Crossing infrastructure investments in particular must be considered in the context of larger-scale programs or projects into which they could be packaged for funding and implementation. WSDOT’s Active Transportation Plan has as one of its purposes “to identify gaps in the pedestrian and bicycle network, where a gap is defined as either a physical barrier, or a highway segment that provides for a pedestrian or bicycle Level of Traffic Stress (LTS) 3 or 4….” Identification of such gaps supported by safety performance analysis during project development could lead to more detailed prioritization during implementation planning.

C-6. Sidewalk improvements at existing SR 512 crossings

L-12. Steele Street S, Spanaway Loop Road S to Sales Road S: Add sidewalks

L-17. Portland Avenue E, SR 512 to 72nd Street E: Add sidewalks

L-18. Portland Avenue E, 112th Street E to SR 512: Add sidewalks and intersection lanes

L-20. New crossing of SR 512 at 46th Avenue E

L-23. New crossing of SR 512 at 59th Avenue E

L-24. Woodland Avenue E, SR 512 to 160th Street E: Add center turn lane, active transportation facilities

L-25. New crossing of SR 512 at 20th Street SW

L-26. Pipeline Trail, 72nd to South Hill Area

L-27. 86th Avenue E, SR 512 to 176th Street E: Add center turn lane, active transportation facilities

L-28. 94th Avenue E, 39th Avenue SW to the north (TBD): Bike lane

L-33. New crossing of SR 512 at 23rd Avenue SE

L-37. E Pioneer, SR 512 to the west (TBD): Bike boulevard

L-40. Tacoma to Puyallup regional trail along SR 167 extension corridor

L-42. Extend Parkland Community Trail under SR 512

Strategy C-6, a corridor-wide strategy, is intended to capture and represent sidewalk improvement needs at locations not already identified with a location-specific strategy that will also improve or add sidewalks. Locations called out specifically were identified early in the strategy development process as those that would serve areas with more concentrated active transportation use, such as schools, trails, and recreation-oriented areas.

4.1.3 Managed Lanes

A managed lane is one that uses vehicle restrictions and/or pricing to limit access with the specific goal of providing a more reliable travel speed than general purpose lanes. With managed lanes planned on I-5 and SR 167, this strategy type addresses how to fill the gap for longer trips in the study corridor and provide a managed-capacity alternative for travelers with destinations within the study area.

C-7. New Managed (high-occupancy vehicle [HOV]/express toll lane [ETL]) lanes on SR 512

L-11. Managed lane direct connection to future I-5 HOV lanes

L-21. Service connection: Mid-corridor direct access point(s) to/from Managed Lane(s)

L-41. Managed lane direct-connect ramps from future SR 167 managed lanes to SR 512

4.1.4 Transit

Transit strategies generally focus on regional transit services and access to them. Multiple bus rapid transit (BRT) routes are planned by Pierce Transit across and near SR 512. These potential future routes would benefit from strategies that improve their performance. While no transit routes currently exist or are planned to operate on the freeway itself, transit providers could reconsider if other strategies such as managed lanes improve potential SR 512 reliability and/or changes in land use and travel patterns increase travel demand along the corridor.

C-8. SR 512 Bus-on-Shoulder program if route(s) moved to SR 512

C-9: Transit access improvements for north-south bus routes

L-10. BRT: Downtown Tacoma to Lakewood Transit Center (TC) via S Tacoma Way

L-30. BRT: Pierce County Airport to South Hill TC and downtown Puyallup via SR 161/Meridian Avenue

L-31. BRT: Lakewood to South Hill TC via 112th Street E

4.1.5 Strategic Bottleneck Focus

Location-specific strategies that are capital-intensive were developed to address key vehicle traffic bottlenecks, many of which relate to interchanges and merge areas.

L-13. Interchange at Steele Street: Widen overpass and modify ramps

L-15. Interchange at SR 7/Pacific Avenue S: Widen overpass and modify ramps

L-16. Auxiliary lanes from SR 7 to Portland Avenue E (both directions)

L-19. Interchange at Portland Avenue E: Widen overpass and modify ramps

L-22. Interchange at Canyon Road E: Widen overpass and modify ramps

L-29. Interchange at 94th Avenue E: Widen overpass and modify ramps

L-32. Interchange at 31st Avenue SW: Widen overpass and modify ramps

L-34. Auxiliary lanes from 31st Avenue SW to S Meridian (both directions)

L-35. Interchange at S Meridian: Widen overpass and modify ramps

L-36. Auxiliary lane from S Meridian to E Pioneer (eastbound only)

L-38. Interchange at E Pioneer: Widen overpass and modify ramps

4.2 Evaluation Process and Criteria

The evaluation process that was developed identifies the most promising strategies for near-term implementation and groups others that could require longer project development processes or have more prominent implementation barriers into mid- and long-term categories. Travel demand modeling scenarios test the strategies most likely to affect transportation network performance by adding capacity either at the street level or along the SR 512 freeway. Two such modeling scenarios were developed for comparison to the Baseline condition. The 2050 Strategic Bottleneck scenario focuses improvements on the interchanges and does not include any full-length improvements along the SR 512 corridor. The 2050 Managed Lane scenario adds capacity to all of SR 512, with northbound--to--eastbound and westbound-to-southbound direct freeway connector ramps at each end (I-5 and SR 167). This study assumed the managed lanes allow vehicles continuous access along the duration of the SR 512 corridor.

The study team reviewed evaluation criteria with the SAG. Each strategy was evaluated for each criterion to the degree it could provide an improvement over projected future conditions if none of these strategies were implemented (Baseline conditions). Evaluation criteria are described in the following subsections. They are treated equally.

4.2.1 Multimodal Mobility and Connectivity

Those using active transportation modes and transit were identified as experiencing a performance gap. Mobility for non-single occupant drivers depends on a robust and connected network of facilities designed and intended for their use. It applies to facilities for both general and recreational use. The analysis of pedestrian and bicycle LTS described in the previous chapter was a prominent factor in the application of this criterion.

4.2.2 Safety

Safety performance for all modes and facility types can be improved where crash data revealed clusters of crashes and/or relatively high frequency of severe crashes during the study period. Strategies that would improve safety performance or address congestion that leads to crashes would be expected to perform well according to this criterion.

4.2.3 Equity

Those transportation system users who are disproportionately disadvantaged depend more on alternative modes than the general population because they are less likely to have access to a personal vehicle for their travel needs. To that end, strategies that provide more and/or better alternative mode services and improve access to them perform well in terms of equity. This development of this criterion was driven in part by the passage of the HEAL Act in 2021. In its brief on the Act, WSDOT indicates that the Department “has a compelling interest in preventing and addressing environmental effects and health disparities in the state of Washington and ensure all residents have the opportunity to reach their full health and life potential by partnering meaningfully with communities, administering programs to remedy the effects of past disparate treatment of overburdened communities and vulnerable populations, and embed equity and inclusion in mission, planning, goals and measures of progress.”

4.2.4 Economic Vitality

Individual movement is one measure of economic activity, and, conversely, the more delay the transportation system imposes on its users, the less productive they are. Economic vitality accounts for the overall movement of people in the SR 512 study area and the degree to which they are delayed when they travel. Greater use of regional facilities for regional trips and more intersections operating at LOS D or better are two signs of the better utility enabled by a strategy that would perform well with regard to economic vitality.

4.2.5 Resiliency

A resilient transportation system is able to provide more efficient and consistent mobility for the majority of its users. When parts of the system do not function well, it becomes difficult for the system to handle abnormal spikes in delay that might arise due to crashes, recurring congestion, or unforeseen events. Strategies that improve system resiliency are those that increase capacity through potential chokepoints and can function as alternate routes when needed.

4.2.6 Freight and Goods Movement

Although the movement of freight and goods is related to economic vitality, it is considered separately here for its importance to specific locations and routes in the SR 512 study area. Road segments and areas that already carry a higher proportion of truck traffic can benefit from strategies that reduce congestion and improve freight mobility.

4.2.7 Environment

Prior to strategy identification, a high-level review of environmental constraints within the project corridor was conducted through a desktop review of existing information regarding fish and wildlife habitat, critical areas, water resources, wetlands, and cultural resources. WSDOT also documented an overview of the relevant permits and approvals that would likely be required if the resources noted were to be impacted by a proposed strategy. While this high-level information did not drive the definition of strategies at this planning level, more detailed environmental analysis is likely to be required as implementation work continues.

Most attention on the environment in planning studies focuses on the negative effects that increases in built-area footprint can cause, and that type of approach was considered early in this study. However, focusing on impacts would make this criterion unique because the attention would be on what a strategy does not do rather than on what it does. Instead, the Environment criterion considers primarily the general benefits to air quality and energy use associated with less congestion and more efficient travel. Strategies were not tested for direct quantifiable environmental effects. In particular, transit and active transportation strategies were assumed to have a negligible benefit to the environment in the context of this planning study, given the current and projected heavily suburban character of the SR 512 study corridor.

4.2.8 Reliability

The travel reliability criterion was developed to account for strategies that allow the system to handle incidents such as enforcement activity and broken-down vehicles and those that address spot congestion issues that inhibit travel time consistency on a day-to-day basis, for any mode.

4.2.9 Practical Solutions/State of Good Repair

The practical solutions concept extends beyond an overarching approach to address corridor needs. Maximizing the use of existing infrastructure and using technology to extend its life are parts of strategies that perform well when measured by this criterion.

4.2.10 Implementation and Partnerships

The final criterion for evaluation was developed to differentiate strategies by their potential for implementation and the degree to which partnerships with other agencies would be involved. These partnerships are defined as WSDOT and at least one other public agency working together to implement a strategy or package of strategies. Either could lead the implementation effort, and all parties would be obligated to bring sound planning, funding, and project development expertise to bear.

4.3 Evaluation Results

Some criteria used to evaluate strategies were applied qualitatively while others rely on quantitative analysis. Quantitative results are shown here first.

4.3.1 Future Travel Demand

Travel demand represents the volume of traffic indicated by the travel demand model. While there is some congestion in both directions at both peak hours, peak direction travel is the focus of the comparisons between strategies. These are westbound in the AM peak hour and eastbound in the PM peak hour. Peak direction SR 512 freeway demand at six key interchange locations for the AM and PM peak hours are shown in Figure 4-1 and Figure 4-2.

Figure 4-1. Westbound AM Peak Hour Demand

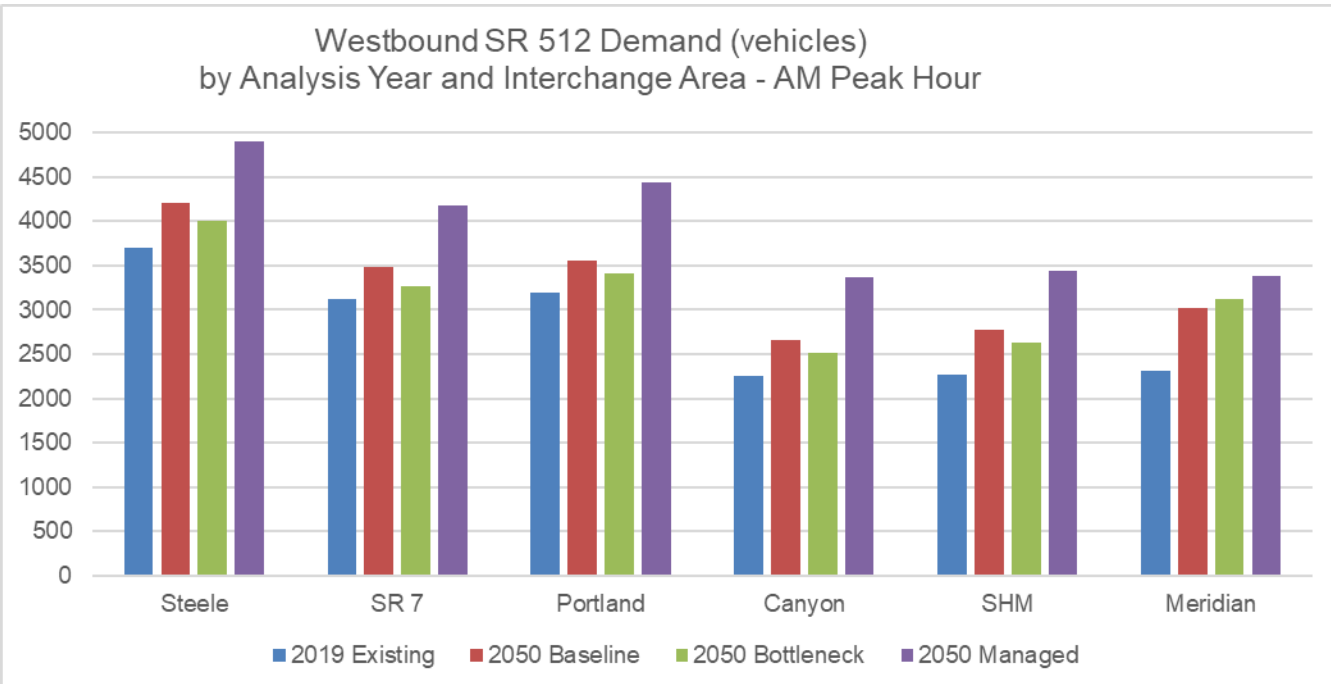
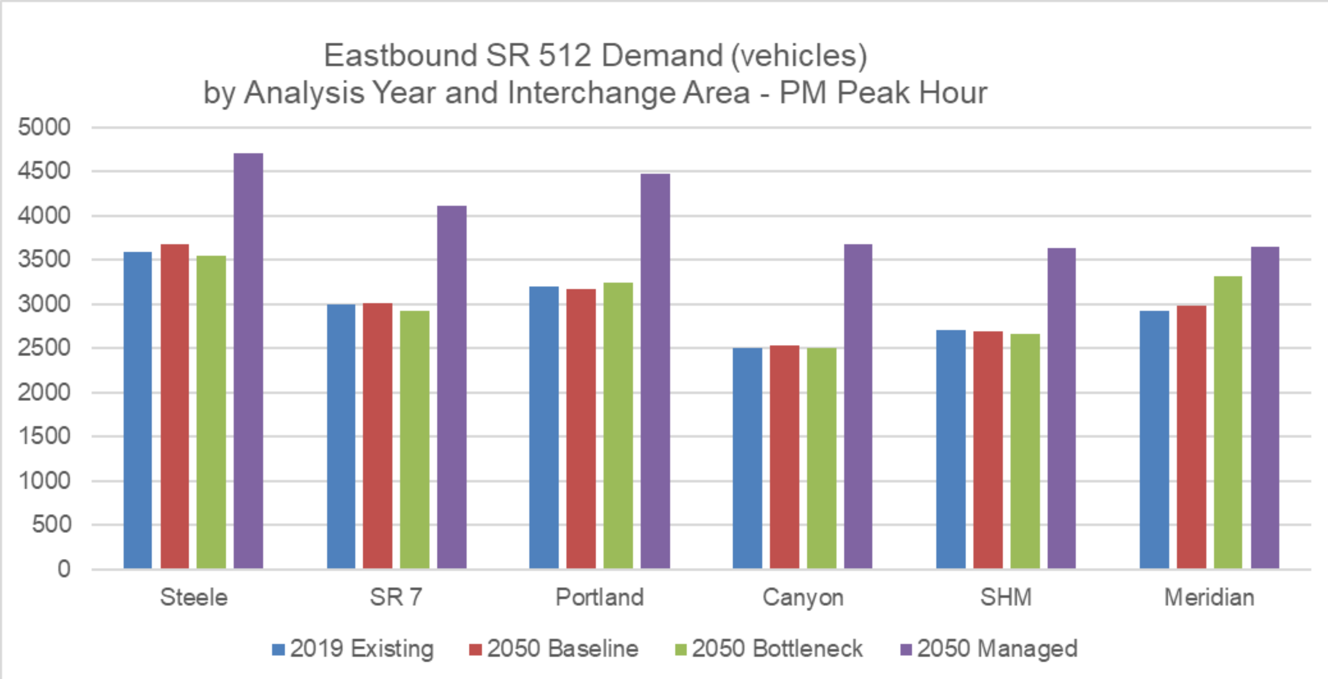


Figure 4-2. Eastbound PM Peak Hour Demand



4.3.2 Future Operating Conditions

Freeway

During the AM and PM peak hours, SR 512 shows the worst performance in the 2050 Baseline scenario. The 2050 Bottleneck scenario's arterial-focused improvements tend to show demand shift from the SR 512 corridor to utilize the improved arterials.

In the existing condition, congestion on eastbound SR 167 is known to result in queues that affect SR 512 eastbound traffic. This congestion occurs outside of the study modeling limits but it was accounted for in both the 2019 Existing and 2050 Baseline scenarios. It was assumed this congestion would be relieved as a part of both the 2050 scenarios analyzed for operations: 2050 Strategic Bottleneck Focus and 2050 Managed Lanes.

Peak Direction Delay

Even though I-5 and SR 167 were not the focus of this study, the peak period congestion occurring on these facilities has a direct impact on the SR 512 corridor. Parts of these facilities were included in the operations model and analyzed to understand the effects of these facilities just beyond the edges of the SR 512 corridor study area. To help describe the impacts associated with I-5 and SR 167, Figure 4-3 and Figure 4-4 show how the overall delays associated with the corridor compare in the peak direction scenarios.

Figure 4-3. Westbound AM Peak Hour Delay

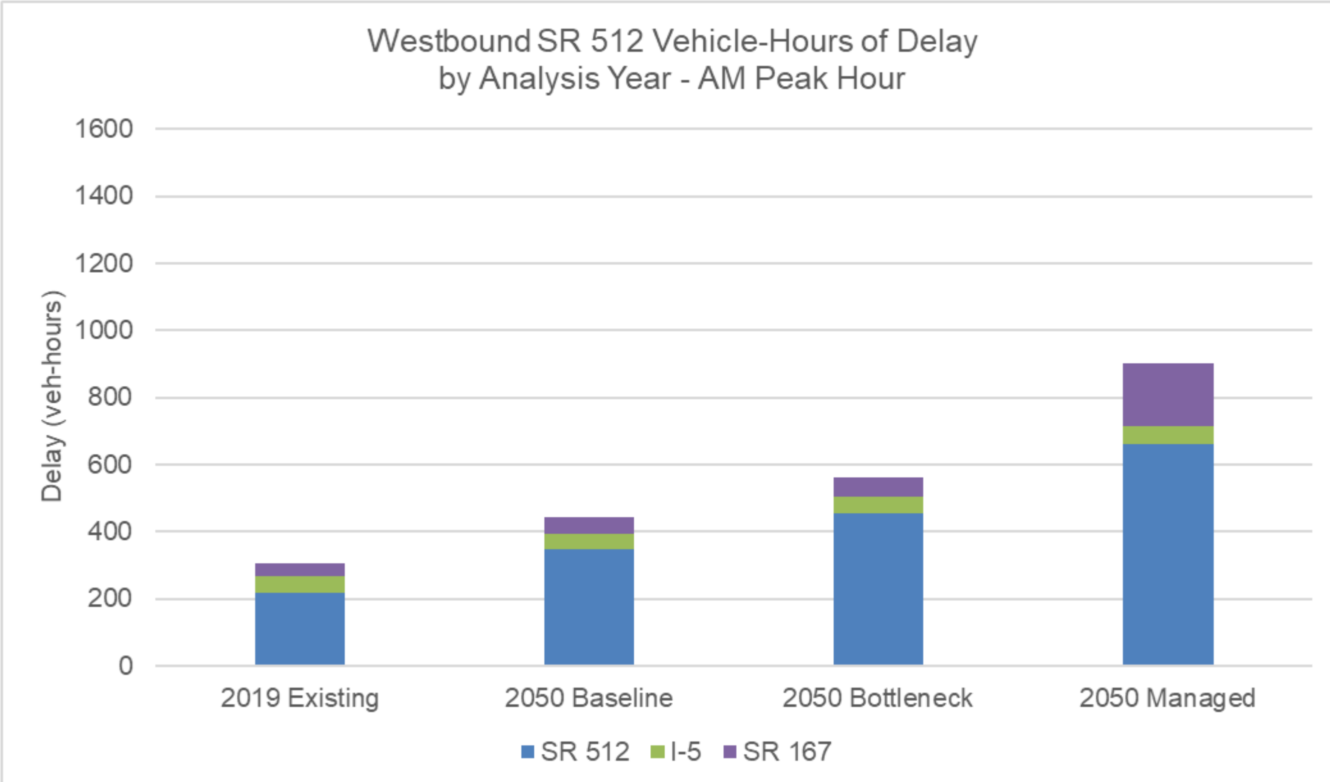
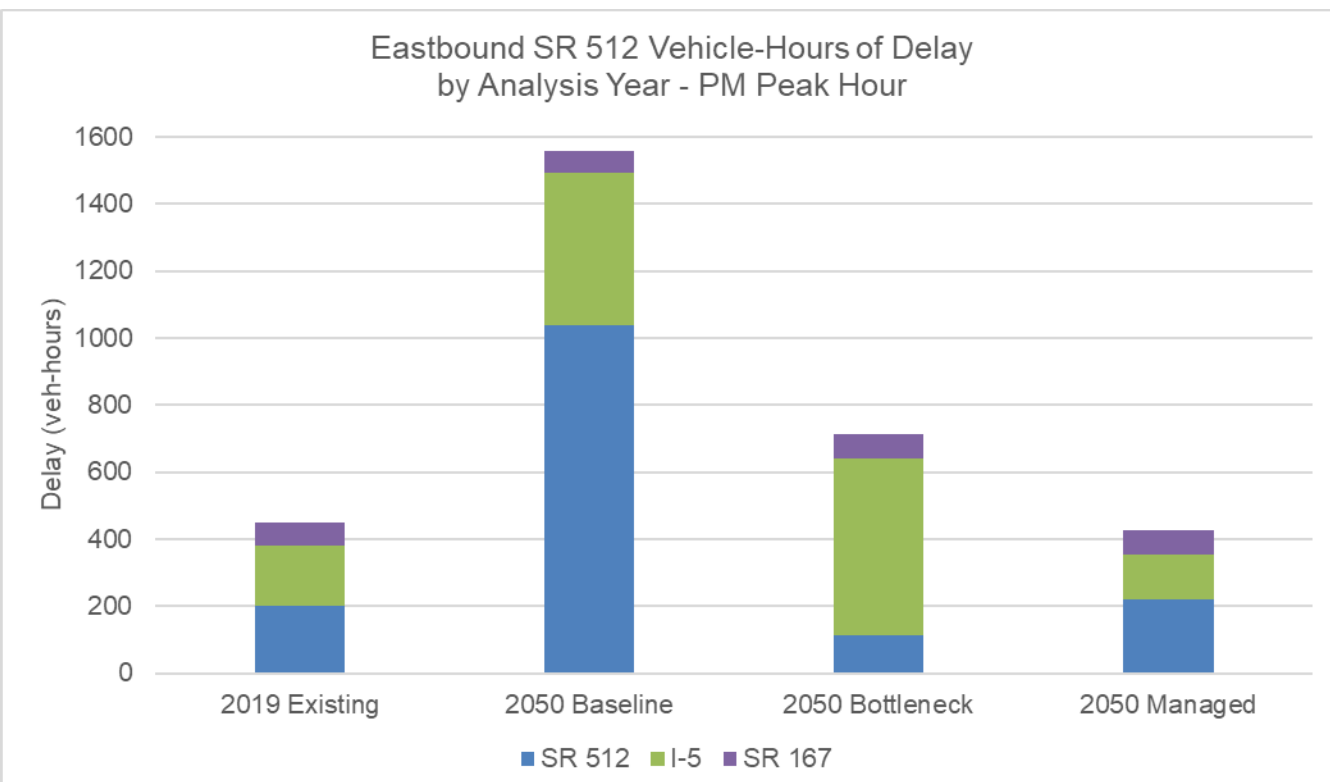


Figure 4-4. Eastbound PM Peak Hour Delay



The aggregate delay information produced from the operations analysis indicated considerable improvement in SR 512 operations in the peak traffic directions (generally westbound in the morning and eastbound in the afternoon) and the effects of I-5 and SR 167 on SR 512.

Peak Direction Travel Time

Travel Times are presented in Figure 4-5 through Figure 4-6. Travel times are summarized between interchange locations as follows: Steele Street to SR 7, SR 7 to Portland Avenue, Portland Avenue to Canyon Road, Canyon Road to South Hill Mall (94th Avenue and 31st Street), South Hill Mall to S Meridian, and S Meridian to E Pioneer. The 2050 Strategic Bottleneck Focus scenario had no improvements along the SR 512 corridor. As such, the travel times associated with this scenario result in similar results when compared to 2019 Existing and 2050 Baseline in the westbound direction. As mentioned previously, known congestion on SR 167 eastbound has queues affecting the SR 512 corridor in the eastbound direction and this results in increased travel time in the 2050 Baseline Scenario. The 2050 Managed Lane scenario resulted in lower overall travel times even though the demand and throughput increased along the corridor. The dedicated lane operates under capacity, allowing traffic in it to travel faster.

Figure 4-5. Westbound AM Peak Hour Travel Time

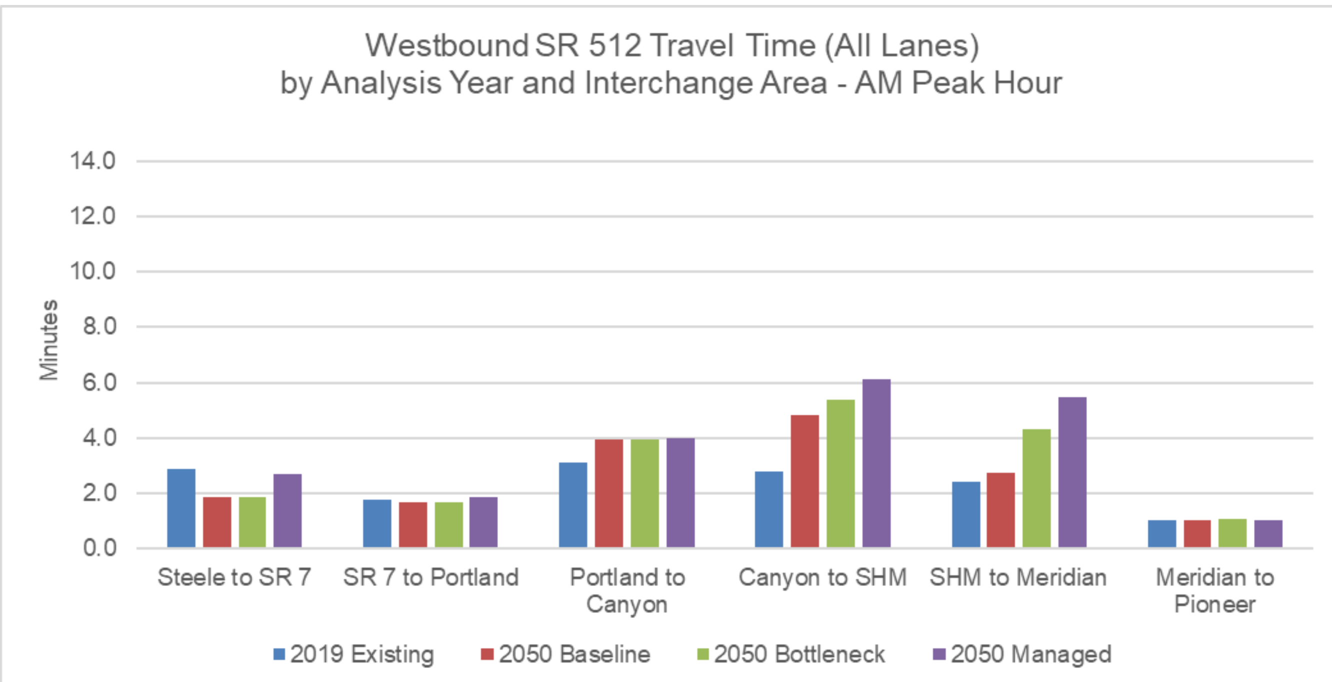
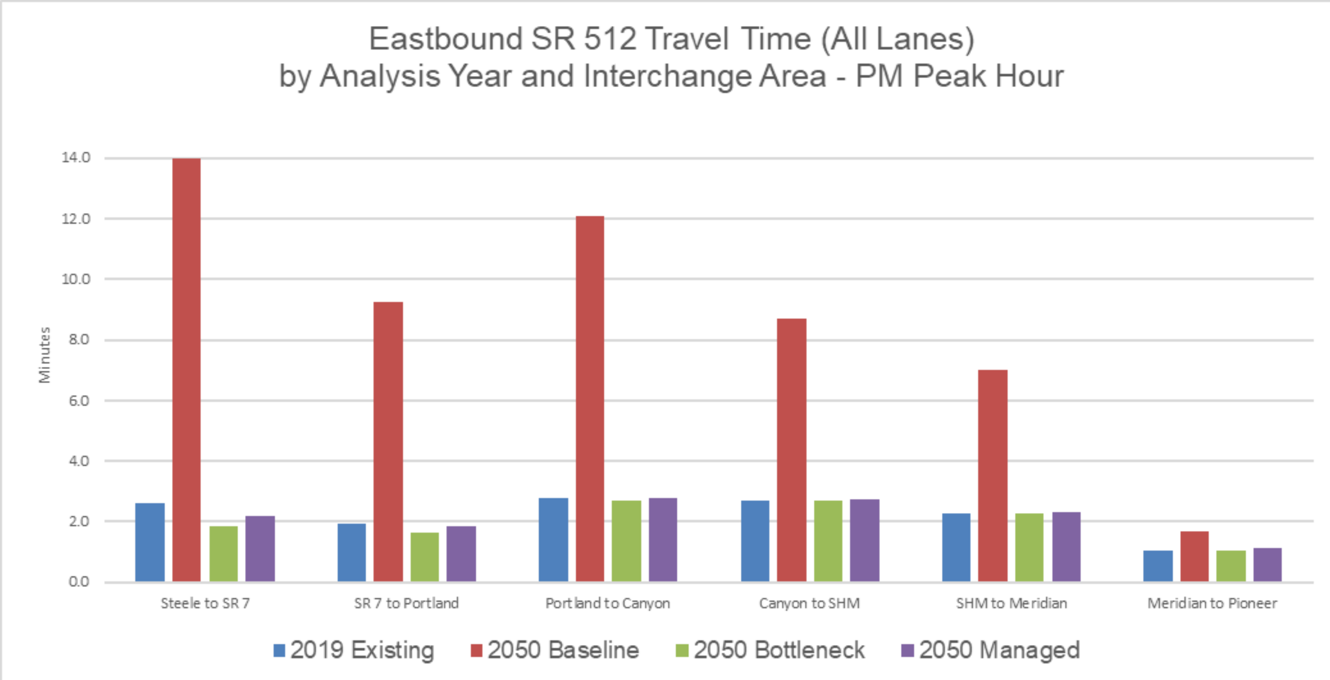


Figure 4-6. Eastbound PM Peak Hour Travel Time



Intersection Level of Service and Queuing

LOS at study area intersections for the AM and PM peak hours are shown in Figure 4-7 and Figure 4-8. The results are summarized in a bar chart that shows the performance as a percentage of intersections meeting the WSDOT LOS performance threshold (LOS D or better). There are four bars of different colors to compare 2019 Existing, 2050 Baseline, 2050 Bottleneck, and 2050 Managed scenario results.

The 95th percentile queuing results at ramp-terminal interchanges were analyzed for the AM and PM peak hours. The queuing metric is the percentage of queues along SR 512 ramp terminals that do not spill back to the mainline during the AM and PM peak hours. The results show queueing impacts to the mainline at ramp terminals in existing conditions, specifically more prominent in the PM peak hour. The results show minimal queueing impacts to the mainline at ramp terminals in future year scenarios due to optimized signal cycles and splits, the SR 167 extension project already implemented, and increased capacity along arterials.

Figure 4-7. Percent of Intersections Meeting LOS Performance Thresholds – AM Peak

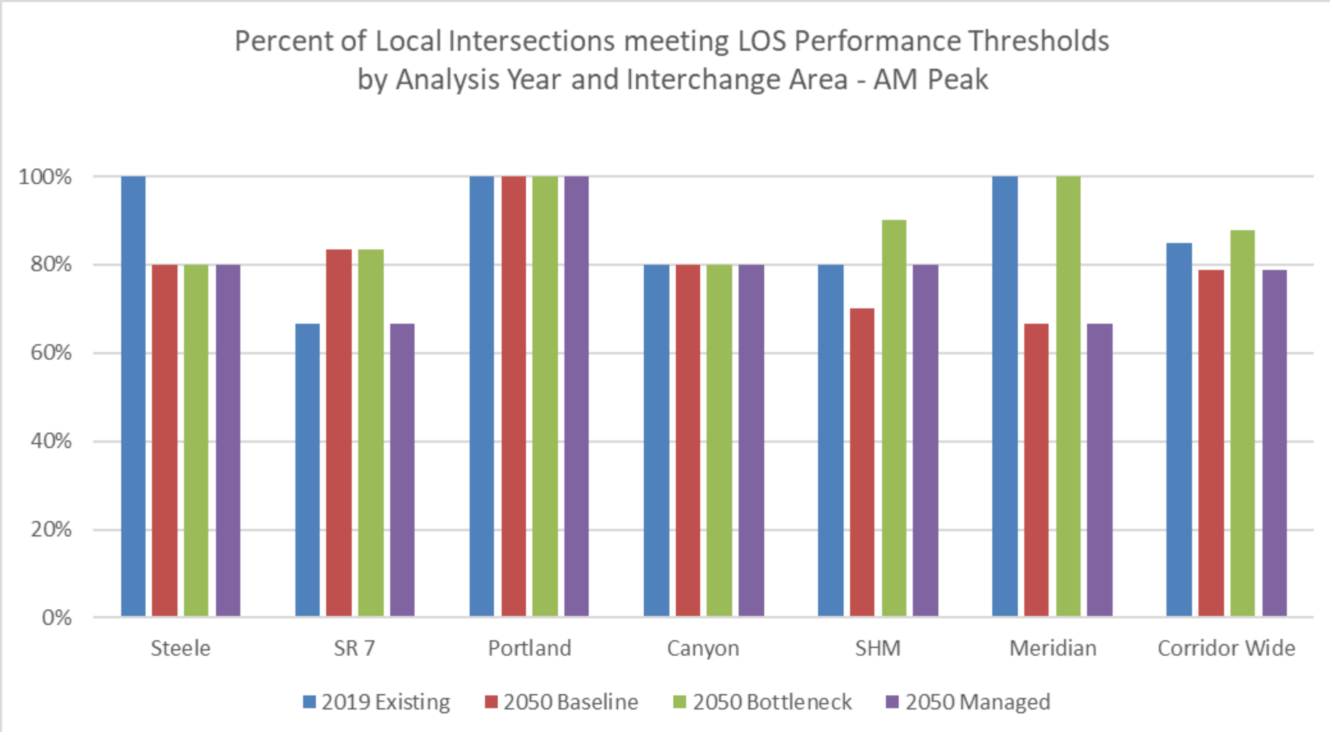
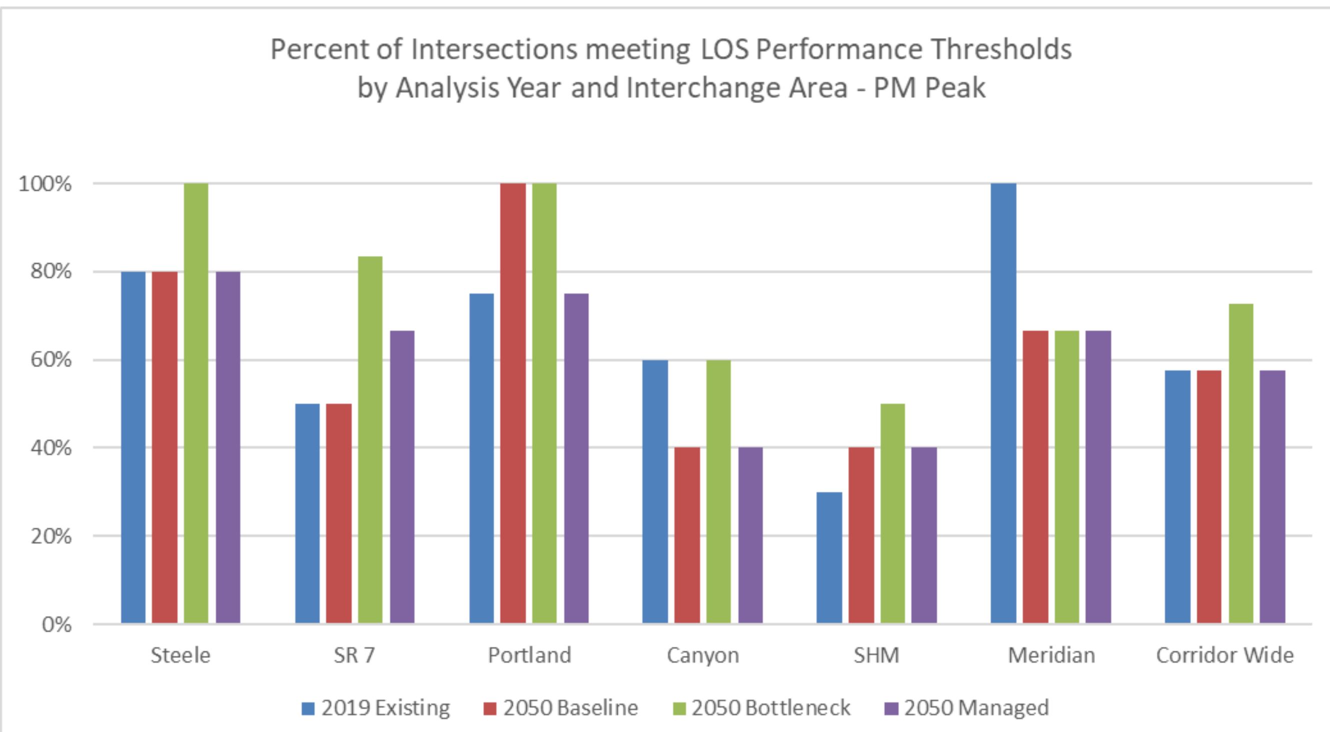


Figure 4-8. Percent of Intersections Meeting LOS Performance Thresholds – PM Peak



Peak hour intersection analysis indicates that three interchange areas exhibit more operational challenges than others. The SR 7, Canyon Road, and South Hill Mall areas showed fewer intersections meeting the LOS standard, even after planning-level improvements in the 2050 Strategic Bottleneck Focus scenario are accounted for. The 2050 Managed Lanes scenario does not include interchange improvements, so there are fewer intersections meeting the LOS standard than with the 2050 Bottleneck Focus scenario, and the the same as in the 2050 Baseline scenario, corridor-wide.

4.3.3 Strategy Performance

The evaluation of strategies for each criterion resulted in one of three performance scores, relative to the Baseline condition. The strategy was indicated to have either (N) no effect or a negligible one, (P) a partial or more localized benefit, or (B) a bigger and/or broader benefit. These scores are listed in Table 4-1.

Table 4-1. Strategy Evaluation Scores

Performance relative to Baseline condition: **N** *= No/negligible benefit;* **P** *= partial or limited benefit;* **B** *= bigger benefit*

Category	Strategy	Multimodal mobility and connectivity	Safety performance	Equity	Economic vitality	Resiliency	Freight and goods movement	Environment	Reliability	Practical Solutions/ state of good repair	Implementation and Partnerships
TSMO	C-1. Corridor-wide fiber optic connectivity: improve freeway management and driver information	N	P	N	P	B	P	N	P	B	N
TSMO	C-2. Metering of selected on-ramps	N	P	N	P	B	N	N	P	P	N
TSMO	C-3. Ramp merge/diverge upgrades: lengthen to modern standards	N	B	N	P	N	N	N	P	B	N
TSMO	C-4. Median access/turnaround(s): enforcement & incident response	N	P	N	N	B	N	N	P	P	N
TSMO	C-5. SR 512 Peak Use Shoulder Lane	N	N	N	P	P	P	N	P	P	N
TSMO	L-14. SR 7, SR 512 to 96th St minor intersection channelization/widening	B	P	P	P	P	N	N	P	P	N
TSMO	L-39. Puyallup 5th St SE corridor operations improvements	N	N	N	N	P	N	N	P	N	B
Active/Crossings	C-6. Sidewalk improvements at existing SR 512 crossings	B	B	B	N	N	N	N	N	P	B
Active/Crossings	L-12. 116th /Steele - Spanaway Loop to Sales: curb, gutter, sidewalk	B	P	P	N	N	N	N	N	N	P
Active/Crossings	L-17. Portland Ave E - SR 512 to 72nd: curb, gutter, sidewalk	B	P	P	N	N	N	N	N	N	P
Active/Crossings	L-18. Portland Ave E - 112th St E to SR 512: sidewalks, turn lanes, capacity	P	P	P	P	P	N	N	N	N	P
Active/Crossings	L-20. New crossing of SR 512 at 46th Ave E	B	P	B	P	P	P	N	P	N	P
Active/Crossings	L-23. New crossing of SR 512 at 59th Ave E	B	P	B	P	P	P	N	P	N	P
Active/Crossings	L-24. Woodland Ave E - SR 512 to 160th St E: center turn lane, active transportation upgrades, access management	B	P	P	N	N	N	N	N	N	B
Active/Crossings	L-25. New crossing of SR 512 at 20th St SW	B	P	B	P	P	P	N	P	N	P
Active/Crossings	L-26. Pipeline Trail - 72nd to South Hill area	B	P	P	N	N	N	N	N	N	B
Active/Crossings	L-27. 86th Ave E - SR 512 to 176th St E: turn lanes and active transportation facilities	B	P	P	N	P	N	N	N	N	B
Active/Crossings	L-28. 94th Ave E - 39th Ave SW and north: bike lane	B	P	P	N	N	N	N	N	N	B
Active/Crossings	L-33. New crossing of SR 512 at 23rd Ave SE	B	P	B	P	P	P	N	P	N	P
Active/Crossings	L-37. E Pioneer - SR 512 interchange and to the west: bike lane	B	P	N	N	N	N	N	N	N	B
Active/Crossings	L-40. Tacoma to Puyallup Regional Trail	B	P	P	N	N	N	N	N	N	B
Active/Crossings	L-42. Extend Parkland Community Trail under SR 512	B	P	P	N	N	N	N	N	P	B

Category	Strategy	Multimodal mobility and connectivity	Safety performance	Equity	Economic vitality	Resiliency	Freight and goods movement	Environment	Reliability	Practical Solutions/ state of good repair	Implementation and Partnerships
Managed Lanes	C-7. Managed Lane (HOV/ETL) in each direction on SR 512	P	P	N	P	B	P	P	B	N	N
Managed Lanes	L-11. Managed Lane direct connection to future I-5 HOV lanes	P	B	N	P	B	P	P	B	N	N
Managed Lanes	L-21. Service connection: mid-corridor direct access to/from Managed Lane	P	P	P	B	B	P	N	B	N	B
Managed Lanes	L-41. Managed Lane direct connection ramps from SR 167 to SR 512	P	P	N	B	B	P	P	B	N	N
Transit	C-8. SR 512 Bus on Shoulder program	P	N	N	N	N	N	N	N	P	N
Transit	C-9. Transit access improvements for north-south bus routes	B	P	B	N	N	N	N	N	P	P
Transit	L-10. BRT: Downtown Tacoma to Lakewood TC via S Tacoma Way	P	N	P	N	N	N	N	N	N	P
Transit	L-30. BRT: Pierce County Airport to South Hill TC and downtown Puyallup via SR 161/Meridian Avenue	B	N	B	N	N	N	N	N	P	P
Transit	L-31. BRT: Lakewood to South Hill Mall TC via 112th Street E	B	N	B	N	N	N	N	N	P	P
Strategic Bottleneck	L-13. Interchange at Steele St: Widen overpass, modify ramps	N	P	N	P	P	P	P	P	N	N
Strategic Bottleneck	L-15: Interchange at SR 7/Pacific Ave S: Widen overpass, modify ramps	B	B	N	B	B	P	P	P	N	N
Strategic Bottleneck	L-16. Auxiliary lanes from SR 7 to Portland Ave E (both directions)	N	B	N	P	P	B	P	B	P	N
Strategic Bottleneck	L-19: Interchange at Portland Ave S: Widen overpass, modify ramps	N	N	N	N	N	P	P	N	N	N
Strategic Bottleneck	L-22. Interchange at Canyon Rd E: Widen overpass, modify ramps	N	P	N	B	B	B	P	P	N	N
Strategic Bottleneck	L-29. Interchange at 94th Ave E: Widen overpass, modify ramps	N	B	N	P	P	P	P	P	N	N
Strategic Bottleneck	L-32. Interchange at 31st Ave SW: Widen overpass, modify ramps	N	P	N	B	B	P	P	P	N	N
Strategic Bottleneck	L-34. Auxiliary lanes from 31st Ave SW to S Meridian (both directions)	N	B	N	P	P	B	P	B	P	N
Strategic Bottleneck	L-35. Interchange at S Meridian: Widen overpass, modify ramps	P	P	N	P	P	N	P	P	N	N
Strategic Bottleneck	L-36. Auxiliary lane from S Meridian to E Pioneer (eastbound)	N	B	N	P	P	B	P	B	P	N
Strategic Bottleneck	L-38. Interchange at E Pioneer: Widen overpass, modify ramps	N	N	N	P	P	P	P	N	N	N

Transportation System Management and Operations

TSMO strategies feature partial-benefit performance ratings for reliability. Strategy L-14 to address the northern part of the SR 7 interchange area was estimated to perform the best of these strategies in terms of multiple criteria due to the need for upgrades to support the SR 7 BRT project. While the corridor-wide strategies to make spot improvements have not been studied in enough detail to call out specific locations, they are expected to provide substantial benefit, especially in terms of resiliency. Ramp merge and diverge area upgrades are important for their benefits to safety and represent an efficient way to solve a problem with a targeted efficient investment. Strategy L-29 to improve 5th St SE operations is expected to be implemented under City of Puyallup leadership and have only partial benefits to SR 512.

Active Transportation and Crossings

Most of the specific benefits of strategies in the Active Transportation and Crossings category accrue in the multimodal mobility, safety, and equity criteria. New crossings would also be particularly effective at improving reliability and resiliency by providing more alternate routes across SR 512. All of the strategies in this category would involve some level of partnership with the Cities and/or Pierce County.

Managed Lanes

Managed lane strategies have the most potential to improve conditions with respect to resiliency and reliability and to provide at least secondary benefits to corridor-wide freight mobility. A mid-corridor direct access to managed lanes has strong potential to both reduce freeway weaving and function as a new crossing of 512 for non-interchange traffic, which could provide secondary benefits to adjoining interchanges by spreading traffic across more routes.

Transit

The transit strategies recommended here primarily address the future BRT corridors of 112th Street E and S Meridian. While the Downtown Tacoma to Lakewood BRT project is important to the regional transit system and is recommended here, it received lower performance ratings because it does not serve primary transit demand within the SR 512 study area itself. Transit access improvements will provide important first mile/last mile connectivity to those who depend on transit.

Strategic Bottlenecks

Interchange and auxiliary lane strategies that performed the best in the evaluation were those that exhibited the most Baseline scenario operating issues, as indicated by freeway and intersection analysis documented in Chapter 3. In particular, delays projected at the SR 7, Canyon Road E, and 31st Avenue SW interchanges showed the most responsiveness to planning-level improvements defined by the strategies developed for them. Auxiliary lanes represent a potential expansion of interchange capacity beyond the merge/weave area upgrade strategy included in the TSMO category. All of these strategies would be almost entirely WSDOT’s responsibility.

4.3.4 Cost Estimates

Planning-level cost estimates were developed for each strategy using the WSDOT Planning Level Cost Estimating Tool. These are broad ranges that reflect the high-level, conceptual nature of this study and will be refined during future phases of strategy development. Cost estimate ranges are shown in Table 4-2 below.

Table 4-2. Cost Estimates

Number	Strategy Name	Low Cost ($M)	High Cost ($M)
C-1	Corridor-wide fiber optic connectivity: improve freeway management & driver information	$ 34.9	$ 46.6
C-2	Metering of selected on-ramps	$ 1.8	$ 2.4
C-3	Ramp merge/diverge upgrades: lengthen to modern standards	$ 280	$ 373
C-4	Median access/turnaround(s): enforcement & incident response	$ 0.6	$ 0.8
C-5	SR 512 Peak Use Shoulder Lane	$ 5.3	$ 7.1
C-6	Sidewalk improvements at existing SR 512 crossings	$ 8.0	$ 10.7
C-7	Managed Lane (HOV/ETL) in each direction on SR 512	$ 146	$ 194
C-8	SR 512 Bus on Shoulder program, if route(s) moved to SR 512	$ 5.3	$ 7.1
C-9	Transit access improvements for north-south bus routes	$ 11.6	$ 15.4
L-10	BRT: Downtown Tacoma to Lakewood TC via S Tacoma Way	$ 79.5	$ 106
L-11	Managed Lane direct connection to future I-5 HOV lanes	$ 133	$ 178
L-12	116th /Steele - Spanaway Loop to Sales: curb, gutter, sidewalk	$ 4.3	$ 5.8
L-13	Interchange at Steele Street: Widen overpass & modify ramps	$ 37.1	$ 49.5
L-14	SR 7, SR 512 to 96th St minor intersection channelization/widening	$ 2.6	$ 3.5
L-15	Interchange at SR 7/Pacific Avenue S: Widen overpass & modify ramps	$ 43.0	$ 57.3
L-16	Auxiliary lanes from SR 7 to Portland Avenue E (both directions)	$ 16.4	$ 21.9
L-17	Portland Ave E - SR 512 to 72nd: curb, gutter, sidewalk	$ 8.84	$ 11.8
L-18	Portland Ave E - 112th St E to SR 512: sidewalks, turn lanes, capacity	$ 5.8	$ 7.7
L-19	Interchange at Portland Avenue S: Widen overpass & modify ramps	$ 35.1	$ 46.8
L-20	New crossing of SR 512 at 46th Ave E	$ 7.0	$ 9.3
L-21	Service connection: mid-corridor direct access to/from Managed Lane	$ 133	$ 178
L-22	Interchange at Canyon Road E: Widen overpass & modify ramps	$ 37.1	$ 49.5
L-23	New crossing of SR 512 at 59th Ave E	$ 7.0	$ 9.3
L-24	Woodland Ave E - SR 512 to 160th St E: center turn lane, active transportation upgrades, access management	$ 39.8	$ 53.0
L-25	New crossing of SR 512 at 20th St SW	$ 7.0	$ 9.3
L-26	Pipeline Trail - 72nd to South Hill area	$ 17.0	$ 22.7
L-27	86th Ave E - SR 512 to 176th St E: turn lanes & active transportation facilities	$ 48.2	$ 64.3
L-28	94th Ave E - 39th Ave SW & north: bike lane	$ 3.7	$ 5.0
L-29	Interchange at 94th Avenue E: Widen overpass & modify ramps	$ 38.9	$ 51.9
L-30	BRT: Pierce County Airport to South Hill TC & downtown Puyallup via SR 161/Meridian Avenue	$ 43.0	$ 57.3
L-31	BRT: Lakewood to South Hill Mall TC via 112th Street E	$ 105	$ 140
L-32	Interchange at 31st Avenue SW: Widen overpass & modify ramps	$ 38.1	$ 50.8
L-33	New crossing of SR 512 at 23rd Ave SE	$ 8.9	$ 11.8
L-34	Auxiliary lanes from 31st Ave SW to Meridian (both directions)	$ 8.6	$ 11.5
L-35	Interchange at S Meridian: Widen overpass & modify ramps	$ 35.0	$ 46.5
L-36	Auxiliary lanes from S Meridian to E Pioneer (both directions)	$ 6.2	$ 8.3
L-37	E Pioneer - SR 512 interchange & to the west: bike lane	$ 6.2	$ 8.3

Number	Strategy Name	Low Cost ($M)	High Cost ($M)
L-38	Interchange at E Pioneer: Widen overpass & modify ramps	$ 37.0	$ 49.3
L-39	Puyallup 5th St SE corridor operations improvements	$ 0.3	$ 0.4
L-40	Tacoma to Puyallup Regional Trail	$ 12.2	$ 16.3
L-41	Managed Lane direct connection ramps from SR 167 to SR 512	$ 133	$ 178
L-42	Extend Parkland Community Trail under SR 512	$ 9.2	$ 12.2

Estimates are in 2023 dollars

4.3.5 Supplemental Analysis of the SR 512/SR 167 Interface

WSDOT undertook a focused analysis of peak-period traffic operations on SR 512 in conjunction with potential extension of future SR 167 express toll lanes (ETL) into the SR 512 corridor. This analysis informs future discussions surrounding potential termination points for the SR 167 ETLs in relation to potential managed lane implementation in the SR 512 corridor. However, this supplemental analysis did not directly influence strategy evaluation or phasing for SR 512 recommendations.

The analysis, which appears in Appendix H, suggests that different approaches may be pursued for westbound and eastbound SR 512. For westbound SR 512, the analysis suggests that year 2030 traffic operations would be optimized by extending the SR 167 ETL lanes via a transition lane along SR 512 westbound as far as 31st Avenue SW. For eastbound SR 512, acceptable year 2030 traffic operations can be achieved if the SR 167 ETL lane begins north of the Puyallup River bridge as long as an additional auxiliary lane is provided on eastbound SR 512 between Meridian and Pioneer. The analysis also shows that, by year 2050, the SR 167 ETL transition points would need to be extended further west in the SR 512 corridor to achieve desired operational performance.

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Chapter 5 Corridor Vision and Implementation

The implementation plan advances the recommended strategies most likely to improve multimodal corridor performance. This process resulted in a clear long-term vision for the corridor that will address performance gaps for all users and make SR 512 a more resilient, connected, and sustainable multimodal facility in the region's transportation network.

5.1 Elements of the SR 512 Vision

The long-term corridor vision for SR 512 includes the following four components that individually – and collectively - address one or more performance gaps identified during the study process.

Corridor-wide managed lanes form the backbone of the overall SR 512 vision. Managed lanes provide the best opportunity for efficient and measured capacity expansion to serve projected growth, while minimizing impacts associated with traditional highway widening. Managed-lane facilities are already planned to connect corridors at each end of SR 512. These interlinked corridors, with SR 512 at the center, provide an important route option for both regional and local travelers. The other vision components below will contribute to the success of corridor-wide managed lanes.

Addressing **strategic bottlenecks** at SR 512 interchange ramp terminals and crossings will be a vital step toward the successful realization of the long-term vision. In partnership with local agencies through the South Pierce Multimodal Corridor Study, WSDOT will continue to examine and advance interchange improvement strategies aimed at stabilizing travel times and improving multimodal reliability. These progressive and targeted improvements will ease the chokepoints that plague the corridor now and are expected to worsen over time without action.

Transit facilitation represents an even earlier opportunity for partnerships that address equity concerns with mobility and access to services in the area. Beyond housing and jobs, land uses such as education, medical care, shopping, and recreation, and access to transportation links beyond the corridor can be improved through high-quality public transit.

Active transportation and system management is the foundational element for many of the improvements needed to realize the SR 512 corridor vision. This study identifies several improvements that maximize the use of existing infrastructure through efficient, specialized upgrades. These improvements can solve immediate needs and be expanded upon later with larger-scale projects as funding is identified. Those pressing needs that can be addressed by simpler strategies with lower barriers to implementation were some of the first identified by this study.

5.2 Implementation Groups

Assignment of individual strategies into near-, mid-, and long-term time horizons was informed by the existing and future Baseline performance analysis, the scale and likely cost of each strategy, the likely timing of planned transportation projects in adjacent corridors, and a strategy's role in delivering the strategic vision described in Section 5.1. Essentially, the goal was to develop a phased plan that is consistent with the WSDOT Practical Solutions approach of delivering the right project at the right place at the right time.

This grouping process was developed to recognize and highlight the sequential nature of, and interactions between, certain combinations of strategies that will help guide the steps to implement them. Near-term strategies are those that can be implemented in a shorter timeframe to address an immediate performance gap; in some cases, a near-term strategy will be an initial phase of a larger project. Mid-term strategies begin to address more intractable performance gaps through larger-scale work. Long-term strategies that require careful planning, funding, and coordination complete the picture with more robust upgrades to safe, equitable, and flexible transportation networks and services. The strategy groupings are shown schematically in Figure 5-1 and Figure 5-2 with accompanying Table 5-1 through Table 5-5. They are presented by timeline and category in Table 5-6 through Table 5-10.

The long-term vision for the SR 512 corridor will take shape as more of the strategy pieces come together. It is WSDOT's intent that each recommended strategy will be considered by all interested and affected parties with regard to its contribution to the long-term vision, its relationship with other strategies in SR 512 and adjacent corridors, and the transportation needs of the corridor and the region as they evolve over time.

5.3 Lead Roles and Partnerships

The strategies recommended in this planning study represent a mix of those for which implementation would be led by WSDOT and those led by partner agencies with some WSDOT involvement. Partner agencies are those with interest in any prominent facility included in the corridor study area, whether generally or as outlined in WSDOT's City Streets as Part of State Highways Guidelines. Funding for recommended strategies remains to be identified and may be a mix of legislative line-item requests, discretionary grants, and locally-generated revenue. An agency's lead role during strategy development is independent of funding; all partners in the SR 512 Corridor Study have a shared role in identifying and securing project funding.

WSDOT-led strategies are those where changes would be made to facilities owned by WSDOT. Partnership arrangements would be developed for other strategies where facilities are owned or managed by others and where transportation service and/or maintenance would be provided by another agency such as Pierce Transit, the City of Puyallup, or Pierce County. The assignments of these "Lead" designations are subject to change as the strategy development process continues.

Figure 5-1. Recommended Strategies: Western Corridor

Recommended Strategies

ID	Corridor-Wide Strategies	Implementation Term
C-1	Corridor-wide fiber optic connectivity: improve freeway management & driver information	Near
C-2	Metering of selected on-ramps	Near
C-3	Ramp merge/diverge upgrades: lengthen to modern standards	Near
C-4	Median access/turnaround(s): enforcement & incident response	Near
C-5	SR 512 Peak Use Shoulder Lane	Mid
C-6	Sidewalk improvements at existing SR 512 crossings	Near
C-7	Managed Lane (HOV/ETL) in each direction on SR 512	Long
C-8	SR 512 Bus on Shoulder program, if route(s) moved to SR 512	Mid
C-9	Transit access improvements for north-south bus routes	Near

Focus Area	ID	Location-Specific Strategies	Implementation Term
A	L-10	BRT: Downtown Tacoma to Lakewood TC via S Tacoma Way	Mid
B	L-11	Managed Lane direct connection to future I-5 HOV lanes	Long
C	L-12	116th /Steele - Spanaway Loop to Sales: curb, gutter, sidewalk	Near
	L-13	Interchange at Steele Street: Widen overpass & modify ramps	Long
D	L-14	SR 7, SR 512 to 96th St minor intersection channelization/widening	Near
	L-15	Interchange at SR 7/Pacific Ave S: Widen overpass & modify ramps	Mid
	L-42	Extend Parkland Community Trail under SR 512	Near
E	L-16	Auxiliary lanes from SR 7 to Portland Avenue E (both directions)	Mid

Focus Area	ID	Location-Specific Strategies, continued	Implementation Term
F	L-17	Portland Ave E - SR 512 to 72nd: curb, gutter, sidewalk	Near
	L-18	Portland Ave E - 112th St E to SR 512: sidewalks, turn lanes, capacity	Mid
G	L-19	Interchange at Portland Avenue S: Widen overpass & modify ramps	Long
H	L-20	New crossing of SR 512 at 46th Ave E	Long
	L-21	Service connection: mid-corridor direct access to/from Managed Lane	Long
	L-22	Interchange at Canyon Road E: Widen overpass & modify ramps	Mid
	L-23	New crossing of SR 512 at 59th Ave E	Long
K	L-26	Pipeline Trail - 72nd to South Hill area	Mid

Table 5-1. Corridor-Wide Strategies

ID	Corridor-Wide Strategies	Implementation Term
C-1	Corridor-wide fiber optic connectivity: improve freeway management & driver information	Near
C-2	Metering of selected on-ramps	Near
C-3	Ramp merge/diverge upgrades: lengthen to modern standards	Near
C-4	Median access/turnaround(s): enforcement & incident response	Near
C-5	SR 512 Peak Use Shoulder Lane	Mid
C-6	Sidewalk improvements at existing SR 512 crossings	Near
C-7	Managed Lane (HOV/ETL) in each direction on SR 512	Mid
C-8	SR 512 Bus on Shoulder program, if route(s) moved to SR 512	Mid
C-9	Transit access improvements for north-south bus routes	Near

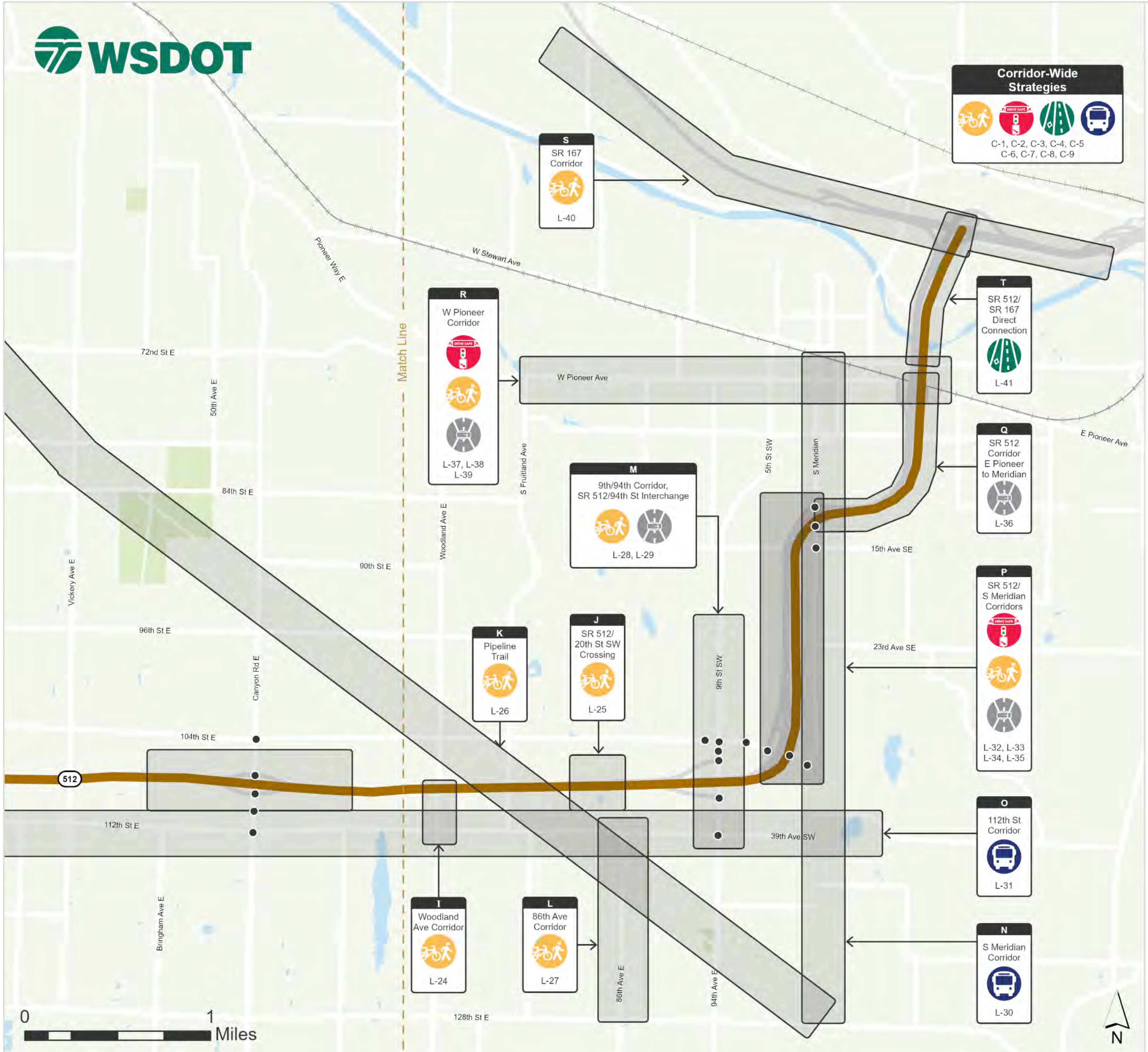
Table 5-2. Location-Specific Strategies

Focus Area	ID	Location-Specific Strategies	Implementation Term
A	L-10	BRT: Downtown Tacoma to Lakewood TC via S Tacoma Way	Mid
B	L-11	Managed Lane direct connection to future I-5 HOV lanes	Long
C	L-12	116th /Steele - Spanaway Loop to Sales: curb, gutter, sidewalk	Near
C	L-13	Interchange at Steele Street: Widen overpass & modify ramps	Long
D	L-14	SR 7, SR 512 to 96th St minor intersection channelization/widening	Near
D	L-15	Interchange at SR 7/Pacific Ave S: Widen overpass & modify ramps	Mid
D	L-42	Extend Parkland Community Trail under SR 512	Near
E	L-16	Auxiliary lanes from SR 7 to Portland Avenue E (both directions)	Mid

Table 5-3. Location-Specific Strategies, continued

Focus Area	ID	Location-Specific Strategies, continued	Implementation Term
F	L-17	Portland Ave E - SR 512 to 72nd: curb, gutter, sidewalk	Near
F	L-18	Portland Ave E - 112th St E to SR 512: sidewalks, turn lanes, capacity	Mid
G	L-19	Interchange at Portland Avenue S: Widen overpass & modify ramps	Long
H	L-20	New crossing of SR 512 at 46th Ave E	Long
H	L-21	Service connection: mid-corridor direct access to/from Managed Lane	Long
H	L-22	Interchange at Canyon Road E: Widen overpass & modify ramps	Mid
H	L-23	New crossing of SR 512 at 59th Ave E	Long
K	L-26	Pipeline Trail - 72nd to South Hill area	Mid

Figure 5-2. Recommended Strategies: Eastern Corridor



Recommended Strategies

ID	Corridor-Wide Strategies	Implementation Term
C-1	Corridor-wide fiber optic connectivity: improve freeway management & driver information	Near
C-2	Metering of selected on-ramps	Near
C-3	Ramp merge/diverge upgrades: lengthen to modern standards	Near
C-4	Median access/turnaround(s): enforcement & incident response	Near
C-5	SR 512 Peak Use Shoulder Lane	Mid
C-6	Sidewalk improvements at existing SR 512 crossings	Near
C-7	Managed Lane (HOV/ETL) in each direction on SR 512	Long
C-8	SR 512 Bus on Shoulder program, if route(s) moved to SR 512	Mid
C-9	Transit access improvements for north-south bus routes	Near

Focus Area	ID	Location-Specific Strategies, continued	Implementation Term
I	L-24	Woodland Ave E - SR 512 to 160th St E: center turn lane, active transportation upgrades, access management	Mid
J	L-25	New crossing of SR 512 at 20th St SW	Long
K	L-26	Pipeline Trail - 72nd to South Hill area	Mid
L	L-27	86th Ave E - SR 512 to 176th St E: turn lanes & active transportation facilities	Near
M	L-28	94th Ave I - 39th Ave SW & north: bike lane	Mid
	L-29	Interchange at 94th Ave E: Widen overpass & modify ramps	Long
N	L-30	BRT: Pierce County Airport to South Hill TC & downtown Puyallup via SR 161/Meridian Ave	Long
O	L-31	BRT: Lakewood to South Hill Mall TC via 112th St E	Long
P	L-32	Interchange at 31st Ave SW: Widen overpass & modify ramps	Mid
	L-33	New crossing of SR 512 at 23rd Ave SE	Long
	L-34	Auxiliary lanes from 31st to Meridian (both directions)	Mid
	L-35	Interchange at S Meridian: Widen overpass & modify ramps	Long
Q	L-36	Auxiliary lanes from Meridian to Pioneer (Eastbound)	Mid
R	L-37	E Pioneer - SR 512 interchange & to the west: bike lane	Mid
	L-38	Interchange at E Pioneer: Widen overpass & modify ramps	Long
	L-39	Puyallup 5th St SE corridor operations improvements	Mid
S	L-40	Tacoma to Puyallup Regional Trail	Mid
T	L-41	Managed Lane direct connection ramps from SR 167 to SR 512 across the Puyallup River	Mid

Legend

- Study Intersections
- Study Corridor
- Focus Area
- Transportation System Management and Operations
- Active/ Crossings
- Managed Lanes
- Transit
- Strategic Bottleneck

Table 5-4. Corridor-Wide Strategies

ID	Corridor-Wide Strategies	Implementation Term
C-1	Corridor-wide fiber optic connectivity: improve freeway management & driver information	Near
C-2	Metering of selected on-ramps	Near
C-3	Ramp merge/diverge upgrades: lengthen to modern standards	Near
C-4	Median access/turnaround(s): enforcement & incident response	Near
C-5	SR 512 Peak Use Shoulder Lane	Mid
C-6	Sidewalk improvements at existing SR 512 crossings	Near
C-7	Managed Lane (HOV/ETL) in each direction on SR 512	Mid
C-8	SR 512 Bus on Shoulder program, if route(s) moved to SR 512	Mid
C-9	Transit access improvements for north-south bus routes	Near

Table 5-5. Location-Specific Strategies

Focus Area	ID	Location-Specific Strategies	Implementation Term
I	L-24	Woodland Ave E - SR 512 to 160th St E: center turn lane, active transportation upgrades, access management	Mid
J	L-25	New crossing of SR 512 at 20th St SW	Long
K	L-26	Pipeline Trail - 72nd to South Hill area	Mid
L	L-27	86th Ave E - SR 512 to 176th St E: turn lanes & active transportation facilities	Near
M	L-28	94th Ave I - 39th Ave SW & north: bike lane	Mid
M	L-29	Interchange at 94th Ave E: Widen overpass & modify ramps	Long
N	L-30	BRT: Pierce County Airport to South Hill TC & downtown Puyallup via SR 161/Meridian Ave	Long
O	L-31	BRT: Lakewood to South Hill Mall TC via 112th St E	Long
P	L-32	Interchange at 31st Ave SW: Widen overpass & modify ramps	Mid
P	L-33	New crossing of SR 512 at 23rd Ave SE	Long
P	L-34	Auxiliary lanes from 31st to Meridian (both directions)	Mid
P	L-35	Interchange at S Meridian: Widen overpass & modify ramps	Long
Q	L-36	Auxiliary lanes from Meridian to Pioneer (Eastbound)	Mid
R	L-37	E Pioneer - SR 512 interchange & to the west: bike lane	Mid
R	L-38	Interchange at E Pioneer: Widen overpass & modify ramps	Long
R	L-39	Puyallup 5th St SE corridor operations improvements	Mid
S	L-40	Tacoma to Puyallup Regional Trail	Mid
T	L-41	Managed Lane direct connection ramps from SR 167 to SR 512 across the Puyallup River	Mid

Table 5-6. Planned and Programmed Projects

Project	Lead	Project	Lead	Project	Lead
SR 167 Gateway Extension to I-5	WSDOT	ETL Direct Access Ramp to SR 167 ETL in Auburn	WSDOT	Canyon Road Extension	Partnerships
I-5/SR 512 Interchange Replacement	WSDOT	ETL Direct Access Ramp to SR 167 ETL in Sumner	WSDOT	SR 7 Improvements	WSDOT
Auxiliary Lane on SR 512 from E Pioneer to S Meridian (westbound)	WSDOT	BRT/Enhanced Transit on SR 167	WSDOT	SR 161 Improvements	WSDOT
Southbound Single ETL lane between Ellingson and SR 410	WSDOT	Missing SR 18 Ramps + Auxiliary Lane Capacity	WSDOT		
ETL Direct Access Ramp to SR 167 ETL in Kent	WSDOT	Complete Valley Ave interchange with SR 167 Extension	WSDOT		

Table 5-7. Corridor-Wide Managed Lanes

Near-Term Strategies	Lead	Mid-Term Strategies	Lead	Long-Term Strategies	Lead
C-1. Corridor-wide fiber optic connectivity: improve freeway management & driver information	WSDOT	C-5. SR 512 Peak Use Shoulder Lane	WSDOT	C-7. Managed Lane (HOV/ETL) in each direction on SR 512	WSDOT
C-4. Median access/turnaround(s): enforcement & incident response	WSDOT	L-41. Managed Lane direct connection ramps from SR 167 to SR 512	WSDOT	L-11. Managed Lane direct connection to future I-5 HOV lanes	WSDOT
				L-21. Service connection: mid-corridor direct access to/from Managed Lane	WSDOT

Table 5-8. TSMO & Strategic Bottlenecks

Near-Term Strategies	Lead	Mid-Term Strategies	Lead	Long-Term Strategies	Lead
C-2. Metering of selected on-ramps	WSDOT	L-15. Interchange at SR 7/Pacific Avenue S: Widen overpass & modify ramps	WSDOT	L-13. Interchange at Steele Street: Widen overpass & modify ramps	WSDOT
C-3. Ramp merge/diverge upgrades: lengthen to modern standards	WSDOT	L-22. Interchange at Canyon Road E: Widen overpass & modify ramps	WSDOT	L-19. Interchange at Portland Avenue S: Widen overpass & modify ramps	WSDOT
L-14. SR 7, SR 512 to 96th St minor intersection channelization/widening	WSDOT	L-32. Interchange at 31st Avenue SW: Widen overpass & modify ramps	WSDOT	L-29. Interchange at 94th Avenue E: Widen overpass & modify ramps	WSDOT
		L-16. Auxiliary lanes from SR 7 to Portland Avenue E (both directions)	WSDOT	L-35. Interchange at S Meridian: Widen overpass & modify ramps	WSDOT
		L-34. Auxiliary lanes from 31st Ave SW to Meridian (both directions)	WSDOT	L-38. Interchange at E Pioneer: Widen overpass & modify ramps	WSDOT
		L-36. Auxiliary lane from S Meridian to E Pioneer (eastbound)	WSDOT		
		L-39. Puyallup 5th St SE corridor operations improvements	WSDOT		

Table 5-9. Facilitate Transit

Near-Term Strategies	Lead	Mid-Term Strategies	Lead	Long-Term Strategies	Lead
C-9. Transit access improvements for north-south bus routes	Partnerships	C-8. SR 512 Bus on Shoulder program, if route(s) moved to SR 512	Partnerships	L-30. BRT: Pierce County Airport to South Hill TC & downtown Puyallup via SR 161/Meridian Avenue	Partnerships
		L-10. BRT: Downtown Tacoma to Lakewood TC via S Tacoma Way	Partnerships	L-31. BRT: Lakewood to South Hill Mall TC via 112th Street E	Partnerships

Table 5-10. Active Transportation

Near-Term Strategies	Lead	Mid-Term Strategies	Lead	Long-Term Strategies	Lead
C-6. Sidewalk improvements at existing SR 512 crossings	Partnerships	L-18. Portland Ave E - 112th St E to SR 512: sidewalks, turn lanes, capacity	Partnerships	L-20. New crossing of SR 512 at 46th Ave E	Partnerships
L-12. 116th /Steele - Spanaway Loop to Sales: curb, gutter, sidewalk	Partnerships	L-24. Woodland Ave E - SR 512 to 160th St E: center turn lane, active transportation upgrades, access management	Partnerships	L-23. New crossing of SR 512 at 59th Ave E	Partnerships
L-17. Portland Ave E - SR 512 to 72nd: curb, gutter, sidewalk	Partnerships	L-26. Pipeline Trail - 72nd to South Hill area	Partnerships	L-25. New crossing of SR 512 at 20th St SW	Partnerships
L-27. 86th Ave E - SR 512 to 176th St E: turn lanes & active transportation facilities	Partnerships	L-28. 94th Ave E - 39th Ave SW & north: bike lane	Partnerships	L-33. New crossing of SR 512 at 23rd Ave SE	Partnerships
L-42 Extend Parkland Community Trail under SR 512	Partnerships	L-37. E Pioneer - SR 512 interchange & to the west: bike lane	Partnerships		
		L-40. Tacoma to Puyallup Regional Trail	Partnerships		

Chapter 6 Conclusion and Next Steps

The SR 512 Corridor Study has been completed to address the needs of the planning phases of WSDOT's Practical Solutions approach with the identification of performance gaps and the development and evaluation of strategies to address them. The strategies developed are consistent with local and regional plans. The information developed for this study was used to demonstrate needs, form strategies for consideration, and evaluate those strategies across a broad range of criteria.

This study documentation will be used to support next steps toward refining strategies, pursuing and justifying funding, and eventual implementation. Based on existing and anticipated future gaps in the transportation network, the SAG worked with the project team to prepare prioritized recommended solutions for the SR 512 corridor.

6.1 Moving Forward

WSDOT will work with stakeholders and partners to implement near-term, low-cost strategies and continue to work with stakeholders on the further definition and development of mid-term and long-term strategies in the corridor. The recommended strategies must be incorporated into state, regional, and local plans to position the proposed improvements for future funding and implementation.

The Puget Sound Regional Council is a key partner in moving mobility and access projects forward, and WSDOT will work them and SR 512 study partners to incorporate recommended strategies or combinations of strategies at each stage of PSRC's regional transportation plan update process.

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Appendix A Pedestrian and Bicycle Facilities Within Study Area

Figure A-1. Pedestrian and Bicycle Facilities within Study Area

Corridor	Functional Class	Number of Lanes	Speed Limit	Sidewalks: West Side	Sidewalks: East Side	Bike Lanes: West Side	Bike Lanes: East Side
S Tacoma Way/SR 512	Arterial	4 to 6	35	Yes	Yes	*None	*None
Steele St S	Arterial	4	35	Partial - Between SR 512 WB ramps and Sales Rd S	Partial - Between SR 512 WB ramps and Sales Rd S	*None	*None
Steele St S	Arterial	4	35	Partial - Between SR 512 WB ramps and Sales Rd S	Partial - Between SR 512 EB ramps and just north of 112th Ave S	*None	*None
Pacific Ave S (SR7)	Arterial	4	35	Partial - One block north of 108th St S	Partial - Around the intersections of 112th St S and both C St S and A St S	*None	*None
Pacific Ave S (SR7)	Arterial	4	35	Partial - Between SR 512 EB ramp and 112th St S	Partial - Around the intersections of 112th St S and both C St S and A St S	*None	*None
Pacific Ave S (SR7)	Arterial	4	35	Partial - South of 112th St S	Partial - Around the intersections of 112th St S and both C St S and A St S	*None	*None
Portland Ave E	Minor Arterial	2	35	Partial - Between EB 512 Ramp and 112th	None	*None	*None
Portland Ave E	Minor Arterial	2	35	None - EB Ramps and 108th	None	*None	*None
Canyon Rd E	Arterial	4 to 6	35	Yes	Yes	Partial - EB Ramps to the South	Partial - EB Ramps to the South
Canyon Rd E	Arterial	4 to 6	35	Yes	Yes	*None - EB Ramps to the North	*None - EB Ramps to the North
31st Ave SW	Minor Arterial	2	35	Partial - Between S Hill Park Dr and 9th St SW	Partial - Between S Hill Park Dr and 9th St SW	None	None
S Meridian	Primary Arterial	4	30	Yes	Yes	None	None
SR 512	Limited Access Highway	4 to 6	60	None	None	None	None
**Ainsworth Ave S	Minor Arterial	2	30	Yes	Yes	None	None
**Golden Given Rd E	Minor Arterial	2	30	None	None	None	None

**Crossing between Golden Given Rd E and Portland Ave E	Pedestrian Bridge	N/A	N/A	Yes	Yes	None	None
**Waller Rd E	Minor Arterial	2	35	None	None	*None	*None
**Vickery Ave E	Minor Arterial	2	35	None	None	*None	*None
**Woodland Ave E	Minor Arterial	2	35	None	None	None	None
** S Fruitland	Minor Arterial	2	35	None	None	None	None
**15th Ave SW	Minor Arterial	2	30	Yes	Yes	*None	*None
**7th Ave SW	Minor Arterial	2	30	Yes	Yes	None	None
**E Main Ave	Minor Arterial	2	30	Yes	Yes	None	None
**Benston Dr E	Minor Arterial	2	30	None	None	None	None

*Note – Wide shoulders present but not signed as a bicycle lane
**Note – Facilities that cross SR 512 but have no direct access to SR

Appendix B Vissim Calibration Results

SR 512 Vissim Temporal Speed Results - AM Period

Figure B-1. AM Peak SR 512 Eastbound-General Purpose Lanes (I-5 to Puyallup River Bridge)

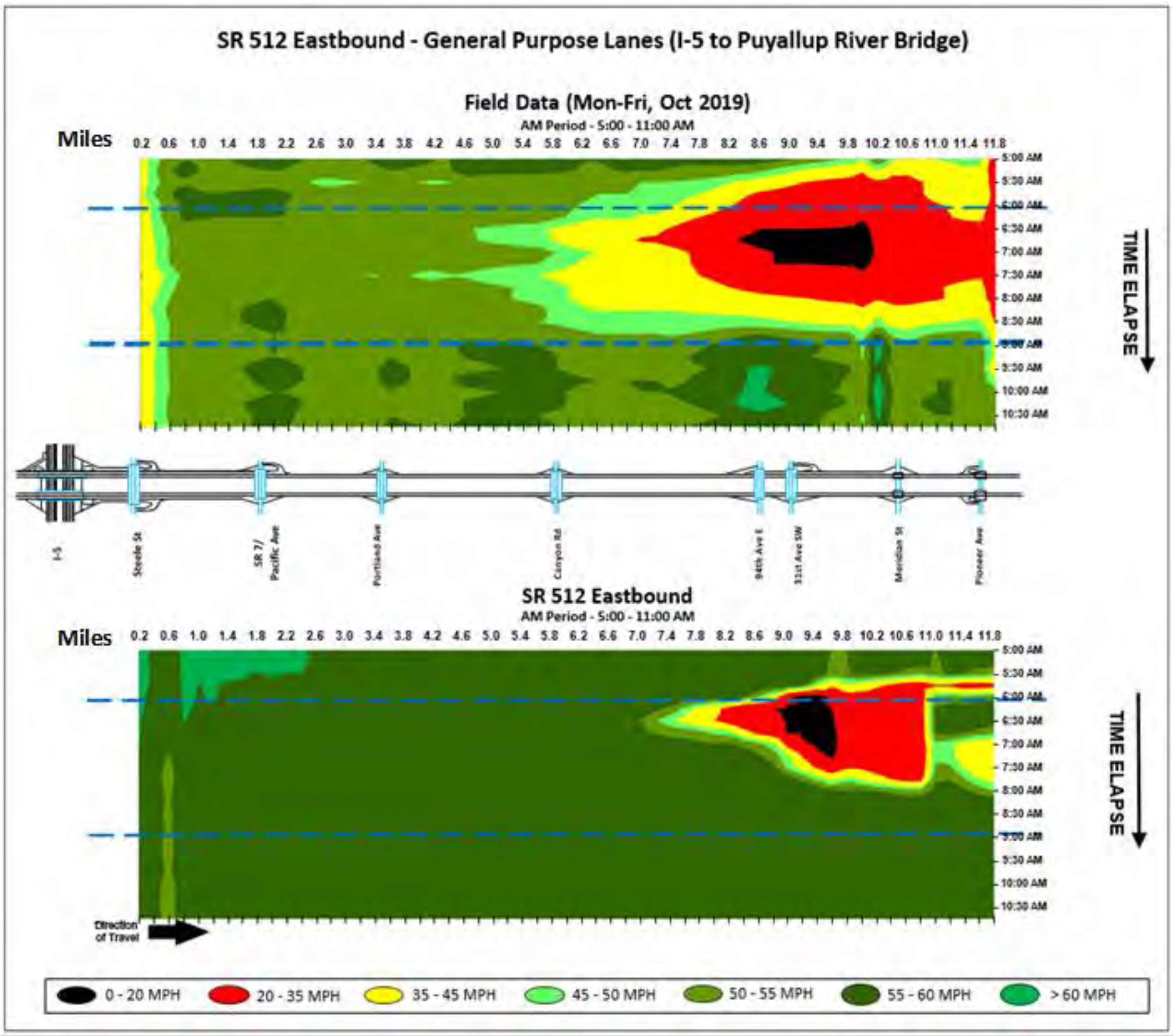
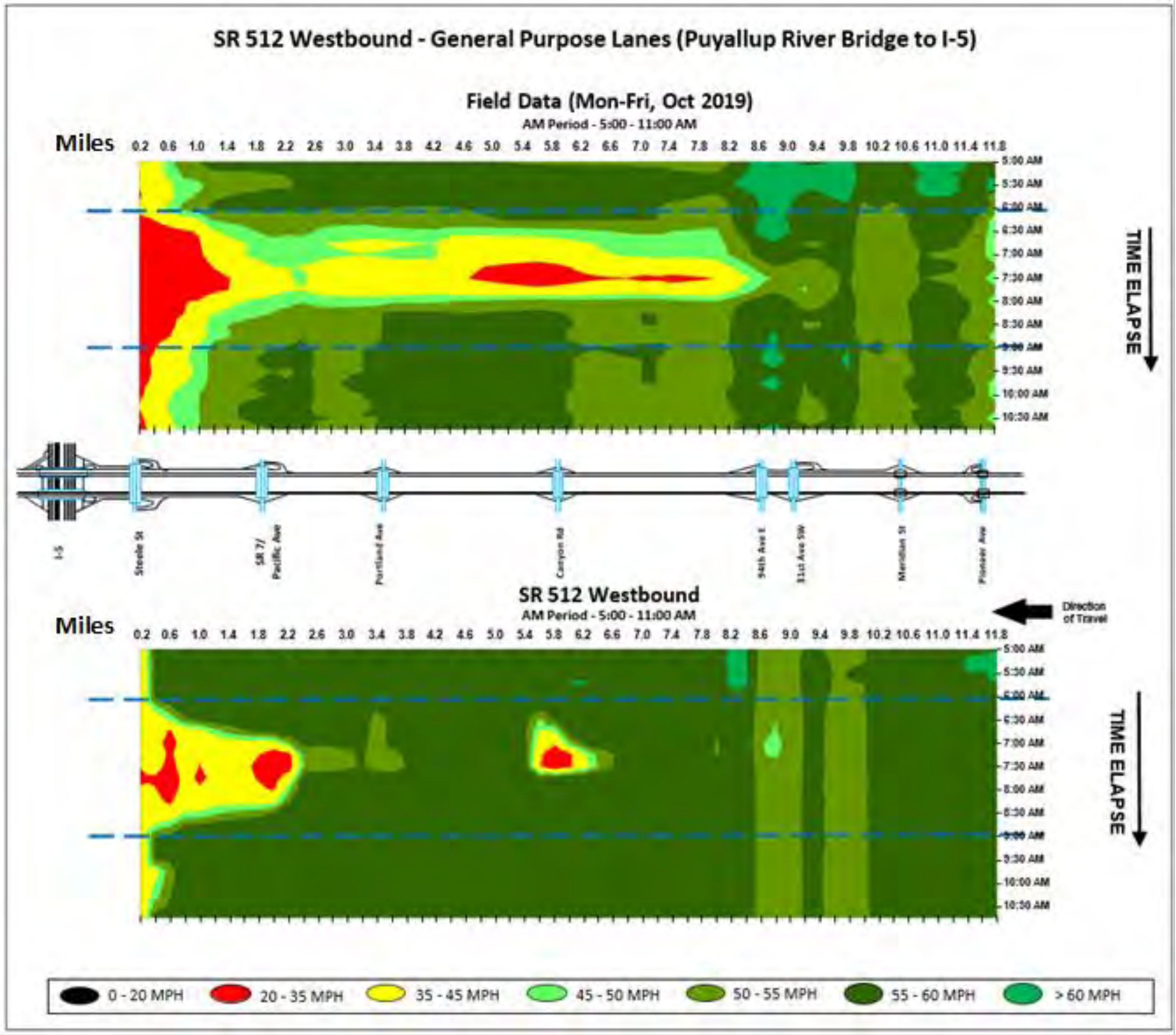


Figure B-2. AM Peak SR 512 Westbound-General Purpose Lanes (I-5 to Puyallup River Bridge)



I-5 Vissim Validation Results - 2019 Existing AM Peak Period (6:00-9:00 AM)

Table B-1. AM Peak Volume Validation (GEH Criteria)

Lane Type	Total Links with counts	# Links that meet criteria	Results	Validation Metric Achieved
Freeway Mainline	29	25		
Ramps	51	51		
Total of All Links =	80	76	95%	Yes

Table B-2. AM Peak Volume Validation (FHWA Volume Criteria)

Lane Type	Total Links with counts	# Links that meet criteria	Results	Validation Metric Achieved
Freeway Mainline	29	29		
Ramps	51	51		
Total of All Links =	80	80	100%	Yes
		Difference in sum of all link flows =	-16%	Yes

Table B-3. FHWA Performance Criteria and Measures

FHWA Performance Criteria and Measures	Validation Acceptance Target
Individual Link Flows	
Flow < 700 veh/h, Within 100 veh/h	> 85% of cases
700 veh/h < Flow < 2700 veh/h, Within 15%	> 85% of cases
Flow > 2700 veh/h, Within 400 veh/h	> 85% of cases
Difference in sum of all link flows	Within 5%
GEH Statistic Value	
GEH Statistic Value < 5, for individual link flows	> 85% cases
GEH Statistic Value for Sum of All Link Flows	< 4
Travel Times, Model versus Observed	
Within 15% (or 1 min, if higher)	> 85% cases

Table B-4. Network Travel Time Calibration: 2019 AM Peak 3 Hour - 6:00-9:00 AM (Primary Travel Time Routes for Calibration, SR 512 Eastbound)

Pathway	Segment	Distance (Miles)	Field Travel Time (Minutes)	VISSIM Travel Time (Minutes)	Abs Diff (Minutes)	Diff.%	Within 1 minute?	Validation Metric Achieved?
512-EB1-2	SR 512 Eastbound - Steele St S to Puyallup River Bridge	10.93	17.5	17.3	-0.2	-1%	Yes	Yes
512-EB1	SR 512 Eastbound - Steele St S to Waller Rd S	3.94	4.4	4.1	-0.3	-7%	Yes	Yes
512-EB2	SR 512 Eastbound - Waller Rd S to Puyallup River Bridge	6.99	13.1	13.2	0.1	1%	Yes	Yes

Table B-5. Network Travel Time Calibration: 2019 AM Peak 3 Hour - 6:00-9:00 AM (Secondary Travel Time Routes for Calibration, SR 512 Westbound)

Pathway	Segment	Distance (Miles)	Field Travel Time (Minutes)	VISSIM Travel Time (Minutes)	Abs Diff (Minutes)	Diff.%	Within 1 minute?	Validation Metric Achieved?
512-WB1-2	SR 512 Westbound - Puyallup River Bridge to Steele St S	10.90	14.6	14.2	-0.4	-3%	Yes	Yes
512-WB1	SR 512 Westbound - Puyallup River Bridge to Waller Rd S	6.97	9.0	7.8	-1.2	-13%	No	Yes
512-WB2	SR 512 Westbound - Waller Rd S to Steele St S	3.93	5.6	6.4	0.8	14%	Yes	Yes

Table B-6. FHWA Validation Results-Throughput Volumes-Peak 3 Hour – 6:00-9:00 AM

Road/ Direction	Link ID	Facility Type	Roadway Description	Field Count (vph)	VISSIM Model Throughput (vph)	Pass/Fail FHWA Volume Criteria	GEH	Pass/Fail GEH Criteria
I-5 Northbound	N005OFS1234	Off-Ramp	NB I-5 off to N Thorne Ln SW	207	206	PASS	0.1	PASS
I-5 Northbound	N005GPL1236	Mainline	NB I-5 at N Thorne Ln SW	3,953	4031	PASS	1.2	PASS
I-5 Northbound	N005ONS1239	On-Ramp	NB I-5 on from N Thorne Ln SW	381	380	PASS	0.0	PASS
I-5 Northbound	N005GPL1241	Mainline	NB I-5 btwn Thorne Lane & Gravelly Lake Dr	4,418	4408	PASS	0.1	PASS
I-5 Northbound	N005OFS1243	Off-Ramp	NB I-5 off to Gravelly Lake Dr SW	473	470	PASS	0.1	PASS
I-5 Northbound	N005ONS1251	On-Ramp	NB I-5 on from Gravelly Lake Dr SW	548	547	PASS	0.0	PASS
I-5 Northbound	N005OFS1256	Off-Ramp	NB I-5 Off to Bridgeport Way	641	637	PASS	0.2	PASS
I-5 Northbound	N005GPL1267	Mainline	NB I-5 btwn Bridgeport Way & SR 512	4,513	4255	PASS	3.9	PASS
I-5 Northbound	S512ONL0001	System Ramp	NB I-5-to-WB SR 512 (NE Loop)	153	150	PASS	0.2	PASS
I-5 Northbound	N512ONS0003	System Ramp	NB I-5-to-SR 512 EB (SE Slip)	1,181	1175	PASS	0.2	PASS
I-5 Northbound	S512OFS0003	System Ramp	WB SR512-to-NB I-5 (NE Slip)	1,837	1839	PASS	0.0	PASS
I-5 Northbound	N512OFL0001	System Ramp	EB SR512-to-NB I-5 (SE Loop)	397	396	PASS	0.1	PASS
I-5 Northbound	N005GPL1283	Mainline	NB I-5 btwn SR 512 & S 84th St	5,274	5159	PASS	1.6	PASS
I-5 Northbound	N005OFS1286	Off-Ramp	NB I-5 Off to S Hosmer St	150	148	PASS	0.2	PASS
I-5 Northbound	N005GPL1289	Mainline	NB I-5 btwn S 84th St & S 72nd St	4,860	5010	PASS	2.1	PASS
I-5 Northbound	N005OFS1294	Off-Ramp	NB I-5 Off to S 74th St	212	206	PASS	0.4	PASS
I-5 Southbound	S005ONL1293	On-Ramp	SB I-5 On from S 72nd St	222	222	PASS	0.0	PASS
I-5 Southbound	S005GPL1289	Mainline	SB I-5 btwn S 72nd St and S 84th St	4,587	4658	PASS	1.0	PASS
I-5 Southbound	S005ONS1286	On-Ramp	SB I-5 On from S 84th St	271	271	PASS	0.0	PASS
I-5 Southbound	N512ONS0000	System Ramp	SB I-5 Off to SR 512 EB (3 SB LT)	1,177	1162	PASS	0.4	PASS
I-5 Southbound	S512ONS0000	System Ramp	SB I-5 Off to SR 512 WB (2 SB RT)	562	556	PASS	0.2	PASS
I-5 Southbound	S005GPL1274	Mainline	SB I-5 at SR 512	3,368	3192	PASS	3.1	PASS
I-5 Southbound	S512OFL0000	System Ramp	WB SR 512 to SB I-5 (NW loop)	1,406	1360	PASS	1.2	PASS
I-5 Southbound	N512OFS0000	System Ramp	EB SR 512 to SB I-5 (SW slip)	245	244	PASS	0.1	PASS
I-5 Southbound	S005GPL1267	Mainline	SB I-5 btwn SR 512 and Bridgeport Way	4,839	4792	PASS	0.7	PASS
I-5 Southbound	S005OFS1261	Off-Ramp	SB I-5 Off to Bridgeport Way	484	474	PASS	0.4	PASS
I-5 Southbound	S005ONS1256	On-Ramp	SB I-5 On from Bridgeport Way	583	581	PASS	0.1	PASS
I-5 Southbound	S005OFS1251	Off-Ramp	SB I-5 Off to Gravelly Lake Dr SW	400	390	PASS	0.5	PASS
I-5 Southbound	S005ONS1243	On-Ramp	SB I-5 On from Gravelly Lake Dr SW	595	592	PASS	0.1	PASS
I-5 Southbound	S005GPL1241	Mainline	SB I-5 btwn Gravelly Lake Dr SW and N Thorne Ln SW	4,868	5089	PASS	3.1	PASS

Road/ Direction	Link ID	Facility Type	Roadway Description	Field Count (vph)	VISSIM Model Throughput (vph)	Pass/Fail FHWA Volume Criteria	GEH	Pass/Fail GEH Criteria
I-5 Southbound	S005GPL1236	Mainline	SB I-5 at N Thorne Ln SW	4,281	4575	PASS	4.4	PASS
I-5 Southbound	S005ONS1234	On-Ramp	SB I-5 On from N Thorne Ln SW	314	314	PASS	0.0	PASS
SR 512 Eastbound	N512GPL-002	Mainline Enter	EB SR 512 btwn Tacoma Way and I-5	1,199	1197	PASS	0.1	PASS
SR 512 Eastbound	N512OFL0007	Off-Ramp	EB SR 512 Off to Steele St S	620	611	PASS	0.4	PASS
SR 512 Eastbound	N512GPL0007	Mainline	EB SR 512 at Steele St S	2,295	2275	PASS	0.4	PASS
SR 512 Eastbound	N512ONS0009	On-Ramp	EB SR 512 On from Steele St S	233	234	PASS	0.1	PASS
SR 512 Eastbound	N512OFS0017	Off-Ramp	EB SR 512 Off to SR 7	509	499	PASS	0.4	PASS
SR 512 Eastbound	N512GPL0020	Mainline	EB SR 512 at SR 7	2,094	2006	PASS	1.9	PASS
SR 512 Eastbound	N512ONS0025	On-Ramp	EB SR 512 On from SR 7	529	529	PASS	0.0	PASS
SR 512 Eastbound	N512OFS0035	Off-Ramp	EB SR 512 Off to Portland Ave E	357	354	PASS	0.2	PASS
SR 512 Eastbound	N512ONS0039	On-Ramp	EB SR 512 On from Portland Ave E	358	359	PASS	0.1	PASS
SR 512 Eastbound	N512GPL0050	Mainline	EB SR 512 btwn Portland Ave E and Canyon Rd E	2,497	2535	PASS	0.8	PASS
SR 512 Eastbound	N512OFS0056	Off-Ramp	EB SR 512 Off to Canyon Rd E	646	640	PASS	0.2	PASS
SR 512 Eastbound	N512GPL0070	Mainline	EB SR 512 btwn Canyon Rd E and 94th Ave E	2,784	2948	PASS	3.1	PASS
SR 512 Eastbound	N512OFS0079	Off-Ramp	EB SR 512 Off to 94th Ave E	455	440	PASS	0.7	PASS
SR 512 Eastbound	N512OFS0085	Off-Ramp	EB SR 512 Off to 31st Ave SW	466	451	PASS	0.7	PASS
SR 512 Eastbound	N512GPL0090	Mainline	EB SR 512 at 31st Ave SW	2,022	2057	PASS	0.8	PASS
SR 512 Eastbound	N512ONS0090	On-Ramp	EB SR 512 On from 31st Ave SW	1,117	1136	PASS	0.6	PASS
SR 512 Eastbound	N512GPL0095	Mainline	EB SR 512 btwn 31st Ave SW and Meridian St	3,082	3252	PASS	3.0	PASS
SR 512 Eastbound	N512OFS0098	Off-Ramp	EB SR 512 Off to Meridian St	242	240	PASS	0.1	PASS
SR 512 Eastbound	N512GPL0100	Mainline	EB SR 512 at Meridian St	2,684	3033	PASS	6.5	SUSPECT
SR 512 Eastbound	N512ONS0104	On-Ramp	EB SR 512 On from Meridian St	593	593	PASS	0.0	PASS
SR 512 Eastbound	N512OFS0111	Off-Ramp	EB SR 512 Off to Pioneer Ave	361	367	PASS	0.3	PASS
SR 512 Eastbound	N512GPL0111	Mainline	EB SR 512 at Pioneer Ave	3,052	3315	PASS	4.7	PASS
SR 512 Eastbound	N512ONL0111	On-Ramp	EB SR 512 On from Pioneer Ave	226	226	PASS	0.0	PASS
SR 512 Eastbound	N512GPL0116	Mainline Exit	EB SR 512 n/o Pioneer Ave	3,292	3553	PASS	4.5	PASS
SR 512	S512GPL0116	Mainline Enter	WB SR 512 n/o E Pioneer	2,466	2181	PASS	5.9	SUSPECT
SR 512	S512OFL0111	Off-Ramp	WB SR 512 Off to E Pioneer	164	131	PASS	2.7	PASS
SR 512	S512GPL0111	Mainline	WB SR 512 at E Pioneer	2,320	2049	PASS	5.8	SUSPECT
SR 512	S512ONS0111	On-Ramp	WB SR 512 On from E Pioneer	290	297	PASS	0.4	PASS
SR 512	S512OFS0	Off-Ramp	WB SR 512 Off to S Meridian	338	281	PASS	3.2	PASS

Road/ Direction	Link ID	Facility Type	Roadway Description	Field Count (vph)	VISSIM Model Throughput (vph)	Pass/Fail FHWA Volume Criteria	GEH	Pass/Fail GEH Criteria
	104							
SR 512	S512ONS0098	On-Ramp	WB SR 512 On from S Meridian	198	206	PASS	0.6	PASS
SR 512	S512GPL0095	Mainline	WB SR 512 btwn S Meridian and 31st Avenue SW	2,519	2266	PASS	5.2	SUSPECT
SR 512	S512OFS0090	Off-Ramp	WB SR 512 Off to 31st Avenue SW	910	789	PASS	4.1	PASS
SR 512	S512GPL0083	Mainline	WB SR 512 btwn 31st Avenue SW and 94th Avenue E	2,190	2043	PASS	3.2	PASS
SR 512	S512ONS0079	On-Ramp	WB SR 512 On from 94th Avenue E	634	649	PASS	0.6	PASS
SR 512	S512GPL0070	Mainline	WB SR 512 btwn 94th Avenue E and Canyon Rd E	2,747	2690	PASS	1.1	PASS
SR 512	S512OFS0061	Off-Ramp	WB SR 512 Off to Canyon Rd E	665	619	PASS	1.8	PASS
SR 512	S512ONS0056	On-Ramp	WB SR 512 On from Canyon Rd E	1,181	1215	PASS	1.0	PASS
SR 512	S512GPL0050	Mainline	WB SR 512 btwn Canyon Rd E and Portland Avenue E	3,261	3278	PASS	0.3	PASS
SR 512	S512OFS0039	Off-Ramp	WB SR 512 Off to Portland Avenue E	296	300	PASS	0.2	PASS
SR 512	S512ONS0035	On-Ramp	WB SR 512 On from Portland Avenue E	380	367	PASS	0.7	PASS
SR 512	S512OFS0025	Off-Ramp	WB SR 512 Off to SR 7	417	407	PASS	0.5	PASS
SR 512	S512GPL0024	Mainline	WB SR 512 btwn SR 7 Off & Loop On	2,961	2924	PASS	0.7	PASS
SR 512	S512ONL0022	On-Ramp	WB SR 512 On from SR 7 NB	458	452	PASS	0.3	PASS
SR 512	S512GPL0020	Mainline	WB SR 512 btwn SR 7 Loop On & Slip On	3,341	3376	PASS	0.6	PASS
SR 512	S512ONS0017	On-Ramp	WB SR 512 On from SR 7 SB	160	157	PASS	0.2	PASS
SR 512	S512OFS0009	Off-Ramp	WB SR 512 Off to Steele St S	284	296	PASS	0.7	PASS
SR 512	S512ONL0007	On-Ramp	WB SR 512 On from Steele St S	837	837	PASS	0.0	PASS
SR 512	S512GPL-002	Mainline Exit	WB SR 512 w/o I-5	1,586	1570	PASS	0.4	PASS
			Sum of All Segment Flows within Calibration Area (Freeway and Arterial) =	157,290	132,494		-15.8%	Fail

Table B-7. FHWA Performance Criteria and Measures

FHWA Performance Criteria and Measures	Validation Acceptance Target
Individual link flows	
Flow < 700 veh/h, Within 100 veh/h	> 85% of cases
700 veh/h < Flow < 2700 veh/h, Within 15%	> 85% of cases
Flow > 2700 veh/h, Within 400 veh/h	> 85% of cases
Difference in sum of all link flows	Within 5%
GEH Statistic Value	
GEH Statistic Value < 5, for individual link flows	> 85% cases
GEH Statistic Value for Sum of All Link Flows	< 4
Travel Times, Model versus Observed	
Within 15% (or 1 min, if higher)	> 85% cases

Table B-8. FHWA Validation Results-Throughput Volumes-Peak 3 Hour – 6:00-9:00 AM Peak Summary (Individual Link Flows)

Measure	Value	Pass/Fail
# of Freeway Mainline Links with Counts:	29	
# that meet FHWA Volume Criteria:	29	
% that meet FHWA Volume Criteria:	100%	Pass
# of Freeway Ramp Links with Counts:	51	
# that meet FHWA Volume Criteria:	51	
% that meet FHWA Volume Criteria:	100%	Pass

Table B-9. FHWA Validation Results-Throughput Volumes-Peak 3 Hour – 6:00-9:00 AM Peak Summary (GEH Statistics Value)

Measure	Value	Pass/Fail
# of Freeway Mainline Links with Counts:	29	
# with GEH <= 5:	25	
% with GEH <= 5:	86%	Pass
# of Freeway Ramp Links with Counts:	51	
# with GEH <= 5:	51	
% with GEH <= 5:	100%	Pass

I-5 – Vissim Validation Results with WSDOT VISSIM Protocol Criteria-2019 Existing AM Peak Period (6:00-9:00 AM)

Table B-10. AM Peak Volume Validation (WSDOT VISSIM Protocol Criteria)

Lane Type	Total Links with counts	# Links that meet criteria	Results	Validation Metric Achieved
State Facility Segments	25	22	88%	
Entry/Exit Locations	4	2	50%	
Entrance/Exit Ramps	51	49	96%	
Local Road Segments	0	0	n/a	
85% of All Links Within Criteria?	80	73	91%	Yes
		Sum of All Segment Flows =	-16%	Yes

Table B-11. Network Travel Time Calibration: 2019 AM Peak 3 Hour - 6:00-9:00 AM (Primary Travel Time Routes for Calibration, SR 512 Eastbound)

Pathway	Segment	Facility Type	Distance (Miles)	Field Travel Time (Minutes)	VISSIM Travel Time (Minutes)	Abs Diff (Minutes)	Calibration Goal based on Facility Type (+/- Minutes)	Validation Metric Achieved?
512-EB1-2	SR 512 Eastbound - Steele St S to Puyallup River Bridge	Free-Flowing	10.93	17.5	17.3	-0.2	1.6	Yes
512-EB1	SR 512 Eastbound - Steele St S to Waller Rd S	Free-Flowing	3.94	4.4	4.1	-0.3	0.3	No
512-EB2	SR 512 Eastbound - Waller Rd S to Puyallup River Bridge	Free-Flowing	6.99	13.1	13.2	0.1	1.4	Yes

Table B-12. Network Travel Time Calibration: 2019 AM Peak 3 Hour - 6:00-9:00 AM (Secondary Travel Time Routes for Calibration, SR 512 Westbound)

Pathway	Segment	Facility Type	Distance (Miles)	Field Travel Time (Minutes)	VISSIM Travel Time (Minutes)	Abs Diff (Minutes)	Calibration Goal based on Facility Type (+/- Minutes)	Validation Metric Achieved?
512-WB1-2	SR 512 Westbound - Puyallup River Bridge to Steele St S	Free-Flowing	10.90	14.6	14.2	-0.4	1.1	Yes
512-WB1	SR 512 Westbound - Puyallup River Bridge to Waller Rd S	Free-Flowing	6.97	9.0	7.8	-1.2	0.7	No
512-WB2	SR 512 Westbound - Waller Rd S to Steele St S	Free-Flowing	3.93	5.6	6.4	0.8	0.5	No

Table B-13. GEH Criteria and Targets

Criteria	Acceptable Targets
GEH < 3.0	All state facility segments within the calibration area
GEH < 3.0	All entry and exit locations within the calibration area
GEH < 3.0	All entrance and exit ramps within the calibration area
GEH < 5.0	At least 85% of applicable local roadway segments
Sum of all segment flows within the calibration area	Within 5%

Table B-14. Facility Type Equations

Facility Type	Equation
Free-flowing	$\Delta = \dfrac{1}{\frac{1}{t} - \frac{4.4}{L}} - t$
Interrupted Flow	$\Delta = \dfrac{1}{\frac{1}{t} - \frac{0.1 * 5280\,S}{3600\,L}} - t$
Δ = Allowable Travel Time Variation (+/- seconds) t = Real World Travel Time (seconds) L = Length (feet) S = Free Flow Speed (mph); Posted Speed may be used for FFS if unknown	

Table B-15. WSDOT VISSIM Protocol Validation Results - Throughput Volumes - Peak 3 Hour - 6:00-9:00 AM

Road/ Direction	Link ID	Facility Type	Roadway Description	Count (vph)	VISSIM Model (vph)	GEH Statistic Calibration Score	Pass/Fail GEH Criteria
I-5 Northbound	N005OF S1234	Off-Ramp	NB I-5 off to N Thorne Ln SW	207	206	0.1	PASS
I-5 Northbound	N005GP L1236	Mainline	NB I-5 at N Thorne Ln SW	3,953	4031	0.7	PASS
I-5 Northbound	N005ON S1239	On-Ramp	NB I-5 on from N Thorne Ln SW	381	380	0.0	PASS
I-5 Northbound	N005GP L1241	Mainline	NB I-5 btwn Thorne Lane & Gravelly Lake Dr	4,418	4408	0.1	PASS
I-5 Northbound	N005OF S1243	Off-Ramp	NB I-5 off to Gravelly Lake Dr SW	473	470	0.1	PASS
I-5 Northbound	N005ON S1251	On-Ramp	NB I-5 on from Gravelly Lake Dr SW	548	547	0.0	PASS
I-5 Northbound	N005OF S1256	Off-Ramp	NB I-5 Off to Bridgeport Way	641	637	0.2	PASS
I-5 Northbound	N005GP L1267	Mainline	NB I-5 btwn Bridgeport Way & SR 512	4,513	4255	1.9	PASS
I-5 Northbound	S512ON L0001	System Ramp	NB I-5-to-WB SR 512 (NE Loop)	153	150	0.2	PASS
I-5 Northbound	N512ON S0003	System Ramp	NB I-5-to-SR 512 EB (SE Slip)	1,181	1175	0.2	PASS
I-5 Northbound	S512OF S0003	System Ramp	WB SR512-to-NB I-5 (NE Slip)	1,837	1839	0.0	PASS
I-5 Northbound	N512OF L0001	System Ramp	EB SR512-to-NB I-5 (SE Loop)	397	396	0.1	PASS
I-5 Northbound	N005GP L1283	Mainline	NB I-5 btwn SR 512 & S 84th St	5,274	5159	0.8	PASS
I-5 Northbound	N005OF S1286	Off-Ramp	NB I-5 Off to S Hosmer St	150	148	0.2	PASS
I-5 Northbound	N005GP L1289	Mainline	NB I-5 btwn S 84th St & S 72nd St	4,860	5010	1.1	PASS
I-5 Northbound	N005OF S1294	Off-Ramp	NB I-5 Off to S 74th St	212	206	0.4	PASS
I-5 Southbound	S005ON L1293	On-Ramp	SB I-5 On from S 72nd St	222	222	0.0	PASS
I-5 Southbound	S005GP L1289	Mainline	SB I-5 btwn S 72nd St and S 84th St	4,587	4658	0.5	PASS
I-5 Southbound	S005ON S1286	On-Ramp	SB I-5 On from S 84th St	271	271	0.0	PASS
I-5 Southbound	N512ON S0000	System Ramp	SB I-5 Off to SR 512 EB (3 SB LT)	1,177	1162	0.2	PASS
I-5 Southbound	S512ON S0000	System Ramp	SB I-5 Off to SR 512 WB (2 SB RT)	562	556	0.2	PASS
I-5 Southbound	S005GP L1274	Mainline	SB I-5 at SR 512	3,368	3192	1.5	PASS
I-5 Southbound	S512OF L0000	System Ramp	WB SR 512 to SB I-5 (NW loop)	1,406	1360	1.2	PASS
I-5 Southbound	N512OF S0000	System Ramp	EB SR 512 to SB I-5 (SW slip)	245	244	0.1	PASS
I-5 Southbound	S005GP L1267	Mainline	SB I-5 btwn SR 512 and Bridgeport Way	4,839	4792	0.3	PASS
I-5 Southbound	S005OF S1261	Off-Ramp	SB I-5 Off to Bridgeport Way	484	474	0.4	PASS
I-5 Southbound	S005ON S1256	On-Ramp	SB I-5 On from Bridgeport Way	583	581	0.1	PASS
I-5 Southbound	S005OF S1251	Off-Ramp	SB I-5 Off to Gravelly Lake Dr SW	400	390	0.5	PASS

Road/ Direction	Link ID	Facility Type	Roadway Description	Count (vph)	VISSIM Model (vph)	GEH Statistic Calibration Score	Pass/Fail GEH Criteria
I-5 Southbound	S005ON S1243	On-Ramp	SB I-5 On from Gravelly Lake Dr SW	595	592	0.1	PASS
I-5 Southbound	S005GP L1241	Mainline	SB I-5 btwn Gravelly Lake Dr SW and N Thorne Ln SW	4,868	5089	1.6	PASS
I-5 Southbound	S005GP L1236	Mainline	SB I-5 at N Thorne Ln SW	4,281	4575	2.6	PASS
I-5 Southbound	S005ON S1234	On-Ramp	SB I-5 On from N Thorne Ln SW	314	314	0.0	PASS
SR 512 Eastbound	N512GP L-002	Mainline Enter	EB SR 512 btwn Tacoma Way and I-5	1,199	1197	0.0	PASS
SR 512 Eastbound	N512OF L0007	Off-Ramp	EB SR 512 Off to Steele St S	620	611	0.4	PASS
SR 512 Eastbound	N512GP L0007	Mainline	EB SR 512 at Steele St S	2,295	2275	0.2	PASS
SR 512 Eastbound	N512ON S0009	On-Ramp	EB SR 512 On from Steele St S	233	234	0.1	PASS
SR 512 Eastbound	N512OF S0017	Off-Ramp	EB SR 512 Off to SR 7	509	499	0.4	PASS
SR 512 Eastbound	N512GP L0020	Mainline	EB SR 512 at SR 7	2,094	2006	1.4	PASS
SR 512 Eastbound	N512ON S0025	On-Ramp	EB SR 512 On from SR 7	529	529	0.0	PASS
SR 512 Eastbound	N512OF S0035	Off-Ramp	EB SR 512 Off to Portland Ave E	357	354	0.2	PASS
SR 512 Eastbound	N512ON S0039	On-Ramp	EB SR 512 On from Portland Ave E	358	359	0.1	PASS
SR 512 Eastbound	N512GP L0050	Mainline	EB SR 512 btwn Portland Ave E and Canyon Rd E	2,497	2535	0.5	PASS
SR 512 Eastbound	N512OF S0056	Off-Ramp	EB SR 512 Off to Canyon Rd E	646	640	0.2	PASS
SR 512 Eastbound	N512GP L0070	Mainline	EB SR 512 btwn Canyon Rd E and 94th Ave E	2,784	2948	2.2	PASS
SR 512 Eastbound	N512OF S0079	Off-Ramp	EB SR 512 Off to 94th Ave E	455	440	0.7	PASS
SR 512 Eastbound	N512OF S0085	Off-Ramp	EB SR 512 Off to 31st Ave SW	466	451	0.7	PASS
SR 512 Eastbound	N512GP L0090	Mainline	EB SR 512 at 31st Ave SW	2,022	2057	0.6	PASS
SR 512 Eastbound	N512ON S0090	On-Ramp	EB SR 512 On from 31st Ave SW	1,117	1136	0.6	PASS
SR 512 Eastbound	N512GP L0095	Mainline	EB SR 512 btwn 31st Ave SW and Meridian St	3,082	3252	2.1	PASS
SR 512 Eastbound	N512OF S0098	Off-Ramp	EB SR 512 Off to Meridian St	242	240	0.1	PASS
SR 512 Eastbound	N512GP L0100	Mainline	EB SR 512 at Meridian St	2,684	3033	4.6	SUSPECT
SR 512 Eastbound	N512ON S0104	On-Ramp	EB SR 512 On from Meridian St	593	593	0.0	PASS
SR 512 Eastbound	N512OF S0111	Off-Ramp	EB SR 512 Off to Pioneer Ave	361	367	0.3	PASS
SR 512 Eastbound	N512GP L0111	Mainline	EB SR 512 at Pioneer Ave	3,052	3315	3.3	SUSPECT
SR 512 Eastbound	N512ON L0111	On-Ramp	EB SR 512 On from Pioneer Ave	226	226	0.0	PASS
SR 512 Eastbound	N512GP L0116	Mainline Exit	EB SR 512 n/o Pioneer Ave	3,292	3553	3.2	SUSPECT
SR 512 Westbound	S512GP L0116	Mainline Enter	WB SR 512 n/o E Pioneer	2,466	2181	4.2	SUSPECT
SR 512 Westbound	S512OF L0111	Off-Ramp	WB SR 512 Off to E Pioneer	164	131	2.7	PASS

Road/ Direction	Link ID	Facility Type	Roadway Description	Count (vph)	VISSIM Model (vph)	GEH Statistic Calibration Score	Pass/Fail GEH Criteria
SR 512 Westbound	S512GP L0111	Mainline	WB SR 512 at E Pioneer	2,320	2049	4.1	SUSPECT
SR 512 Westbound	S512ON S0111	On-Ramp	WB SR 512 On from E Pioneer	290	297	0.4	PASS
SR 512 Westbound	S512OF S0104	Off-Ramp	WB SR 512 Off to S Meridian	338	281	3.2	SUSPECT
SR 512 Westbound	S512ON S0098	On-Ramp	WB SR 512 On from S Meridian	198	206	0.6	PASS
SR 512 Westbound	S512GP L0095	Mainline	WB SR 512 btwn S Meridian and 31st Avenue SW	2,519	2266	3.0	PASS
SR 512 Westbound	S512OF S0090	Off-Ramp	WB SR 512 Off to 31st Avenue SW	910	789	4.1	SUSPECT
SR 512 Westbound	S512GP L0083	Mainline	WB SR 512 btwn 31st Avenue SW and 94th Avenue E	2,190	2043	1.9	PASS
SR 512 Westbound	S512ON S0079	On-Ramp	WB SR 512 On from 94th Avenue E	634	649	0.6	PASS
SR 512 Westbound	S512GP L0070	Mainline	WB SR 512 btwn 94th Avenue E and Canyon Rd E	2,747	2690	0.8	PASS
SR 512 Westbound	S512OF S0061	Off-Ramp	WB SR 512 Off to Canyon Rd E	665	619	1.8	PASS
SR 512 Westbound	S512ON S0056	On-Ramp	WB SR 512 On from Canyon Rd E	1,181	1215	1.0	PASS
SR 512 Westbound	S512GP L0050	Mainline	WB SR 512 btwn Canyon Rd E and Portland Avenue E	3,261	3278	0.2	PASS
SR 512 Westbound	S512OF S0039	Off-Ramp	WB SR 512 Off to Portland Avenue E	296	300	0.2	PASS
SR 512 Westbound	S512ON S0035	On-Ramp	WB SR 512 On from Portland Avenue E	380	367	0.7	PASS
SR 512 Westbound	S512OF S0025	Off-Ramp	WB SR 512 Off to SR 7	417	407	0.5	PASS
SR 512 Westbound	S512GP L0024	Mainline	WB SR 512 btwn SR 7 Off & Loop On	2,961	2924	0.5	PASS
SR 512 Westbound	S512ON L0022	On-Ramp	WB SR 512 On from SR 7 NB	458	452	0.3	PASS
SR 512 Westbound	S512GP L0020	Mainline	WB SR 512 btwn SR 7 Loop On & Slip On	3,341	3376	0.3	PASS
SR 512 Westbound	S512ON S0017	On-Ramp	WB SR 512 On from SR 7 SB	160	157	0.2	PASS
SR 512 Westbound	S512OF S0009	Off-Ramp	WB SR 512 Off to Steele St S	284	296	0.7	PASS
SR 512 Westbound	S512ON L0007	On-Ramp	WB SR 512 On from Steele St S	837	837	0.0	PASS
SR 512 Westbound	S512GP L-002	Mainline Exit	WB SR 512 w/o I-5	1,586	1570	0.2	PASS
			Sum of All Segment Flows within Calibration Area =	157,290	132,494	-15.8%	FAIL

Table B-16. WSDOT VISSIM Protocol Validation Results - Throughput Volumes - Peak 3 Hour - 6:00-9:00 AM Peak Summary

Measure	Value
# of Freeway Mainline Links with Counts	25
# of Freeway Mainline Links with GEH <= 3	22
% of Freeway Mainline Links with GEH <=3	88%
# of Freeway Mainline Entry/Exit Links with Counts:	4
# of Freeway Mainline Entry/Exit Links with GEH <=3:	2
% of Freeway Mainline Entry/Exit Links with GEH <=3:	50%
# of Entrance/Exit Ramp Links with Counts:	51
# of Entrance/Exit Ramp Links with GEH <= 3:	49
% of Entrance/Exit Ramp Links with GEH <= 3:	96%
# of Local Roadway Links with Counts:	0
# of Local Roadway Links with GEH <= 3:	0
% of Local Roadway Links with GEH <= 3:	N/A

SR 512 Vissim Temporal Speed Results – PM Period

Figure B-3. PM Period SR 512 Eastbound-General Purpose Lanes (I-5 to Puyallup River Bridge)

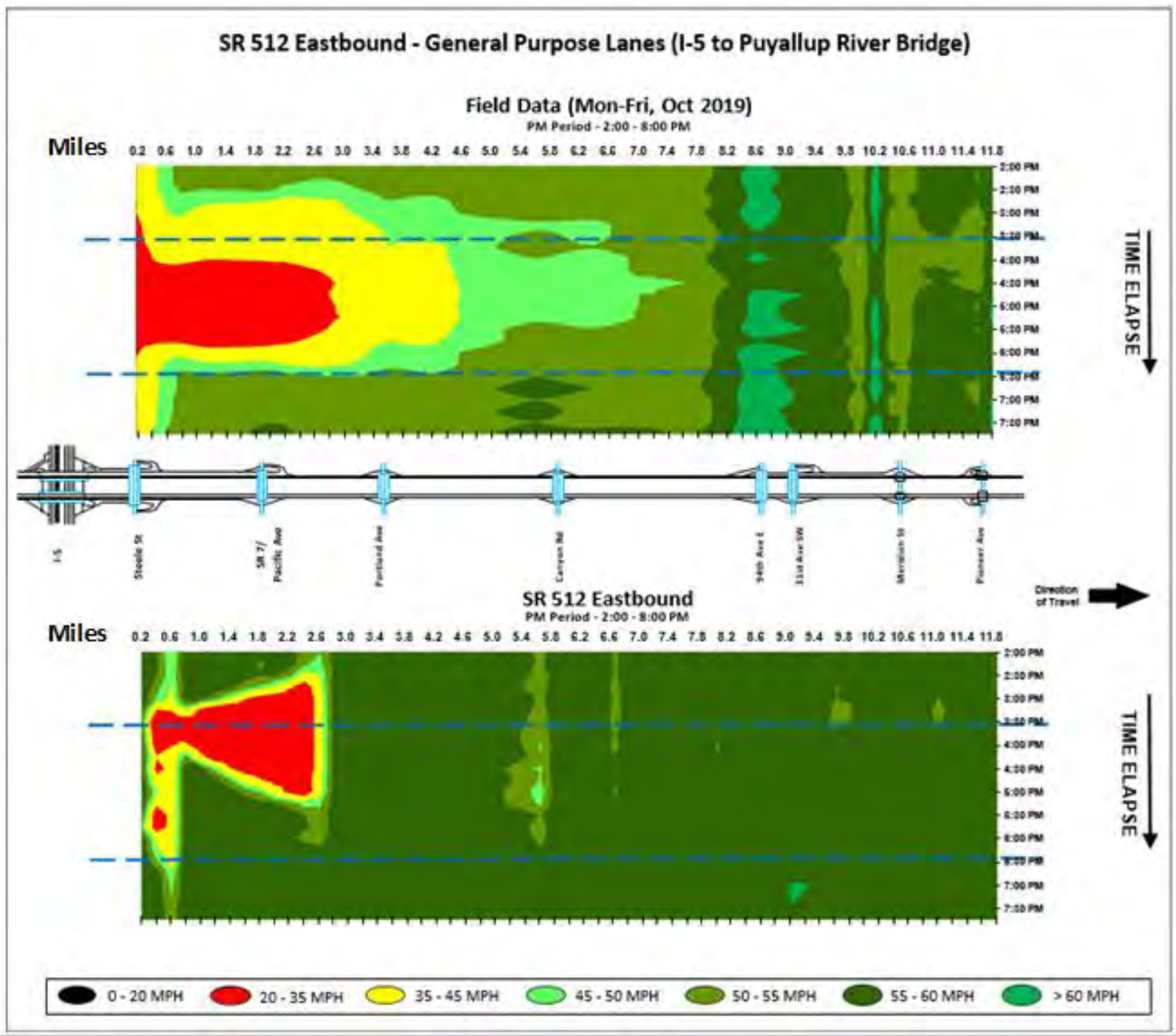
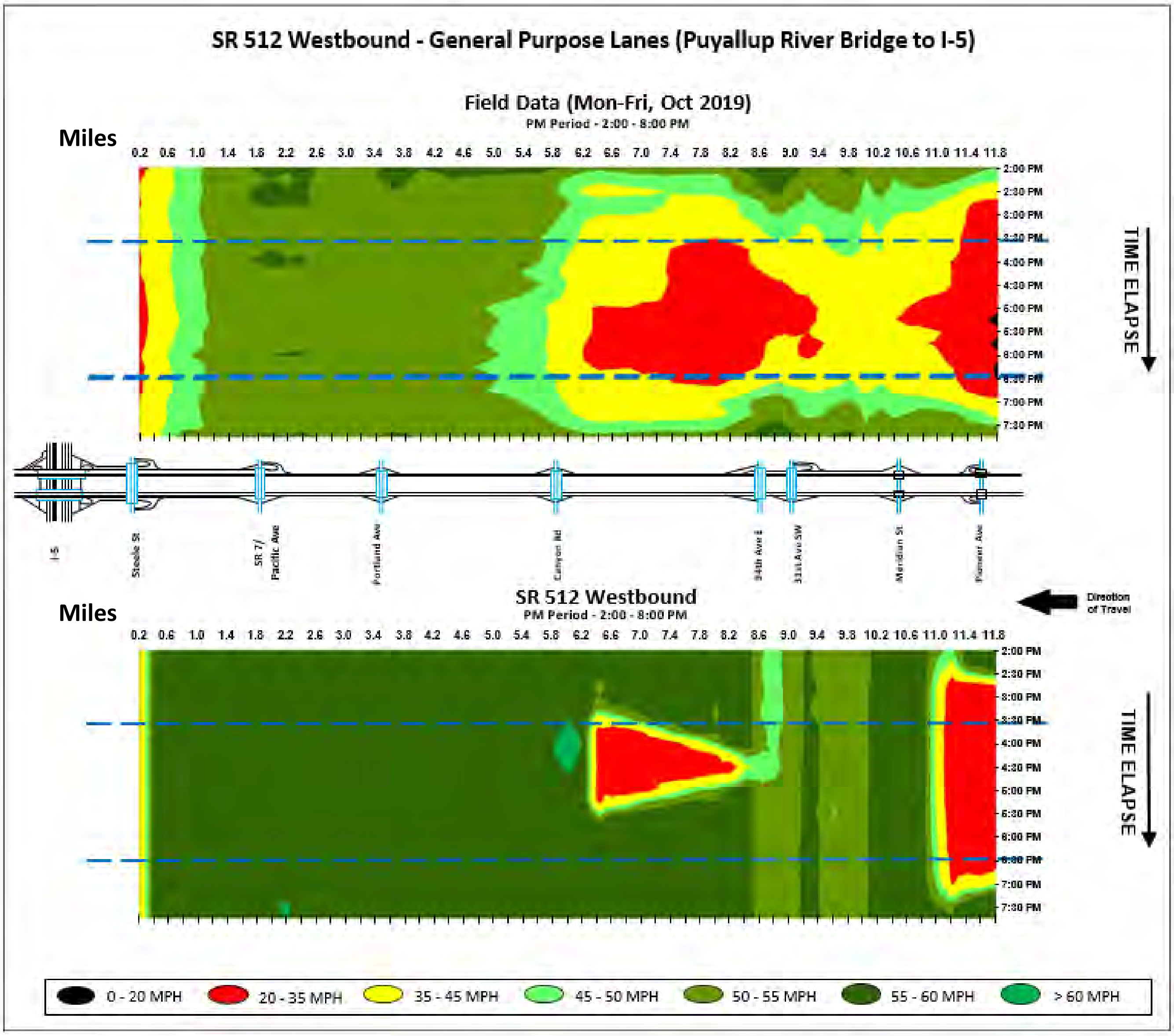


Figure B-4. PM Peak Westbound General Purpose Lanes (Puyallup River Bridge to I-5)



I-5 Vissim Validation Results - 2019 Existing PM Peak Period (3:30-6:30 PM)

Table B-17. PM Peak Volume Validation (GEH Criteria)

Lane Type	Total Links with counts	# Links that meet criteria	Results	Validation Metric Achieved
Freeway Mainline	26	20		
Ramps	51	51		
Total of All Links =	77	71	92%	Yes

Table B-18. PM Peak Volume Validation (FHWA Volume Criteria)

Lane Type	Total Links with counts	# Links that meet criteria	Results	Validation Metric Achieved
Freeway Mainline	26	22		
Ramps	51	51		
Total of All Links =	77	73	95%	Yes
		Difference in sum of all link flows =	4%	Yes

Table B-19. FHWA Performance Criteria and Measures

FHWA Performance Criteria and Measures	Validation Acceptance Target
Individual link flows	
Flow < 700 veh/h, Within 100 veh/h	> 85% of cases
700 veh/h < Flow < 2700 veh/h, Within 15%	> 85% of cases
Flow > 2700 veh/h, Within 400 veh/h	> 85% of cases
Difference in sum of all link flows	Within 5%
GEH Statistic Value	
GEH Statistic Value < 5, for individual link flows	> 85% cases
GEH Statistic Value for Sum of All Link Flows	< 4
Travel Times, Model versus Observed	
Within 15% (or 1 min, if higher)	> 85% cases

Table B-20. Network Travel Time Calibration: 2019 PM Peak 3 Hour - 3:30-6:30 PM (Primary Travel Time Routes for Calibration, SR 512 Eastbound)

Pathway	Segment	Distance (Miles)	Field Travel Time (Minutes)	VISSIM Travel Time (Minutes)	Abs Diff (Minutes)	Diff.%	Within 1 minute?	Validation Metric Achieved?
512-EB1-2	SR 512 Eastbound - Steele St S to Puyallup River Bridge	10.93	14.7	14.7	0.0	0%	Yes	Yes
512-EB1	SR 512 Eastbound - Steele St S to Waller Rd S	3.94	7.0	7.3	0.3	4%	Yes	Yes
512-EB2	SR 512 Eastbound - Waller Rd S to Puyallup River Bridge	6.99	7.7	7.4	-0.3	-4%	Yes	Yes

Table B-21. Network Travel Time Calibration: 2019 PM Peak 3 Hour - 3:30-6:30 PM (Secondary Travel Time Routes for Calibration, SR 512 Westbound)

Pathway	Segment	Distance (Miles)	Field Travel Time (Minutes)	VISSIM Travel Time (Minutes)	Abs Diff (Minutes)	Diff.%	Within 1 minute?	Validation Metric Achieved?
512-WB1-2	SR 512 Westbound - Puyallup River Bridge to Steele St S	10.90	15.4	14.5	-0.9	-6%	Yes	Yes
512-WB1	SR 512 Westbound - Puyallup River Bridge to Waller Rd S	6.97	11.2	10.4	-0.8	-7%	Yes	Yes
512-WB2	SR 512 Westbound - Waller Rd S to Steele St S	3.93	4.2	4.1	-0.1	-2%	Yes	Yes

Table B-22. FHWA Validation Results - Throughput Volumes - Peak 3 Hour - 3:30-6:30 PM

Road/ Direction	Link ID	Facility Type	Roadway Description	Field Count (vph)	VISSIM Model Throughput (vph)	Pass/Fail FHWA Volume Criteria	GEH	Pass/Fail GEH Criteria
I-5 Northbound	N005OF S1234	Off-Ramp	NB I-5 off to N Thorne Ln SW	228	228	PASS	0.0	PASS
I-5 Northbound	N005GP L1236	Mainline	NB I-5 at N Thorne Ln SW	4,654	4668	PASS	0.2	PASS
I-5 Northbound	N005ON S1239	On-Ramp	NB I-5 on from N Thorne Ln SW	840	800	PASS	1.4	PASS
I-5 Northbound	N005GP L1241	Mainline	NB I-5 btwn Thorne Lane & Gravelly Lake Dr	5,201	5473	PASS	3.7	PASS
I-5 Northbound	N005OF S1243	Off-Ramp	NB I-5 off to Gravelly Lake Dr SW	686	690	PASS	0.2	PASS
I-5 Northbound	N005ON S1251	On-Ramp	NB I-5 on from Gravelly Lake Dr SW	504	506	PASS	0.1	PASS
I-5 Northbound	N005OF S1256	Off-Ramp	NB I-5 Off to Bridgeport Way	667	670	PASS	0.1	PASS
I-5 Northbound	N005GP L1259	Mainline	NB I-5 at Bridgeport Way	4,400	4623	PASS	3.3	PASS
I-5 Northbound	N005GP L1267	Mainline	NB I-5 btwn Bridgeport Way & SR 512	5,276	5346	PASS	1.0	PASS
I-5 Northbound	S512ON L0001	System Ramp	NB I-5-to-WB SR 512 (NE Loop)	106	106	PASS	0.0	PASS
I-5 Northbound	N512ON S0003	System Ramp	NB I-5-to-SR 512 EB (SE Slip)	1,359	1431	PASS	1.9	PASS
I-5 Northbound	S512OF S0003	System Ramp	WB SR512-to-NB I-5 (NE Slip)	1,598	1601	PASS	0.1	PASS
I-5 Northbound	N512OF L0001	System Ramp	EB SR512-to-NB I-5 (SE Loop)	458	459	PASS	0.1	PASS
I-5 Northbound	N005GP L1283	Mainline	NB I-5 btwn SR 512 & S 84th St	5,812	5880	PASS	0.9	PASS
I-5 Northbound	N005OF S1286	Off-Ramp	NB I-5 Off to S Hosmer St	378	375	PASS	0.1	PASS
I-5 Northbound	N005OF S1294	Off-Ramp	NB I-5 Off to S 74th St	375	374	PASS	0.1	PASS
I-5 Southbound	S005ON L1293	On-Ramp	SB I-5 On from S 72nd St	294	294	PASS	0.0	PASS
I-5 Southbound	S005GP L1289	Mainline	SB I-5 btwn S 72nd St and S 84th St	5,246	5283	PASS	0.5	PASS
I-5 Southbound	S005ON S1286	On-Ramp	SB I-5 On from S 84th St	289	289	PASS	0.0	PASS
I-5 Southbound	N512ON S0000	System Ramp	SB I-5 Off to SR 512 EB (3 SB LT)	2,184	2183	PASS	0.0	PASS
I-5 Southbound	S512ON S0000	System Ramp	SB I-5 Off to SR 512 WB (2 SB RT)	487	488	PASS	0.1	PASS
I-5 Southbound	S512OF L0000	System Ramp	WB SR 512 to SB I-5 (NW loop)	914	897	PASS	0.6	PASS
I-5 Southbound	N512OF S0000	System Ramp	EB SR 512 to SB I-5 (SW slip)	217	217	PASS	0.0	PASS
I-5 Southbound	S005GP L1267	Mainline	SB I-5 btwn SR 512 and Bridgeport Way	4,264	4018	PASS	3.8	PASS
I-5 Southbound	S005OF S1261	Off-Ramp	SB I-5 Off to Bridgeport Way	525	524	PASS	0.0	PASS
I-5 Southbound	S005GP L1259	Mainline	SB I-5 at Bridgeport Way	3,656	3497	PASS	2.7	PASS
I-5 Southbound	S005ON S1256	On-Ramp	SB I-5 On from Bridgeport Way	622	623	PASS	0.1	PASS
I-5 Southbound	S005OF S1251	Off-Ramp	SB I-5 Off to Gravelly Lake Dr SW	362	362	PASS	0.0	PASS
I-5 Southbound	S005GP	Mainline	SB I-5 at Gravelly Lake Dr SW	3,567	3761	PASS	3.2	PASS

Road/ Direction	Link ID	Facility Type	Roadway Description	Field Count (vph)	VISSIM Model Throughput (vph)	Pass/Fail FHWA Volume Criteria	GEH	Pass/Fail GEH Criteria
	L1247							
I-5 Southbound	S005ON S1243	On-Ramp	SB I-5 On from Gravelly Lake Dr SW	569	573	PASS	0.2	PASS
I-5 Southbound	S005GP L1241	Mainline	SB I-5 btwn Gravelly Lake Dr SW and N Thorne Ln SW	4,329	4335	PASS	0.1	PASS
I-5 Southbound	S005GP L1236	Mainline	SB I-5 at N Thorne Ln SW	3,774	3859	PASS	1.4	PASS
I-5 Southbound	S005ON S1234	On-Ramp	SB I-5 On from N Thorne Ln SW	244	245	PASS	0.1	PASS
SR 512 Eastbound	N512OF L0007	Off-Ramp	EB SR 512 Off to Steele St S	1,153	1141	PASS	0.4	PASS
SR 512 Eastbound	N512ON S0009	On-Ramp	EB SR 512 On from Steele St S	207	214	PASS	0.5	PASS
SR 512 Eastbound	N512GP L0013	Mainline	EB SR 512 btwn Steele St S and SR 7	2,201	3810	FAIL	29.3	FAIL
SR 512 Eastbound	N512OF S0017	Off-Ramp	EB SR 512 Off to SR 7	839	865	PASS	0.9	PASS
SR 512 Eastbound	N512GP L0020	Mainline	EB SR 512 at SR 7	2,712	3023	PASS	5.8	SUSPECT
SR 512 Eastbound	N512ON S0025	On-Ramp	EB SR 512 On from SR 7	504	542	PASS	1.6	PASS
SR 512 Eastbound	N512OF S0035	Off-Ramp	EB SR 512 Off to Portland Ave E	343	376	PASS	1.7	PASS
SR 512 Eastbound	N512ON S0039	On-Ramp	EB SR 512 On from Portland Ave E	372	373	PASS	0.1	PASS
SR 512 Eastbound	N512GP L0050	Mainline	EB SR 512 btwn Portland Ave E and Canyon Rd E	3,133	3586	FAIL	7.8	SUSPECT
SR 512 Eastbound	N512OF S0056	Off-Ramp	EB SR 512 Off to Canyon Rd E	1,029	1083	PASS	1.7	PASS
SR 512 Eastbound	N512GP L0070	Mainline	EB SR 512 btwn Canyon Rd E and 94th Ave E	2,943	3354	FAIL	7.3	SUSPECT
SR 512 Eastbound	N512OF S0079	Off-Ramp	EB SR 512 Off to 94th Ave E	633	669	PASS	1.4	PASS
SR 512 Eastbound	N512OF S0085	Off-Ramp	EB SR 512 Off to 31st Ave SW	608	632	PASS	1.0	PASS
SR 512 Eastbound	N512GP L0090	Mainline	EB SR 512 at 31st Ave SW	1,889	2069	PASS	4.0	PASS
SR 512 Eastbound	N512ON S0090	On-Ramp	EB SR 512 On from 31st Ave SW	1,069	1105	PASS	1.1	PASS
SR 512 Eastbound	N512GP L0095	Mainline	EB SR 512 btwn 31st Ave SW and Meridian St	2,953	3181	PASS	4.1	PASS
SR 512 Eastbound	N512OF S0098	Off-Ramp	EB SR 512 Off to Meridian St	238	251	PASS	0.8	PASS
SR 512 Eastbound	N512GP L0100	Mainline	EB SR 512 at Meridian St	2,534	2935	FAIL	7.7	SUSPECT
SR 512 Eastbound	N512ON S0104	On-Ramp	EB SR 512 On from Meridian St	444	462	PASS	0.9	PASS
SR 512 Eastbound	N512OF S0111	Off-Ramp	EB SR 512 Off to Pioneer Ave	413	427	PASS	0.7	PASS
SR 512 Eastbound	N512GP L0111	Mainline	EB SR 512 at Pioneer Ave	2,782	2979	PASS	3.7	PASS
SR 512 Eastbound	N512ON L0111	On-Ramp	EB SR 512 On from Pioneer Ave	184	185	PASS	0.1	PASS
SR 512 Eastbound	N512GP L0116	Mainline Exit	EB SR 512 n/o Pioneer Ave	2,960	3166	PASS	3.7	PASS
SR 512 Westbound	S512GP L0116	Mainline Enter	WB SR 512 n/o E Pioneer	3,342	3116	PASS	4.0	PASS
SR 512 Westbound	S512OF L0111	Off-Ramp	WB SR 512 Off to E Pioneer	143	132	PASS	0.9	PASS
SR 512	S512ON	On-Ramp	WB SR 512 On from E Pioneer	679	674	PASS	0.2	PASS

Road/ Direction	Link ID	Facility Type	Roadway Description	Field Count (vph)	VISSIM Model Throughput (vph)	Pass/Fail FHWA Volume Criteria	GEH	Pass/Fail GEH Criteria
Westbound	S0111							
SR 512 Westbound	S512OF S0104	Off-Ramp	WB SR 512 Off to S Meridian	358	329	PASS	1.6	PASS
SR 512 Westbound	S512ON S0098	On-Ramp	WB SR 512 On from S Meridian	366	366	PASS	0.0	PASS
SR 512 Westbound	S512OF S0090	Off-Ramp	WB SR 512 Off to 31st Avenue SW	1,584	1469	PASS	2.9	PASS
SR 512 Westbound	S512ON S0079	On-Ramp	WB SR 512 On from 94th Avenue E	406	416	PASS	0.5	PASS
SR 512 Westbound	S512GP L0070	Mainline	WB SR 512 btwn 94th Avenue E and Canyon Rd E	3,133	3121	PASS	0.2	PASS
SR 512 Westbound	S512OF S0061	Off-Ramp	WB SR 512 Off to Canyon Rd E	933	883	PASS	1.7	PASS
SR 512 Westbound	S512ON S0056	On-Ramp	WB SR 512 On from Canyon Rd E	704	703	PASS	0.0	PASS
SR 512 Westbound	S512GP L0050	Mainline	WB SR 512 btwn Canyon Rd E and Portland Avenue E	2,840	2952	PASS	2.1	PASS
SR 512 Westbound	S512OF S0039	Off-Ramp	WB SR 512 Off to Portland Avenue E	441	419	PASS	1.0	PASS
SR 512 Westbound	S512ON S0035	On-Ramp	WB SR 512 On from Portland Avenue E	377	377	PASS	0.0	PASS
SR 512 Westbound	S512OF S0025	Off-Ramp	WB SR 512 Off to SR 7	645	626	PASS	0.8	PASS
SR 512 Westbound	S512GP L0024	Mainline	WB SR 512 btwn SR 7 Off & Loop On	2,167	2300	PASS	2.8	PASS
SR 512 Westbound	S512ON L0022	On-Ramp	WB SR 512 On from SR 7 NB	419	416	PASS	0.2	PASS
SR 512 Westbound	S512GP L0020	Mainline	WB SR 512 btwn SR 7 Loop On & Slip On	2,531	2716	PASS	3.6	PASS
SR 512 Westbound	S512ON S0017	On-Ramp	WB SR 512 On from SR 7 SB	215	230	PASS	1.0	PASS
SR 512 Westbound	S512OF S0009	Off-Ramp	WB SR 512 Off to Steele St S	253	251	PASS	0.1	PASS
SR 512 Westbound	S512ON L0007	On-Ramp	WB SR 512 On from Steele St S	652	652	PASS	0.0	PASS
SR 512 Westbound	S512GP L0004	Mainline	WB SR 512 btwn Steele St S and I-5	3,068	3352	PASS	5.0	SUSPECT
			Sum of All Segment Flows within Calibration Area (Freeway and Arterial) =	157,291	163,740		4.1%	PASS

Table B-23. FHWA Validation Results - Throughput Volumes - Peak 3 Hour - 3:30-6:30 PM Peak Summary

Measure	Value
# of Freeway Mainline Links with Counts	26
# that meet FHWA Volume Criteria	22
% that meet FHWA Volume Criteria	PASS
# of Freeway Ramp Links with Counts	51
# that meet FHWA Volume Criteria	51
% that meet FHWA Volume Criteria	PASS

Table B-24. FHWA Validation Results - Throughput Volumes - Peak 3 Hour - 3:30-6:30 PM GEH Statistics Value

Measure	Value
# of Freeway Mainline Links with Counts	26
# with GEH <= 5	20
% with GEH <= 5	77% FAIL
# of Freeway Ramp Links with Counts	51
# with GEH <= 5	51
% with GEH <= 5	100% PASS

Table B-25. FHWA Performance Criteria and Measures

FHWA Performance Criteria and Measures	Validation Acceptance Target
Individual link flows	
Flow < 700 veh/h, Within 100 veh/h	> 85% of cases
700 veh/h < Flow < 2700 veh/h, Within 15%	> 85% of cases
Flow > 2700 veh/h, Within 400 veh/h	> 85% of cases
Difference in sum of all link flows	Within 5%
GEH Statistic Value	
GEH Statistic Value < 5, for individual link flows	> 85% cases
GEH Statistic Value for Sum of All Link Flows	< 4
Travel Times, Model versus Observed	
Within 15% (or 1 min, if higher)	> 85% cases

I-5 – Vissim Validation Results with WSDOT VISSIM Protocol Criteria-2019 Existing PM Peak Period (3:30-6:30 PM)

Table B-26. PM Peak Volume Validation (WSDOT VISSIM Protocol Criteria)

Lane Type	Total Links with counts	# Links that meet criteria	Results	Validation Metric Achieved
State Facility Segments	24	19	79%	
Entry/Exit Locations	2	2	100%	
Entrance/Exit Ramps	51	51	100%	
Local Road Segments	0	0	n/a	
85% of All Links Within Criteria?	77	72	94%	Yes
		Sum of All Segment Flows =	4%	Yes

Table B-27. Network Travel Time Calibration: 2019 PM Peak 3 Hour – 3:30-6:30 PM (Primary Travel Time Routes for Calibration, SR 512 Eastbound)

Pathway	Segment	Facility Type	Distance (Miles)	Field Travel Time (Minutes)	VISSIM Travel Time (Minutes)	Abs Diff (Minutes)	Calibration Goal based on Facility Type (+/- Minutes)	Validation Metric Achieved?
512-EB1-2	SR 512 Eastbound - Steele St S to Puyallup River Bridge	Free-Flowing	10.93	14.7	14.7	0.0	1.1	Yes
512-EB1	SR 512 Eastbound - Steele St S to Waller Rd S	Free-Flowing	3.94	7.0	7.3	0.3	0.7	Yes
512-EB2	SR 512 Eastbound - Waller Rd S to Puyallup River Bridge	Free-Flowing	6.99	7.7	7.4	-0.3	0.5	Yes

Table B-28. Network Travel Time Calibration: 2019 PM Peak 3 Hour – 3:30-6:30 PM (Secondary Travel Time Routes for Calibration, SR 512 Westbound)

Pathway	Segment	Facility Type	Distance (Miles)	Field Travel Time (Minutes)	VISSIM Travel Time (Minutes)	Abs Diff (Minutes)	Calibration Goal based on Facility Type (+/- Minutes)	Validation Metric Achieved?
512-WB1-2	SR 512 Westbound - Puyallup River Bridge to Steele St S	Free-Flowing	10.90	15.4	14.5	-0.9	1.2	Yes
512-WB1	SR 512 Westbound - Puyallup River Bridge to Waller Rd S	Free-Flowing	6.97	11.2	10.4	-0.8	1.0	Yes
512-WB2	SR 512 Westbound - Waller Rd S to Steele St S	Free-Flowing	3.93	4.2	4.1	-0.1	0.3	Yes

Table B-29. GEH Criteria and Targets

Criteria	Acceptable Targets
GEH < 3.0	All state facility segments within the calibration area
GEH < 3.0	All entry and exit locations within the calibration area
GEH < 3.0	All entrance and exit ramps within the calibration area
GEH < 5.0	At least 85% of applicable local roadway segments
Sum of all segment flows within the calibration area	Within 5%

Table B-30. Facility Type Equations

Facility Type	Equation
Free-flowing	$\Delta = \dfrac{1}{\dfrac{1}{t} - \dfrac{4.4}{L}} - t$
Interrupted Flow	$\Delta = \dfrac{1}{\dfrac{1}{t} - \dfrac{0.1 * 5280\,S}{3600\,L}} - t$
Δ = Allowable Travel Time Variation (+/- seconds) t = Real World Travel Time (seconds) L = Length (feet) S = Free Flow Speed (mph); Posted Speed may be used for FFS if unknown	

Table B-31. WSDOT VISSIM Protocol Validation Results - Throughput Volumes - Peak 3 Hour - 3:30-6:30 PM

Road/ Direction	Link ID	Facility Type	Roadway Description	Count (vph)	VISSIM Model (vph)	GEH Statistic Calibration Score	Pass/Fail GEH Criteria
I-5 Northbound	N005OF S1234	Off-Ramp	NB I-5 off to N Thorne Ln SW	228	228	0.0	PASS
I-5 Northbound	N005GP L1236	Mainline	NB I-5 at N Thorne Ln SW	4,654	4668	0.1	PASS
I-5 Northbound	N005ON S1239	On-Ramp	NB I-5 on from N Thorne Ln SW	840	800	1.4	PASS
I-5 Northbound	N005GP L1241	Mainline	NB I-5 btwn Thorne Lane & Gravelly Lake Dr	5,201	5473	1.9	PASS
I-5 Northbound	N005OF S1243	Off-Ramp	NB I-5 off to Gravelly Lake Dr SW	686	690	0.2	PASS
I-5 Northbound	N005ON S1251	On-Ramp	NB I-5 on from Gravelly Lake Dr SW	504	506	0.1	PASS
I-5 Northbound	N005OF S1256	Off-Ramp	NB I-5 Off to Bridgeport Way	667	670	0.1	PASS
I-5 Northbound	N005GP L1259	Mainline	NB I-5 at Bridgeport Way	4,400	4623	1.7	PASS
I-5 Northbound	N005GP L1267	Mainline	NB I-5 btwn Bridgeport Way & SR 512	5,276	5346	0.5	PASS
I-5 Northbound	S512ON L0001	System Ramp	NB I-5-to-WB SR 512 (NE Loop)	106	106	0.0	PASS
I-5 Northbound	N512ON S0003	System Ramp	NB I-5-to-SR 512 EB (SE Slip)	1,359	1431	1.9	PASS
I-5 Northbound	S512OF S0003	System Ramp	WB SR512-to-NB I-5 (NE Slip)	1,598	1601	0.1	PASS
I-5 Northbound	N512OF L0001	System Ramp	EB SR512-to-NB I-5 (SE Loop)	458	459	0.1	PASS
I-5 Northbound	N005GP L1283	Mainline	NB I-5 btwn SR 512 & S 84th St	5,812	5880	0.4	PASS

Road/ Direction	Link ID	Facility Type	Roadway Description	Count (vph)	VISSIM Model (vph)	GEH Statistic Calibration Score	Pass/Fail GEH Criteria
I-5 Northbound	N005OF S1286	Off-Ramp	NB I-5 Off to S Hosmer St	378	375	0.1	PASS
I-5 Northbound	N005OF S1294	Off-Ramp	NB I-5 Off to S 74th St	375	374	0.1	PASS
I-5 Southbound	S005ON L1293	On-Ramp	SB I-5 On from S 72nd St	294	294	0.0	PASS
I-5 Southbound	S005GP L1289	Mainline	SB I-5 btwn S 72nd St and S 84th St	5,246	5283	0.3	PASS
I-5 Southbound	S005ON S1286	On-Ramp	SB I-5 On from S 84th St	289	289	0.0	PASS
I-5 Southbound	N512ON S0000	System Ramp	SB I-5 Off to SR 512 EB (3 SB LT)	2,184	2183	0.0	PASS
I-5 Southbound	S512ON S0000	System Ramp	SB I-5 Off to SR 512 WB (2 SB RT)	487	488	0.0	PASS
I-5 Southbound	S512OF L0000	System Ramp	WB SR 512 to SB I-5 (NW loop)	914	897	0.6	PASS
I-5 Southbound	N512OF S0000	System Ramp	EB SR 512 to SB I-5 (SW slip)	217	217	0.0	PASS
I-5 Southbound	S005GP L1267	Mainline	SB I-5 btwn SR 512 and Bridgeport Way	4,264	4018	1.9	PASS
I-5 Southbound	S005OF S1261	Off-Ramp	SB I-5 Off to Bridgeport Way	525	524	0.0	PASS
I-5 Southbound	005GPL1 259	Mainline	SB I-5 at Bridgeport Way	3,656	3497	1.3	PASS
I-5 Southbound	S005ON S1256	On-Ramp	SB I-5 On from Bridgeport Way	622	623	0.1	PASS
I-5 Southbound	S005OF S1251	Off-Ramp	SB I-5 Off to Gravelly Lake Dr SW	362	362	0.0	PASS
I-5 Southbound	S005GP L1247	Mainline	SB I-5 at Gravelly Lake Dr SW	3,567	3761	1.6	PASS
I-5 Southbound	S005ON S1243	On-Ramp	SB I-5 On from Gravelly Lake Dr SW	569	573	0.2	PASS
I-5 Southbound	S005GP L1241	Mainline	SB I-5 btwn Gravelly Lake Dr SW and N Thorne Ln SW	4,329	4335	0.0	PASS
I-5 Southbound	S005GP L1236	Mainline	SB I-5 at N Thorne Ln SW	3,774	3859	0.8	PASS
I-5 Southbound	S005ON S1234	On-Ramp	SB I-5 On from N Thorne Ln SW	244	245	0.1	PASS
SR 512 Eastbound	N512OF L0007	Off-Ramp	EB SR 512 Off to Steele St S	1,153	1141	0.4	PASS
SR 512 Eastbound	N512ON S0009	On-Ramp	EB SR 512 On from Steele St S	207	214	0.5	PASS
SR 512 Eastbound	N512GP L0013	Mainline	EB SR 512 btwn Steele St S and SR 7	2,201	3810	16.9	FAIL
SR 512 Eastbound	N512OF S0017	Off-Ramp	EB SR 512 Off to SR 7	839	865	0.9	PASS
SR 512 Eastbound	N512GP L0020	Mainline	EB SR 512 at SR 7	2,712	3023	4.1	SUSPECT
SR 512 Eastbound	N512ON S0025	On-Ramp	EB SR 512 On from SR 7	504	542	1.6	PASS
SR 512 Eastbound	N512OF S0035	Off-Ramp	EB SR 512 Off to Portland Ave E	343	376	1.7	PASS
SR 512 Eastbound	N512ON S0039	On-Ramp	EB SR 512 On from Portland Ave E	372	373	0.1	PASS
SR 512 Eastbound	N512GP L0050	Mainline	EB SR 512 btwn Portland Ave E and Canyon Rd E	3,133	3586	5.5	FAIL
SR 512 Eastbound	N512OF S0056	Off-Ramp	EB SR 512 Off to Canyon Rd E	1,029	1083	1.7	PASS
SR 512 Eastbound	N512GP L0070	Mainline	EB SR 512 btwn Canyon Rd E and 94th Ave E	2,943	3354	5.2	FAIL
SR 512 Eastbound	N512OF S0079	Off-Ramp	EB SR 512 Off to 94th Ave E	633	669	1.4	PASS

Road/ Direction	Link ID	Facility Type	Roadway Description	Count (vph)	VISSIM Model (vph)	GEH Statistic Calibration Score	Pass/Fail GEH Criteria
SR 512 Eastbound	N512OF S0085	Off-Ramp	EB SR 512 Off to 31st Ave SW	608	632	1.0	PASS
SR 512 Eastbound	N512GP L0090	Mainline	EB SR 512 at 31st Ave SW	1,889	2069	2.9	PASS
SR 512 Eastbound	N512ON S0090	On-Ramp	EB SR 512 On from 31st Ave SW	1,069	1105	1.1	PASS
SR 512 Eastbound	N512GP L0095	Mainline	EB SR 512 btwn 31st Ave SW and Meridian St	2,953	3181	2.9	PASS
SR 512 Eastbound	N512OF S0098	Off-Ramp	EB SR 512 Off to Meridian St	238	251	0.8	PASS
SR 512 Eastbound	N512GP L0100	Mainline	EB SR 512 at Meridian St	2,534	2935	5.4	FAIL
SR 512 Eastbound	N512ON S0104	On-Ramp	EB SR 512 On from Meridian St	444	462	0.9	PASS
SR 512 Eastbound	N512OF S0111	Off-Ramp	EB SR 512 Off to Pioneer Ave	413	427	0.7	PASS
SR 512 Eastbound	N512GP L0111	Mainline	EB SR 512 at Pioneer Ave	2,782	2979	2.6	PASS
SR 512 Eastbound	N512ON L0111	On-Ramp	EB SR 512 On from Pioneer Ave	184	185	0.1	PASS
SR 512 Eastbound	N512GP L0116	Mainline Exit	EB SR 512 n/o Pioneer Ave	2,960	3166	2.6	PASS
SR 512 Westbound	S512GP L0116	Mainline Enter	WB SR 512 n/o E Pioneer	3,342	3116	2.8	PASS
SR 512 Westbound	S512OF L0111	Off-Ramp	WB SR 512 Off to E Pioneer	143	132	0.9	PASS
SR 512 Westbound	S512ON S0111	On-Ramp	WB SR 512 On from E Pioneer	679	674	0.2	PASS
SR 512 Westbound	S512OF S0104	Off-Ramp	WB SR 512 Off to S Meridian	358	329	1.6	PASS
SR 512 Westbound	S512ON S0098	On-Ramp	WB SR 512 On from S Meridian	366	366	0.0	PASS
SR 512 Westbound	S512OF S0090	Off-Ramp	WB SR 512 Off to 31st Avenue SW	1,584	1469	2.9	PASS
SR 512 Westbound	S512ON S0079	On-Ramp	WB SR 512 On from 94th Avenue E	406	416	0.5	PASS
SR 512 Westbound	S512GP L0070	Mainline	WB SR 512 btwn 94th Avenue E and Canyon Rd E	3,133	3121	0.1	PASS
SR 512 Westbound	S512OF S0061	Off-Ramp	WB SR 512 Off to Canyon Rd E	933	883	1.7	PASS
SR 512 Westbound	S512ON S0056	On-Ramp	WB SR 512 On from Canyon Rd E	704	703	0.0	PASS
SR 512 Westbound	S512GP L0050	Mainline	WB SR 512 btwn Canyon Rd E and Portland Avenue E	2,840	2952	1.5	PASS
SR 512 Westbound	S512OF S0039	Off-Ramp	WB SR 512 Off to Portland Avenue E	441	419	1.0	PASS
SR 512 Westbound	S512ON S0035	On-Ramp	WB SR 512 On from Portland Avenue E	377	377	0.0	PASS
SR 512 Westbound	S512OF S0025	Off-Ramp	WB SR 512 Off to SR 7	645	626	0.8	PASS
SR 512 Westbound	S512GP L0024	Mainline	WB SR 512 btwn SR 7 Off & Loop On	2,167	2300	2.0	PASS
SR 512 Westbound	S512ON L0022	On-Ramp	WB SR 512 On from SR 7 NB	419	416	0.2	PASS
SR 512 Westbound	S512GP L0020	Mainline	WB SR 512 btwn SR 7 Loop On & Slip On	2,531	2716	2.1	PASS
SR 512 Westbound	S512ON S0017	On-Ramp	WB SR 512 On from SR 7 SB	215	230	1.0	PASS
SR 512 Westbound	S512OF S0009	Off-Ramp	WB SR 512 Off to Steele St S	253	251	0.1	PASS
SR 512 Westbound	S512ON L0007	On-Ramp	WB SR 512 On from Steele St S	652	652	0.0	PASS

Road/ Direction	Link ID	Facility Type	Roadway Description	Count (vph)	VISSIM Model (vph)	GEH Statistic Calibration Score	Pass/Fail GEH Criteria
SR 512 Westbound	S512GP L0004	Mainline	WB SR 512 btwn Steele St S and I-5	3,068	3352	2.5	PASS
			Sum of All Segment Flows within Calibration Area =		163,740	4.1%	PASS

Table B-32. WSDOT VISSIM Protocol Validation Results - Throughput Volumes - Peak 3 Hour - 3:30-6:30 PM Peak Summary

Measure	Value
# of Freeway Mainline Links with Counts:	24
# of Freeway Mainline Links with GEH <= 3:	19
% of Freeway Mainline Links with GEH <=3:	79%
# of Freeway Mainline Entry/Exit Links with Counts:	2
# of Freeway Mainline Entry/Exit Links with GEH <=3:	2
% of Freeway Mainline Entry/Exit Links with GEH <=3:	100%
# of Entrance/Exit Ramp Links with Counts:	51
# of Entrance/Exit Ramp Links with GEH <= 3:	51
% of Entrance/Exit Ramp Links with GEH <= 3:	100%
# of Local Roadway Links with Counts:	0
# of Local Roadway Links with GEH <= 3:	0
% of Local Roadway Links with GEH <= 3:	N/A

Table B-33. GEH Criteria and Targets

Criteria	Acceptable Targets
GEH < 3.0	All state facility segments within the calibration area
GEH < 3.0	All entry and exit locations within the calibration area
GEH < 3.0	All entrance and exit ramps within the calibration area
GEH < 5.0	At least 85% of applicable local roadway segments
Sum of all segment flows within the calibration area	Within 5%

Appendix C Existing Traffic Volumes

Figure C-1. AM Peak Period (6:00-9:00 AM)

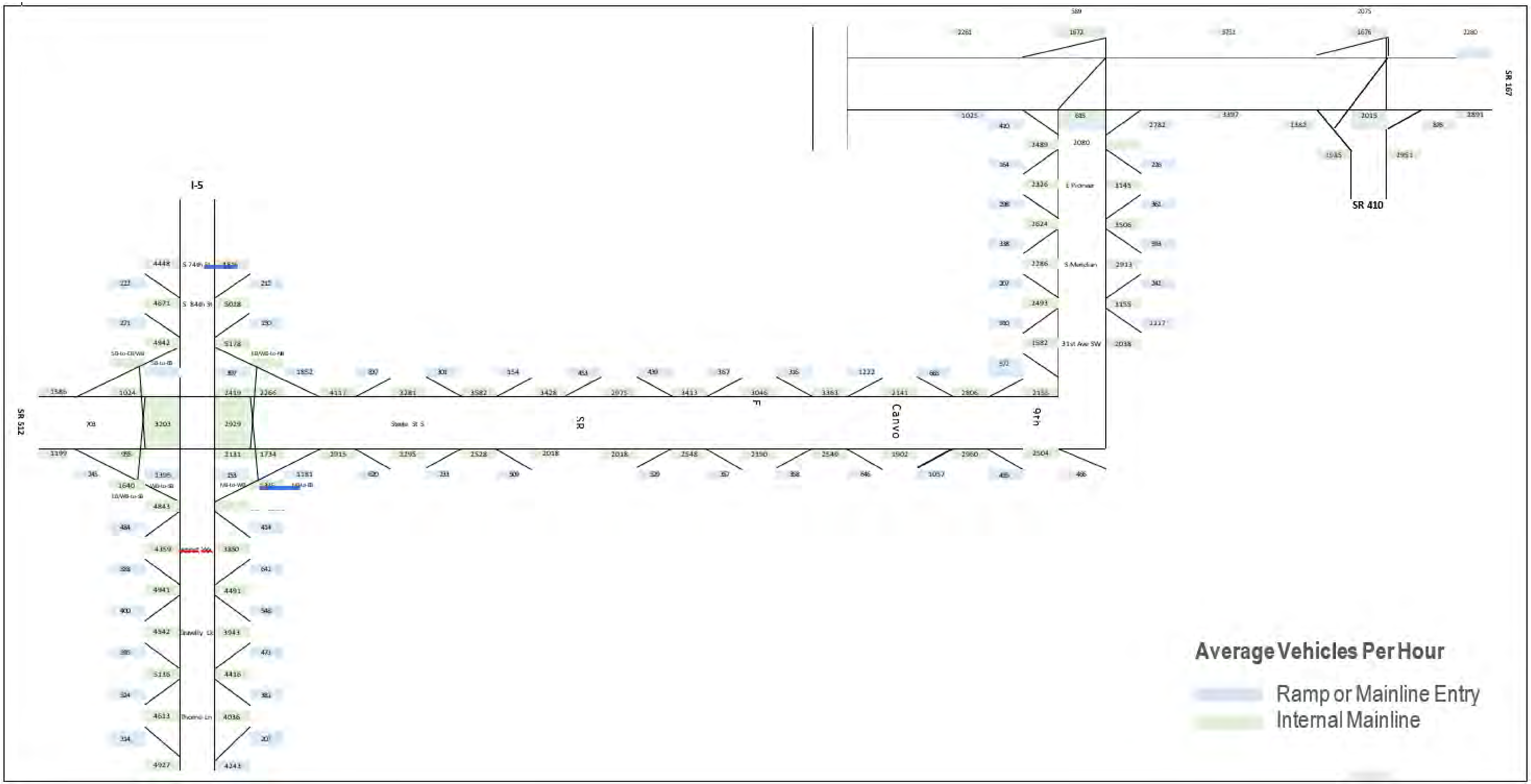


Figure C-2. PM Peak Period (3:30-6:30 PM)

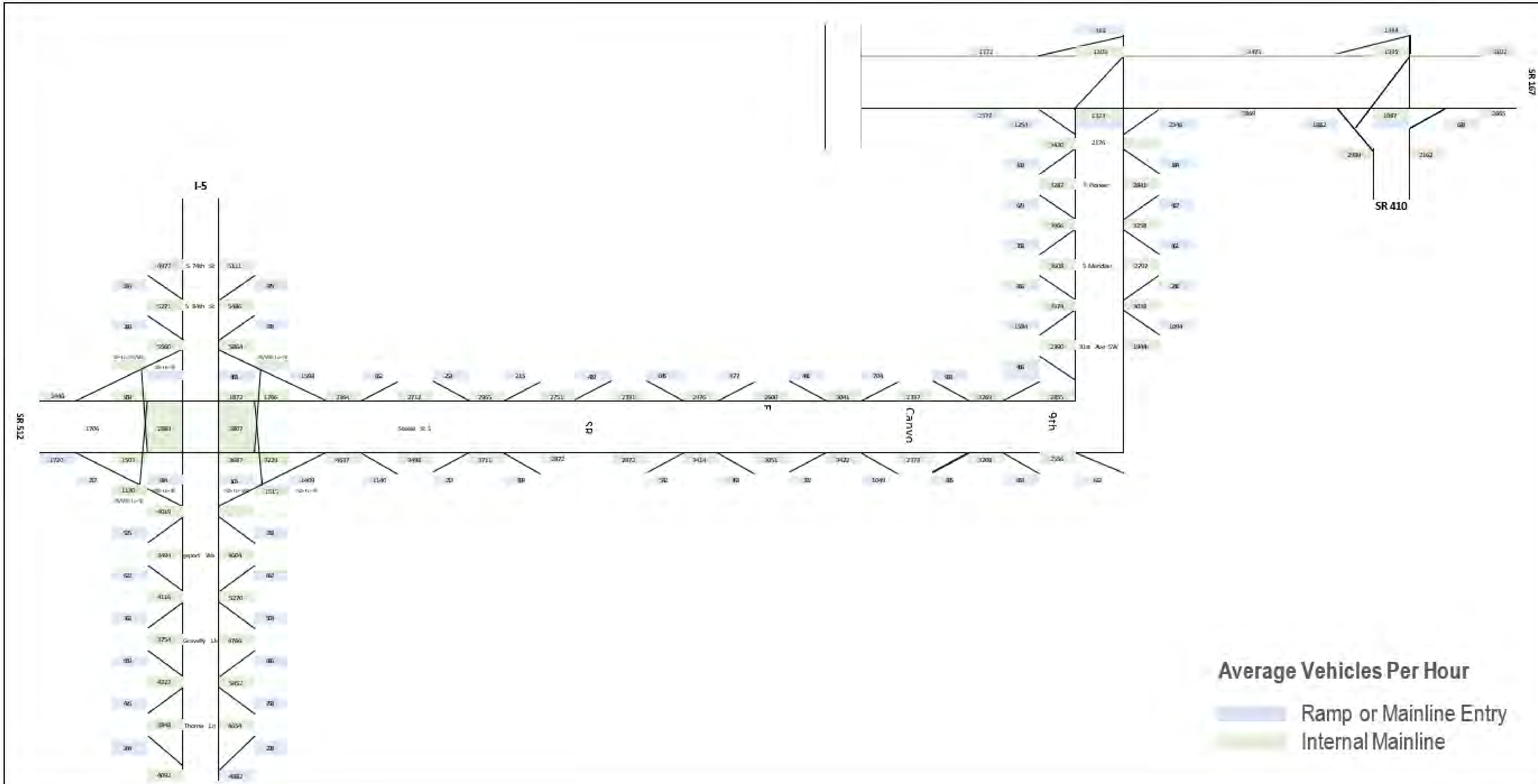


Figure C-3. Existing Traffic Volumes, AM Peak Balance, S Tacoma Way, I-5 Interchange, Steele St S

Figure C-4. Existing Traffic Volumes, AM Peak Balance, SR 7 and Portland Ave E

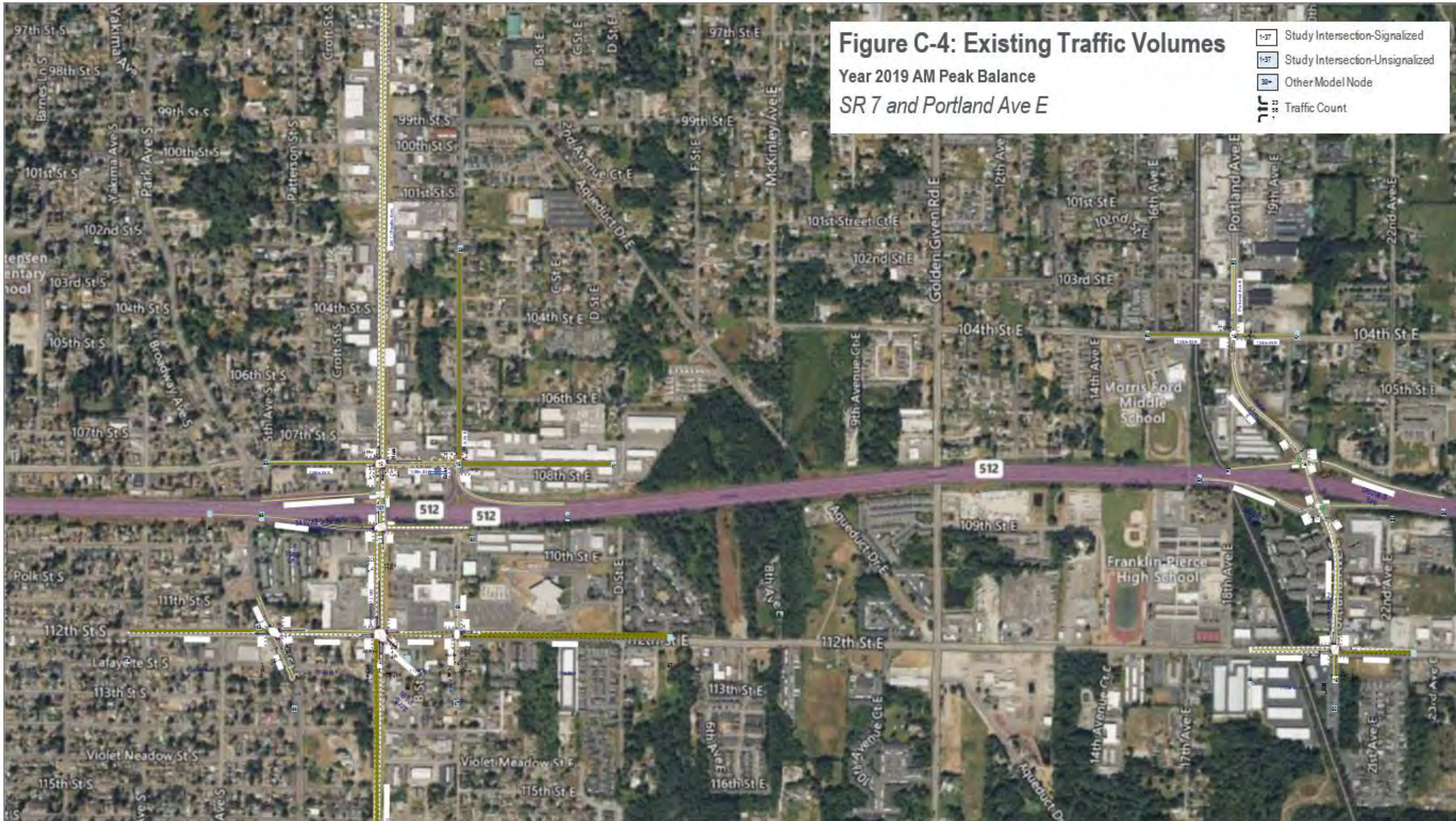


Figure C-5. Existing Traffic Volumes, AM Peak Balance, Canyon Road E

Figure C-6. Existing Traffic Volumes, AM Peak Balance, 94th Ave E and 31st Ave SW

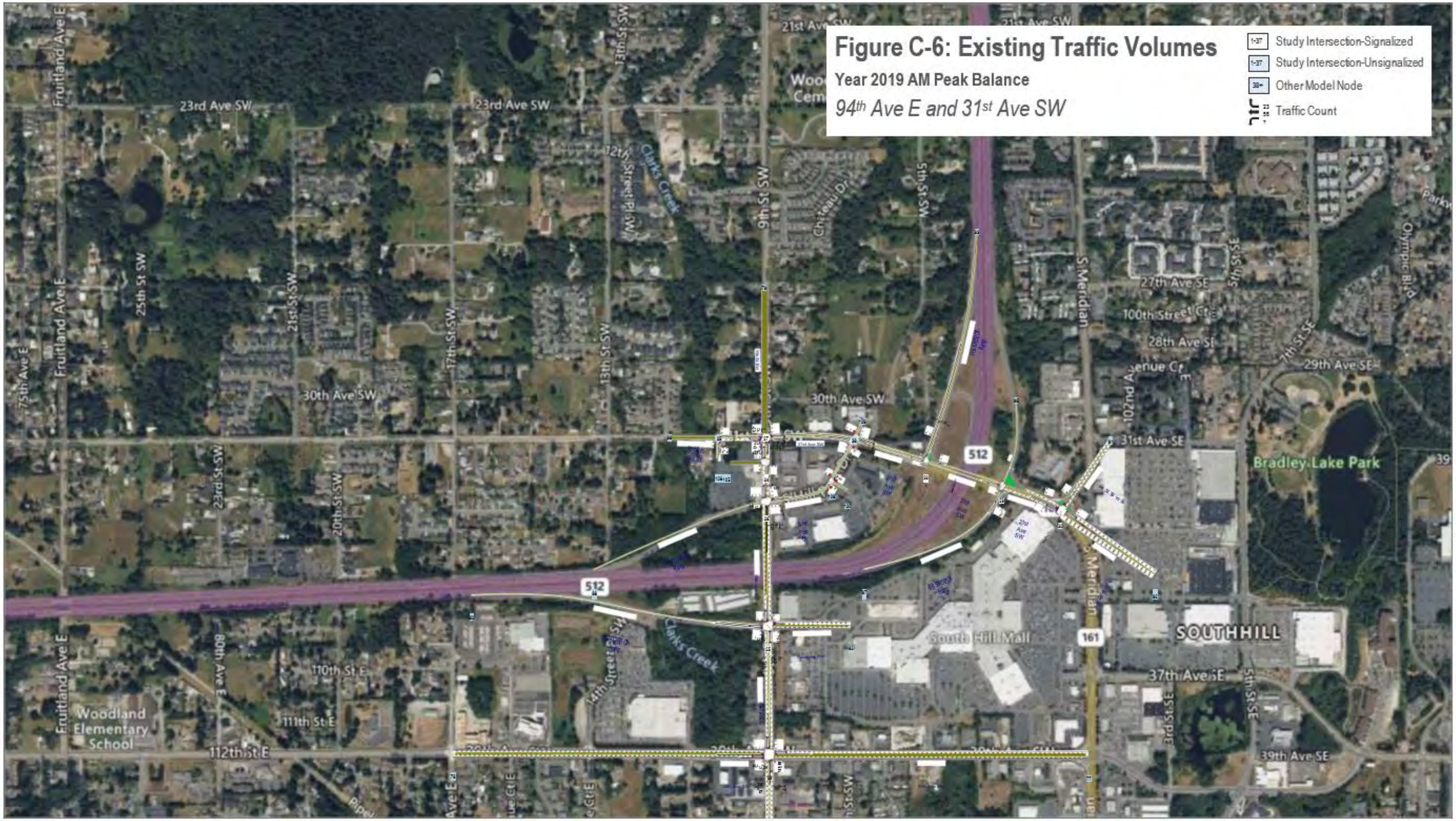


Figure C-7. Existing Traffic Volumes, AM Peak Balance, S Meridian

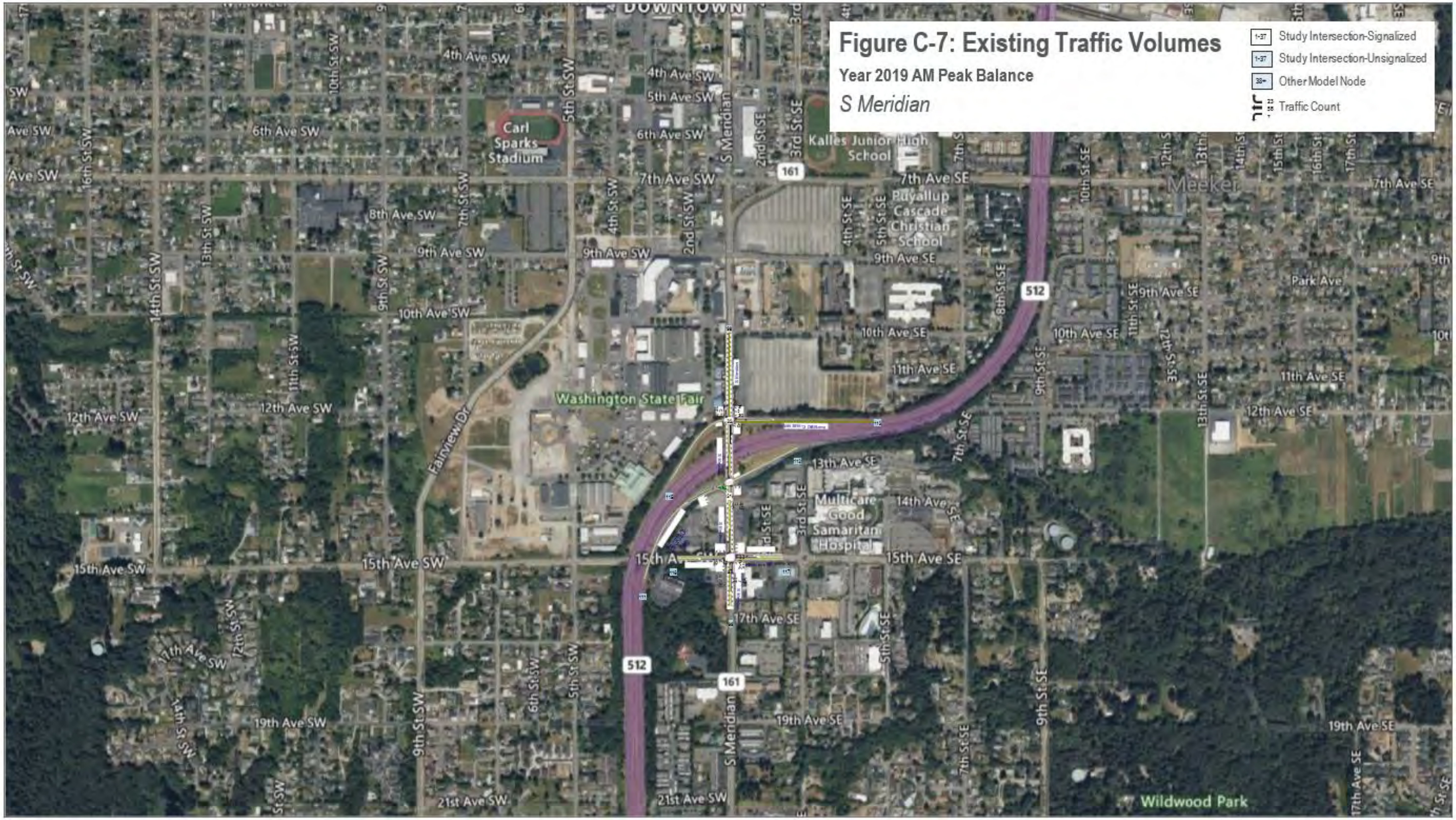


Figure C-8. Existing Traffic Volumes, PM Peak Balance, S Tacoma Way, I-5 Interchange, Steele St S

Figure C-9. Existing Traffic Volumes, PM Peak Balance, SR7 and Portland Ave E

Figure C-10. Existing Traffic Volumes, PM Peak Balance, Canyon Road E

Figure C-11. Existing Traffic Volumes, PM Peak Balance, 94th Ave E and 31st Ave SW

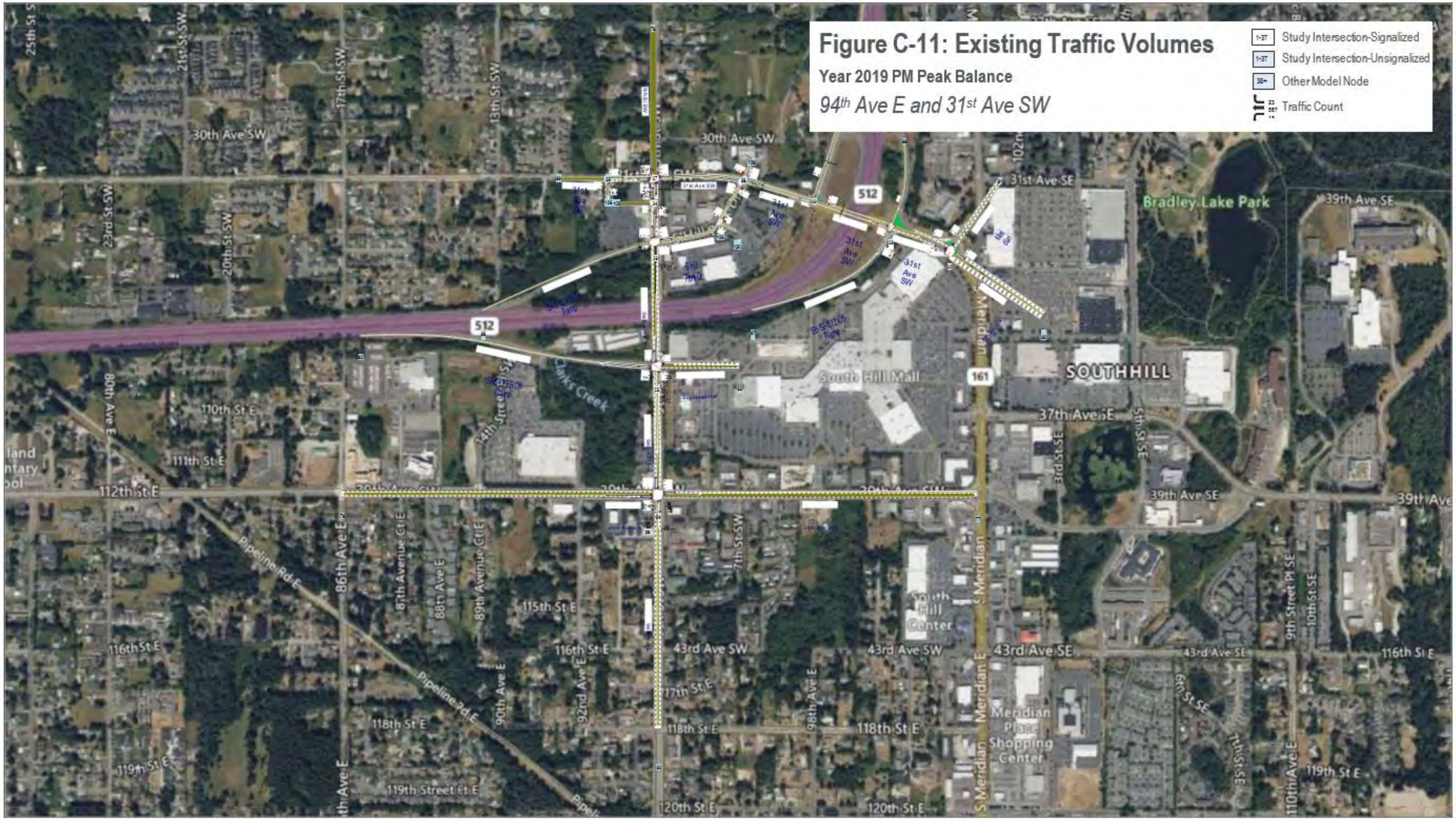


Figure C-12. Existing Traffic Volumes, PM Peak Balance, S Meridian

Appendix D Synchro HCM Results

1.0 AM Peak Hour (7:00-8:00 AM)

Table D-1. HCM 6th Signalized Intersection Summary - SR 512 & I-5 SB Off-Ramp (AM Peak)

HCM 6th Signalized Intersection Summary
1: SR 512 & 1-5 SB Off-Ramp 01/31/2023

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	1036	1261	0	1684	461
Future Volume (veh/h)	0	1036	1261	0	1684	461
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No	No		No	
Adj Sat Flow, veh/h/ln	0	1660	1688	0	1702	1702
Adj Flow Rate, veh/h	0	1126	1371	0	1830	501
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	10	8	0	7	7
Cap, veh/h	0	2565	2608	0	1566	870
Arrive On Green	0.00	0.57	0.57	0.00	0.34	0.34
Sat Flow, veh/h	0	4829	4911	0	4570	2538
Grp Volume(v), veh/h	0	1126	1371	0	1830	501
Grp Sat Flow(s),veh/h/ln	0	1510	1536	0	1523	1269
Q Serve(g_s), s	0.0	17.8	22.8	0.0	42.5	20.0
Cycle Q Clear(g_c), s	0.0	17.8	22.8	0.0	42.5	20.0
Prop In Lane	0.00			0.00	1.00	1.00
Lane Grp Cap(c), veh/h	0	2565	2608	0	1566	870
V/C Ratio(X)	0.00	0.44	0.53	0.00	1.17	0.58
Avail Cap(c_a), veh/h	0	2565	2608	0	1566	870
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	1.00	0.00	1.00	1.00
Uniform Delay (d), s/veh	0.0	15.5	16.6	0.0	40.8	33.4
Incr Delay (d2), s/veh	0.0	0.5	0.8	0.0	83.0	1.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	6.2	8.0	0.0	27.7	6.3
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	0.0	16.1	17.4	0.0	123.7	34.4
LnGrp LOS	A	B	B	A	F	C
Approach Vol, veh/h		1126	1371		2331	
Approach Delay, s/veh		16.1	17.4		104.5	
Approach LOS		B	B		F	

Timer - Assigned Phs	2	6	8
Phs Duration (G+Y+Rc), s	77.0	77.0	47.0
Change Period (Y+Rc), s	6.8	6.8	4.5
Max Green Setting (Gmax), s	70.2	70.2	42.5
Max Q Clear Time (g_c+I1), s	24.8	19.8	44.5
Green Ext Time (p_c), s	22.3	17.7	0.0

Intersection Summary	
HCM 6th Ctrl Delay	59.2
HCM 6th LOS	E

Table D-2. HCM Signalized Intersection Capacity Analysis - S Tacoma Way & Perkins Ln SW (AM Peak)

HCM Signalized Intersection Capacity Analysis
2: S Tacoma Way & Perkins Ln SW 01/31/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	46	117	4	669	31	1022	11	303	508	662	193	6
Future Volume (vph)	46	117	4	669	31	1022	11	303	508	662	193	6
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)		4.0		4.8	4.8	4.8	4.0	4.8	4.0	4.8	4.8	
Lane Util. Factor		0.95		0.95	0.95	0.88	1.00	0.86	1.00	0.97	0.95	
Frpb, ped/bikes		1.00		1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00	
Flpb, ped/bikes		1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt		1.00		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	
Flt Protected		0.99		0.95	0.96	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		3111		1533	1543	2540	1613	5842	1423	3016	3092	
Flt Permitted		0.75		0.95	0.96	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)		2357		1533	1543	2540	1613	5842	1423	3016	3092	
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	52	131	4	752	35	1148	12	340	571	744	217	7
RTOR Reduction (vph)	0	1	0	0	0	195	0	0	0	0	2	0
Lane Group Flow (vph)	0	186	0	391	396	953	12	340	571	744	222	0
Confl. Bikes (#/hr)			10			10			10			10
Heavy Vehicles (%)	8%	8%	8%	6%	6%	6%	6%	6%	6%	10%	10%	10%
Turn Type	Perm	NA		Split	NA	custom	Prot	NA	Free	Prot	NA	
Protected Phases		4		3	3	3 5	1	6		5	2	
Permitted Phases	4					3			Free			
Actuated Green, G (s)		14.0		38.6	38.6	83.0	6.2	13.4	124.0	39.6	47.6	
Effective Green, g (s)		14.0		38.6	38.6	83.0	6.2	13.4	124.0	39.6	47.6	
Actuated g/C Ratio		0.11		0.31	0.31	0.67	0.05	0.11	1.00	0.32	0.38	
Clearance Time (s)		4.0		4.8	4.8		4.0	4.8		4.8	4.8	
Vehicle Extension (s)		3.0		3.8	3.8		3.0	3.8		3.8	3.8	
Lane Grp Cap (vph)		266		477	480	1700	80	631	1423	963	1186	
v/s Ratio Prot				0.26	c0.26	0.38	0.01	0.06		c0.25	0.07	
v/s Ratio Perm		c0.08							c0.40			
v/c Ratio		0.70		0.82	0.82	0.56	0.15	0.54	0.40	0.77	0.19	
Uniform Delay, d1		53.0		39.5	39.6	10.9	56.4	52.4	0.0	38.1	25.4	
Progression Factor		1.00		0.78	0.78	0.62	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2		7.8		13.0	13.3	0.4	0.9	1.1	0.8	4.1	0.1	
Delay (s)		60.8		43.7	44.1	7.2	57.2	53.5	0.8	42.2	25.5	
Level of Service		E		D	D	A	E	D	A	D	C	
Approach Delay (s)		60.8			22.1			21.0			38.3	
Approach LOS		E			C			C			D	

Intersection Summary			
HCM 2000 Control Delay	27.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	124.0	Sum of lost time (s)	18.4
Intersection Capacity Utilization	69.0%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Table D-3. HCM Signalized Intersection Capacity Analysis - S Tacoma Way & 100th St SW (AM Peak)

HCM Signalized Intersection Capacity Analysis
3: S Tacoma Way & 100th St SW 01/31/2023

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	0	396	619	752	465	14
Future Volume (vph)	0	396	619	752	465	14
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)		5.4	5.4	5.4	5.6	
Lane Util. Factor		0.88	0.97	0.95	0.91	
Frpb, ped/bikes		1.00	1.00	1.00	1.00	
Flpb, ped/bikes		1.00	1.00	1.00	1.00	
Frt		0.85	1.00	1.00	1.00	
Flt Protected		1.00	0.95	1.00	1.00	
Satd. Flow (prot)		2470	3159	3257	4446	
Flt Permitted		1.00	0.95	1.00	1.00	
Satd. Flow (perm)		2470	3159	3257	4446	
Peak-hour factor, PHF	0.84	0.84	0.84	0.84	0.84	0.84
Adj. Flow (vph)	0	471	737	895	554	17
RTOR Reduction (vph)	0	0	0	0	4	0
Lane Group Flow (vph)	0	471	737	895	567	0
Confl. Peds. (#/hr)			3			3
Heavy Vehicles (%)	9%	9%	5%	5%	10%	10%
Turn Type		pm+ov	Prot	NA	NA	
Protected Phases		5	5	2	6	
Permitted Phases		2 6				
Actuated Green, G (s)		35.5	16.9	40.9	13.0	
Effective Green, g (s)		35.5	16.9	40.9	13.0	
Actuated g/C Ratio		0.87	0.41	1.00	0.32	
Clearance Time (s)		5.4	5.4	5.4	5.6	
Vehicle Extension (s)		3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		2470	1305	3257	1413	
v/s Ratio Prot		0.08	c0.23	0.27	c0.13	
v/s Ratio Perm		0.11				
v/c Ratio		0.19	0.56	0.27	0.40	
Uniform Delay, d1		0.4	9.2	0.0	10.9	
Progression Factor		1.00	1.00	1.00	1.00	
Incremental Delay, d2		0.0	0.6	0.0	0.2	
Delay (s)		0.5	9.7	0.0	11.1	
Level of Service		A	A	A	B	
Approach Delay (s)	0.5			4.4	11.1	
Approach LOS	A			A	B	

Intersection Summary			
HCM 2000 Control Delay	5.2	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	40.9	Sum of lost time (s)	11.0
Intersection Capacity Utilization	38.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Table D-4. HCM Signalized Intersection Capacity Analysis - Pacific Hwy SW & S Tacoma Way (AM Peak)

HCM Signalized Intersection Capacity Analysis
4: Pacific Hwy SW & S Tacoma Way 01/31/2023

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	397	418	404	166	220	646
Future Volume (vph)	397	418	404	166	220	646
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	4.0	4.9	4.9	5.1	4.9
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frpb, ped/bikes	1.00	0.98	1.00	0.98	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1613	1421	3257	1426	1644	3288
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1613	1421	3257	1426	1644	3288
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	432	454	439	180	239	702
RTOR Reduction (vph)	0	228	0	139	0	0
Lane Group Flow (vph)	432	226	439	41	239	702
Confl. Peds. (#/hr)		4		1	1	
Confl. Bikes (#/hr)		1				
Heavy Vehicles (%)	6%	6%	5%	5%	4%	4%
Turn Type	Prot	Perm	NA	Perm	Prot	NA
Protected Phases	4		2		1	6
Permitted Phases		4		2		
Actuated Green, G (s)	30.3	30.3	18.3	18.3	16.9	40.3
Effective Green, g (s)	30.3	30.3	18.3	18.3	16.9	40.3
Actuated g/C Ratio	0.38	0.38	0.23	0.23	0.21	0.51
Clearance Time (s)	4.0	4.0	4.9	4.9	5.1	4.9
Vehicle Extension (s)	4.0	4.0	3.0	3.0	2.0	3.0
Lane Grp Cap (vph)	614	541	749	328	349	1666
v/s Ratio Prot	c0.27		c0.13		c0.15	0.21
v/s Ratio Perm		0.16		0.03		
v/c Ratio	0.70	0.42	0.59	0.13	0.68	0.42
Uniform Delay, d1	20.8	18.1	27.2	24.3	28.8	12.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.9	0.7	1.2	0.2	4.4	0.2
Delay (s)	24.7	18.8	28.4	24.4	33.2	12.5
Level of Service	C	B	C	C	C	B
Approach Delay (s)	21.7		27.3			17.7
Approach LOS	C		C			B

Intersection Summary			
HCM 2000 Control Delay	21.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	79.5	Sum of lost time (s)	14.0
Intersection Capacity Utilization	60.0%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Table D-5. HCM Signalized Intersection Capacity Analysis - Steele St S & SR512 EB Ramps (AM Peak)

HCM Signalized Intersection Capacity Analysis
5: Steele St S & SR512 EB Ramps 01/31/2023

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	456	109	1048	76	133	226
Future Volume (vph)	456	109	1048	76	133	226
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.5	4.5	3.5	3.5	4.5	3.5
Lane Util. Factor	0.97	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3100	1430	3257	1457	1613	3226
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3100	1430	3257	1457	1613	3226
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	490	117	1127	82	143	243
RTOR Reduction (vph)	0	94	0	36	0	0
Lane Group Flow (vph)	490	23	1127	46	143	243
Heavy Vehicles (%)	7%	7%	5%	5%	6%	6%
Turn Type	Prot	Perm	NA	Perm	Prot	NA
Protected Phases	4		6		5	2
Permitted Phases		4		6		
Actuated Green, G (s)	24.0	24.0	68.0	68.0	15.5	88.0
Effective Green, g (s)	24.0	24.0	68.0	68.0	15.5	88.0
Actuated g/C Ratio	0.20	0.20	0.57	0.57	0.13	0.73
Clearance Time (s)	4.5	4.5	3.5	3.5	4.5	3.5
Vehicle Extension (s)	2.5	2.5	2.5	2.5	2.0	2.5
Lane Grp Cap (vph)	620	286	1845	825	208	2365
v/s Ratio Prot	c0.16		c0.35		c0.09	0.08
v/s Ratio Perm		0.02		0.03		
v/c Ratio	0.79	0.08	0.61	0.06	0.69	0.10
Uniform Delay, d1	45.6	39.0	17.2	11.6	49.9	4.6
Progression Factor	1.00	1.00	1.00	1.00	1.01	0.78
Incremental Delay, d2	6.6	0.1	1.5	0.1	7.3	0.1
Delay (s)	52.2	39.1	18.7	11.8	57.7	3.7
Level of Service	D	D	B	B	E	A
Approach Delay (s)	49.7		18.3			23.7
Approach LOS	D		B			C

Intersection Summary			
HCM 2000 Control Delay	27.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.5
Intersection Capacity Utilization	62.9%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Table D-6. HCM 6th Signalized Intersection Summary - Steele St S & SR512 WB Ramps (AM Peak)

HCM 6th Signalized Intersection Summary
6: Steele St S & SR512 WB Ramps

01/31/2023

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	75	229	636	521	94	284
Future Volume (veh/h)	75	229	636	521	94	284
Initial Q (Qb), veh	30	0	30	0	30	30
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No		No			No
Adj Sat Flow, veh/h/ln	1519	1519	1544	1544	1532	1532
Adj Flow Rate, veh/h	79	241	669	548	99	299
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	8	8	6	6	7	7
Cap, veh/h	259	231	1050	586	213	2170
Arrive On Green	0.18	0.18	1.00	1.00	0.15	0.75
Sat Flow, veh/h	1447	1287	1615	1249	1459	2987
Grp Volume(v), veh/h	79	241	638	579	99	299
Grp Sat Flow(s),veh/h/ln	1447	1287	1467	1319	1459	1455
Q Serve(g_s), s	5.7	21.5	0.0	0.0	7.5	3.5
Cycle Q Clear(g_c), s	5.7	21.5	0.0	0.0	7.5	3.5
Prop In Lane	1.00	1.00		0.95	1.00	
Lane Grp Cap(c), veh/h	259	231	825	763	213	2170
V/C Ratio(X)	0.30	1.04	0.77	0.76	0.47	0.14
Avail Cap(c_a), veh/h	259	231	825	742	213	2170
HCM Platoon Ratio	1.00	1.00	2.00	2.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.79	0.79	0.98	0.98
Uniform Delay (d), s/veh	47.1	49.3	0.0	0.0	51.2	5.0
Incr Delay (d2), s/veh	0.8	71.5	5.6	5.6	1.9	0.1
Initial Q Delay(d3),s/veh	138.8	0.0	10.5	11.5	267.2	1.6
%ile BackOfQ(50%),veh/ln	15.9	18.6	3.7	3.6	22.3	2.9
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	186.6	120.8	16.1	17.1	320.3	6.7
LnGrp LOS	F	F	B	B	F	A
Approach Vol, veh/h	320		1217			398
Approach Delay, s/veh	137.0		16.6			84.7
Approach LOS	F		B			F

Timer - Assigned Phs	2	4	5	6
Phs Duration (G+Y+Rc), s	94.0	26.0	22.0	72.0
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	89.5	21.5	17.5	67.5
Max Q Clear Time (g_c+I1), s	5.5	23.5	9.5	2.0
Green Ext Time (p_c), s	1.8	0.0	0.2	9.7

Intersection Summary	
HCM 6th Ctrl Delay	50.5
HCM 6th LOS	D

Table D-7. HCM Signalized Intersection Capacity Analysis – Steele St S & Sales Rd S & 104th St S (AM Peak)

HCM Signalized Intersection Capacity Analysis
7: Steele St S & Sales Rd S & 104th St S 01/31/2023

Movement	EBL	EBR	EBR2	NBL	NBT	NBR	SBL	SBT	SBR	NWL2	NWL	NWR
Lane Configurations												
Traffic Volume (vph)	0	4	16	76	739	50	42	262	12	100	12	89
Future Volume (vph)	0	4	16	76	739	50	42	262	12	100	12	89
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)		5.5		5.1	5.1	4.0	5.1	5.1			5.5	5.5
Lane Util. Factor		1.00		1.00	0.95	1.00	1.00	0.95			1.00	1.00
Frpb, ped/bikes		1.00		1.00	1.00	0.98	1.00	1.00			1.00	0.98
Flpb, ped/bikes		1.00		1.00	1.00	1.00	1.00	1.00			0.98	1.00
Frt		0.85		1.00	1.00	0.85	1.00	0.99			1.00	0.85
Flt Protected		1.00		0.95	1.00	1.00	0.95	1.00			0.95	1.00
Satd. Flow (prot)		1485		1660	3320	1448	1660	3294			1620	1457
Flt Permitted		1.00		0.95	1.00	1.00	0.95	1.00			0.73	1.00
Satd. Flow (perm)		1485		1660	3320	1448	1660	3294			1246	1457
Peak-hour factor, PHF	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79
Adj. Flow (vph)	0	5	20	96	935	63	53	332	15	127	15	113
RTOR Reduction (vph)	0	21	0	0	0	0	0	4	0	0	0	93
Lane Group Flow (vph)	0	4	0	96	935	63	53	343	0	0	142	20
Confl. Peds. (#/hr)	10	10	10	10		10	10		10	10	10	10
Heavy Vehicles (%)	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
Turn Type	Perm	Prot		Prot	NA	Free	Prot	NA		Perm	Prot	Perm
Protected Phases		8		1	6		5	2			4	
Permitted Phases	8					Free				4		4
Actuated Green, G (s)		9.1		6.3	24.7	52.7	3.2	21.6			9.1	9.1
Effective Green, g (s)		9.1		6.3	24.7	52.7	3.2	21.6			9.1	9.1
Actuated g/C Ratio		0.17		0.12	0.47	1.00	0.06	0.41			0.17	0.17
Clearance Time (s)		5.5		5.1	5.1		5.1	5.1			5.5	5.5
Vehicle Extension (s)		2.0		2.0	2.0		1.0	2.0			2.0	2.0
Lane Grp Cap (vph)		256		198	1556	1448	100	1350			215	251
v/s Ratio Prot		0.00		c0.06	c0.28		0.03	0.10				
v/s Ratio Perm						0.04					c0.11	0.01
v/c Ratio		0.02		0.48	0.60	0.04	0.53	0.25			0.66	0.08
Uniform Delay, d1		18.1		21.7	10.4	0.0	24.0	10.2			20.4	18.3
Progression Factor		1.00		1.00	1.00	1.00	1.00	1.00			1.00	1.00
Incremental Delay, d2		0.0		0.7	0.5	0.1	2.7	0.0			5.8	0.0
Delay (s)		18.1		22.4	10.8	0.1	26.7	10.3			26.1	18.3
Level of Service		B		C	B	A	C	B			C	B
Approach Delay (s)	18.1				11.2			12.5			22.7	
Approach LOS	B				B			B			C	

Intersection Summary			
HCM 2000 Control Delay	13.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	52.7	Sum of lost time (s)	15.7
Intersection Capacity Utilization	59.8%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Table D-8. HCM 6th TWSC – Steele St S & 109th St S (AM Peak)

HCM 6th TWSC
8: Steele St S & 109th St S 01/31/2023

Intersection	
Int Delay, s/veh	0.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	1	7	1117	4	7	675
Future Vol, veh/h	1	7	1117	4	7	675
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	500	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	94	94	94	94	94	94
Heavy Vehicles, %	0	0	5	5	7	7
Mvmt Flow	1	7	1188	4	7	718

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1563	596	0	0	1192	0
Stage 1	1190	-	-	-	-	-
Stage 2	373	-	-	-	-	-
Critical Hdwy	6.25	7.1	-	-	5.44	-
Critical Hdwy Stg 1	6.6	-	-	-	-	-
Critical Hdwy Stg 2	5.8	-	-	-	-	-
Follow-up Hdwy	3.65	3.9	-	-	3.17	-
Pot Cap-1 Maneuver	130	387	-	-	303	-
Stage 1	192	-	-	-	-	-
Stage 2	649	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	125	387	-	-	303	-
Mov Cap-2 Maneuver	168	-	-	-	-	-
Stage 1	192	-	-	-	-	-
Stage 2	624	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	16.1	0	0.2
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	333	303	-
HCM Lane V/C Ratio	-	-	0.026	0.025	-
HCM Control Delay (s)	-	-	16.1	17.2	-
HCM Lane LOS	-	-	C	C	-
HCM 95th %tile Q(veh)	-	-	0.1	0.1	-

Table D-9. HCM 6th Signalized Intersection Summary – 112th St S & Steele St S (AM Peak)

HCM 6th Signalized Intersection Summary
9: 112th St S & Steele St S

01/31/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	20	70	103	31	295	144	397	957	9	59	581	36
Future Volume (veh/h)	20	70	103	31	295	144	397	957	9	59	581	36
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		0.99	1.00		0.99	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758
Adj Flow Rate, veh/h	21	73	107	32	307	150	414	997	9	61	605	38
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	24	343	287	38	359	623	364	1159	10	364	1090	68
Arrive On Green	0.01	0.20	0.20	0.02	0.20	0.20	0.22	0.34	0.34	0.22	0.34	0.34
Sat Flow, veh/h	1674	1758	1467	1674	1758	1468	1674	3391	31	1674	3190	200
Grp Volume(v), veh/h	21	73	107	32	307	150	414	491	515	61	316	327
Grp Sat Flow(s),veh/h/ln	1674	1758	1467	1674	1758	1468	1674	1670	1752	1674	1670	1720
Q Serve(g_s), s	1.1	3.2	5.8	1.7	15.4	6.0	19.9	25.1	25.1	2.7	14.1	14.1
Cycle Q Clear(g_c), s	1.1	3.2	5.8	1.7	15.4	6.0	19.9	25.1	25.1	2.7	14.1	14.1
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.02	1.00		0.12
Lane Grp Cap(c), veh/h	24	343	287	38	359	623	364	571	599	364	571	588
V/C Ratio(X)	0.88	0.21	0.37	0.84	0.86	0.24	1.14	0.86	0.86	0.17	0.55	0.56
Avail Cap(c_a), veh/h	181	403	336	181	403	660	364	819	859	364	636	655
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	45.1	30.9	32.0	44.6	35.2	17.1	35.8	28.1	28.1	29.1	24.5	24.5
Incr Delay (d2), s/veh	29.1	0.1	0.3	16.1	13.8	0.1	90.2	4.8	4.5	1.0	0.3	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	1.3	2.1	0.9	7.8	2.0	17.0	10.4	10.9	1.2	5.5	5.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	74.2	31.0	32.3	60.7	49.0	17.2	126.1	32.9	32.6	30.1	24.8	24.8
LnGrp LOS	E	C	C	E	D	B	F	C	C	C	C	C
Approach Vol, veh/h		201			489			1420			704	
Approach Delay, s/veh		36.2			40.0			60.0			25.3	
Approach LOS		D			D			E			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	25.0	36.4	6.4	23.8	25.0	36.4	7.2	23.0
Change Period (Y+Rc), s	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1
Max Green Setting (Gmax), s	19.9	34.9	9.9	21.0	19.9	44.9	9.9	21.0
Max Q Clear Time (g_c+I1), s	21.9	16.1	3.1	17.4	4.7	27.1	3.7	7.8
Green Ext Time (p_c), s	0.0	2.5	0.0	0.6	0.0	4.2	0.0	0.3

Intersection Summary	
HCM 6th Ctrl Delay	46.1
HCM 6th LOS	D

Table D-10. HCM Signalized Intersection Capacity Analysis – SR 7 (Pacific Ave) & NB Bus Q Jump & 112th St S (AM Peak) A

HCM Signalized Intersection Capacity Analysis
10: SR 7 (Pacific Ave) & NB Bus Q Jump & 112th St S

01/31/2023

Movement	EBL	EBT	EBR2	WBL	WBT	WBR	NBL	NBT	NBR	NBR2	SBL2	SBT
Lane Configurations												
Traffic Volume (vph)	104	132	6	121	183	291	49	1181	58	0	189	512
Future Volume (vph)	104	132	6	121	183	291	49	1181	58	0	189	512
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	12	12	12	12	12	12	11	12	12	11	11
Total Lost time (s)	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.9			4.6	4.9
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95			0.97	0.95
Frpb, ped/bikes	1.00	1.00	0.96	1.00	1.00	0.96	1.00	1.00			1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99			1.00	0.99
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00			0.95	1.00
Satd. Flow (prot)	1629	1714	1398	1629	1714	1405	1660	3183			3083	3147
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00			0.95	1.00
Satd. Flow (perm)	1629	1714	1398	1629	1714	1405	1660	3183			3083	3147
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	117	148	7	136	206	327	55	1327	65	0	212	575
RTOR Reduction (vph)	0	0	6	0	0	228	0	0	0	0	0	2
Lane Group Flow (vph)	117	148	1	136	206	99	55	1392	0	0	212	604
Confl. Peds. (#/hr)	10		10	10		10	10		10		10	
Confl. Bikes (#/hr)			10			10			10			
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	3%	3%	3%	3%	4%	4%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Perm	Prot	NA
Protected Phases	3	8		7	4		5	2			1	6
Permitted Phases			8			4				2		
Actuated Green, G (s)	9.4	22.2	22.2	14.0	26.8	26.8	8.7	79.9			15.2	86.4
Effective Green, g (s)	9.4	22.2	22.2	14.0	26.8	26.8	8.7	79.9			15.2	86.4
Actuated g/C Ratio	0.06	0.15	0.15	0.09	0.18	0.18	0.06	0.53			0.10	0.58
Clearance Time (s)	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.9			4.6	4.9
Vehicle Extension (s)	2.5	2.8	2.8	2.5	2.8	2.8	2.5	2.8			2.5	2.8
Lane Grp Cap (vph)	102	253	206	152	306	251	96	1695			312	1812
v/s Ratio Prot	c0.07	0.09		0.08	c0.12		0.03	c0.44			c0.07	0.19
v/s Ratio Perm			0.00			0.07						
v/c Ratio	1.15	0.58	0.01	0.89	0.67	0.40	0.57	0.82			0.68	0.33
Uniform Delay, d1	70.3	59.6	54.5	67.3	57.5	54.5	68.8	29.1			65.0	16.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			0.92	1.01
Incremental Delay, d2	134.1	3.2	0.0	43.3	5.5	0.9	6.6	4.6			5.0	0.5
Delay (s)	204.4	62.8	54.5	110.5	63.0	55.4	75.5	33.7			64.8	17.3
Level of Service	F	E	D	F	E	E	E	C			E	B
Approach Delay (s)		123.5			68.9			35.3				29.6
Approach LOS		F			E			D				C

Intersection Summary			
HCM 2000 Control Delay	48.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	23.2
Intersection Capacity Utilization	84.5%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Table D-11. HCM Signalized Intersection Capacity Analysis – SR 7 (Pacific Ave) & NB Bus Q Jump & 112th St S (AM Peak) B

HCM Signalized Intersection Capacity Analysis
10: SR 7 (Pacific Ave) & NB Bus Q Jump & 112th St S 01/31/2023

Movement	SBR	NWR
Lane Configurations		
Traffic Volume (vph)	28	0
Future Volume (vph)	28	0
Ideal Flow (vphpl)	1800	1800
Lane Width	12	12
Total Lost time (s)		
Lane Util. Factor		
Frpb, ped/bikes		
Flpb, ped/bikes		
Frt		
Flt Protected		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Peak-hour factor, PHF	0.89	0.89
Adj. Flow (vph)	31	0
RTOR Reduction (vph)	0	0
Lane Group Flow (vph)	0	0
Confl. Peds. (#/hr)	10	
Confl. Bikes (#/hr)	10	
Heavy Vehicles (%)	4%	100%
Turn Type		Prot
Protected Phases		9
Permitted Phases		
Actuated Green, G (s)		
Effective Green, g (s)		
Actuated g/C Ratio		
Clearance Time (s)		
Vehicle Extension (s)		
Lane Grp Cap (vph)		
v/s Ratio Prot		
v/s Ratio Perm		
v/c Ratio		
Uniform Delay, d1		
Progression Factor		
Incremental Delay, d2		
Delay (s)		
Level of Service		
Approach Delay (s)		
Approach LOS		
Intersection Summary		

Table D-12. HCM 6th Signalized Intersection Summary - SR 7 (Pacific Ave) & SR 512 EB Off (AM Peak)

HCM 6th Signalized Intersection Summary
11: SR 7 (Pacific Ave) & SR 512 EB Off 01/31/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	107	2	369	0	0	0	0	1186	390	173	360	0
Future Volume (veh/h)	107	2	369	0	0	0	0	1186	390	173	360	0
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.96				1.00		0.98	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No						No			No	
Adj Sat Flow, veh/h/ln	1716	1716	1716				0	1758	1758	1716	1716	0
Adj Flow Rate, veh/h	118	2	240				0	1303	352	190	396	0
Peak Hour Factor	0.91	0.91	0.91				0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	6	6	6				0	3	3	6	6	0
Cap, veh/h	181	3	276				0	1487	648	572	2692	0
Arrive On Green	0.11	0.11	0.11				0.00	0.89	0.89	0.70	1.00	0.00
Sat Flow, veh/h	1608	27	2446				0	3428	1455	1634	3346	0
Grp Volume(v), veh/h	120	0	240				0	1303	352	190	396	0
Grp Sat Flow(s),veh/h/ln	1635	0	1223				0	1670	1455	1634	1630	0
Q Serve(g_s), s	10.5	0.0	14.5				0.0	29.2	7.7	6.8	0.0	0.0
Cycle Q Clear(g_c), s	10.5	0.0	14.5				0.0	29.2	7.7	6.8	0.0	0.0
Prop In Lane	0.98		1.00				0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	184	0	276				0	1487	648	572	2692	0
V/C Ratio(X)	0.65	0.00	0.87				0.00	0.88	0.54	0.33	0.15	0.00
Avail Cap(c_a), veh/h	201	0	300				0	2169	945	572	2692	0
HCM Platoon Ratio	1.00	1.00	1.00				1.00	2.00	2.00	2.00	2.00	1.00
Upstream Filter(I)	1.00	0.00	1.00				0.00	0.47	0.47	1.00	1.00	0.00
Uniform Delay (d), s/veh	63.7	0.0	65.5				0.0	6.2	5.0	15.6	0.0	0.0
Incr Delay (d2), s/veh	7.6	0.0	22.7				0.0	3.8	1.5	0.7	0.1	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.8	0.0	5.4				0.0	3.6	1.7	2.3	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	71.3	0.0	88.1				0.0	9.9	6.5	16.4	0.1	0.0
LnGrp LOS	E	A	F				A	A	A	B	A	A
Approach Vol, veh/h		360						1655			586	
Approach Delay, s/veh		82.5						9.2			5.4	
Approach LOS		F						A			A	
Timer - Assigned Phs	1	2		4		6						
Phs Duration (G+Y+Rc), s	66.3	62.2		21.5		128.5						
Change Period (Y+Rc), s	4.6	* 4.6		4.6		4.6						
Max Green Setting (Gmax), s	20.5	* 97		18.4		122.4						
Max Q Clear Time (g_c+I1), s	8.8	31.2		16.5		2.0						
Green Ext Time (p_c), s	0.9	17.1		0.4		2.8						
Intersection Summary												
HCM 6th Ctrl Delay			18.5									
HCM 6th LOS			B									
Notes												

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Table D-13. HCM 6th Signalized Intersection Summary - SR 7 (Pacific Ave) & 108th St S (AM Peak)

HCM 6th Signalized Intersection Summary
12: SR 7 (Pacific Ave) & 108th St S
01/31/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	17	10	122	200	113	163	9	793	491	9	387	16
Future Volume (veh/h)	17	10	122	200	113	163	9	793	491	9	387	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.90	1.00		0.95	1.00		0.96	1.00		0.93
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1730	1730	1730	1688	1688	1688	1758	1758	1758	1744	1744	1744
Adj Flow Rate, veh/h	18	11	56	168	187	105	10	853	517	10	416	12
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	5	5	5	8	8	8	3	3	3	4	4	4
Cap, veh/h	57	35	72	231	242	196	877	1178	716	546	519	15
Arrive On Green	0.05	0.05	0.05	0.14	0.14	0.14	0.52	0.35	0.35	0.33	0.16	0.16
Sat Flow, veh/h	1041	636	1315	1607	1688	1362	1674	3340	1424	1661	3280	94
Grp Volume(v), veh/h	29	0	56	168	187	105	10	853	517	10	210	218
Grp Sat Flow(s),veh/h/ln	1678	0	1315	1607	1688	1362	1674	1670	1424	1661	1657	1718
Q Serve(g_s), s	2.5	0.0	6.3	15.0	16.0	10.7	0.4	33.3	43.1	0.6	18.3	18.4
Cycle Q Clear(g_c), s	2.5	0.0	6.3	15.0	16.0	10.7	0.4	33.3	43.1	0.6	18.3	18.4
Prop In Lane	0.62		1.00	1.00		1.00	1.00		1.00	1.00		0.05
Lane Grp Cap(c), veh/h	92	0	72	231	242	196	877	1178	716	546	262	272
V/C Ratio(X)	0.32	0.00	0.78	0.73	0.77	0.54	0.01	0.72	0.72	0.02	0.80	0.80
Avail Cap(c_a), veh/h	173	0	136	488	512	413	877	1414	817	546	701	727
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	68.2	0.0	70.0	61.4	61.9	59.6	17.1	42.2	29.9	34.0	60.9	60.9
Incr Delay (d2), s/veh	2.0	0.0	16.4	4.4	5.2	2.3	0.0	3.9	6.2	0.0	22.1	21.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.1	0.0	2.5	6.4	7.2	3.9	0.2	14.3	20.6	0.3	9.3	9.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	70.2	0.0	86.4	65.8	67.0	61.9	17.1	46.1	36.1	34.0	83.0	82.7
LnGrp LOS	E	A	F	E	E	E	B	D	D	C	F	F
Approach Vol, veh/h		85			460			1380			438	
Approach Delay, s/veh		80.9			65.4			42.1			81.7	
Approach LOS		F			E			D			F	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	53.8	57.4		26.0	83.1	28.2		12.7				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	7.5	63.5		45.5	7.5	63.5		15.5				
Max Q Clear Time (g_c+I1), s	2.6	45.1		18.0	2.4	20.4		8.3				
Green Ext Time (p_c), s	0.0	7.9		2.0	0.0	2.6		0.1				
Intersection Summary												
HCM 6th Ctrl Delay			55.4									
HCM 6th LOS			E									
Notes												

User approved volume balancing among the lanes for turning movement.

Table D-14. HCM 6th Signalized Intersection Summary – 108th St S & A St S (AM Peak)

HCM 6th TWSC
13: 108th St S & A St S 01/31/2023

Intersection	
Int Delay, s/veh	12.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	22	59	429	0	26	1	408	34	16	2	0	42
Future Vol, veh/h	22	59	429	0	26	1	408	34	16	2	0	42
Conflicting Peds, #/hr	0	0	0	0	0	1	1	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Yield	Yield	Yield
RT Channelized	-	-	Free	-	-	None	-	-	None	-	-	None
Storage Length	-	-	75	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	94	94	94	94	94	94	94	94	94	94	94	94
Heavy Vehicles, %	2	2	2	20	20	20	4	4	4	0	0	0
Mvmt Flow	23	63	456	0	28	1	434	36	17	2	0	45

Major/Minor	Minor2			Minor1			Major1		
Conflicting Flow All	929	922	-	-	914	46	1	0	0
Stage 1	1	1	-	-	913	-	-	-	-
Stage 2	928	921	-	-	1	-	-	-	-
Critical Hdwy	7.12	6.52	-	-	6.7	6.4	4.14	-	-
Critical Hdwy Stg 1	-	-	-	-	5.7	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	-	-	4.18	3.48	2.236	-	-
Pot Cap-1 Maneuver	248	270	0	0	255	975	1609	-	-
Stage 1	-	-	0	0	329	-	-	-	-
Stage 2	321	349	0	0	-	-	-	-	-
Platoon blocked, %								-	-
Mov Cap-1 Maneuver	173	194	-	-	184	975	1607	-	-
Mov Cap-2 Maneuver	173	194	-	-	184	-	-	-	-
Stage 1	-	-	-	-	237	-	-	-	-
Stage 2	204	252	-	-	-	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	39.4	27.3	7.2
HCM LOS	E	D	

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1
Capacity (veh/h)	1607	-	-	188	-	190
HCM Lane V/C Ratio	0.27	-	-	0.458	-	0.151
HCM Control Delay (s)	8.1	0	-	39.4	0	27.3
HCM Lane LOS	A	A	-	E	A	D
HCM 95th %tile Q(veh)	1.1	-	-	2.2	-	0.5

Table D-15. HCM 6th Signalized Intersection Summary - A St S & 112th St S (AM Peak)

HCM 6th Signalized Intersection Summary
14: A St S & 112th St S

01/31/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	27	327	25	37	517	29	69	12	97	8	5	9
Future Volume (veh/h)	27	327	25	37	517	29	69	12	97	8	5	9
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.98	0.99		0.99	0.99		0.99	0.99		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758
Adj Flow Rate, veh/h	28	337	26	38	533	30	71	12	100	8	5	9
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	156	783	59	436	1466	82	246	50	171	221	125	134
Arrive On Green	0.27	0.27	0.27	0.02	0.46	0.46	0.21	0.21	0.21	0.21	0.21	0.21
Sat Flow, veh/h	105	2873	218	1674	3213	180	431	239	807	323	590	632
Grp Volume(v), veh/h	206	0	185	38	277	286	183	0	0	22	0	0
Grp Sat Flow(s),veh/h/ln	1641	0	1556	1674	1670	1723	1477	0	0	1544	0	0
Q Serve(g_s), s	0.0	0.0	3.2	0.5	3.5	3.5	1.9	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	3.1	0.0	3.2	0.5	3.5	3.5	3.5	0.0	0.0	0.3	0.0	0.0
Prop In Lane	0.14		0.14	1.00		0.10	0.39		0.55	0.36		0.41
Lane Grp Cap(c), veh/h	574	0	424	436	762	786	467	0	0	479	0	0
V/C Ratio(X)	0.36	0.00	0.44	0.09	0.36	0.36	0.39	0.00	0.00	0.05	0.00	0.00
Avail Cap(c_a), veh/h	1808	0	1681	648	1804	1861	1238	0	0	1245	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	9.6	0.0	9.7	7.2	5.7	5.7	11.4	0.0	0.0	10.2	0.0	0.0
Incr Delay (d2), s/veh	0.1	0.0	0.3	0.0	0.1	0.1	0.2	0.0	0.0	0.0	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.8	0.0	0.7	0.1	0.6	0.6	0.9	0.0	0.0	0.1	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	9.8	0.0	9.9	7.3	5.8	5.8	11.6	0.0	0.0	10.2	0.0	0.0
LnGrp LOS	A	A	A	A	A	A	B	A	A	B	A	A
Approach Vol, veh/h		391			601			183			22	
Approach Delay, s/veh		9.9			5.9			11.6			10.2	
Approach LOS		A			A			B			B	
Timer - Assigned Phs		2		4	5	6		8				
Phs Duration (G+Y+Rc), s		19.9		12.3	5.9	14.0		12.3				
Change Period (Y+Rc), s		5.2		5.5	* 5.2	5.2		5.5				
Max Green Setting (Gmax), s		34.8		24.0	* 4.8	34.8		24.0				
Max Q Clear Time (g_c+I1), s		5.5		5.5	2.5	5.2		2.3				
Green Ext Time (p_c), s		2.1		0.6	0.0	1.5		0.0				
Intersection Summary												
HCM 6th Ctrl Delay			8.1									
HCM 6th LOS			A									
Notes												

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Table D-16. HCM 6th Signalized Intersection Summary - C St S & 112th St S (AM Peak)

HCM 6th Signalized Intersection Summary
15: C St S & 112th St S

01/31/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	18	143	20	12	167	81	44	345	59	40	93	4
Future Volume (veh/h)	18	143	20	12	167	81	44	345	59	40	93	4
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.98	0.99		0.98	0.99		0.99	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758
Adj Flow Rate, veh/h	21	170	24	14	199	96	52	411	70	48	111	5
Peak Hour Factor	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	448	793	110	521	475	395	671	656	552	424	623	28
Arrive On Green	0.27	0.27	0.27	0.27	0.27	0.27	0.37	0.37	0.37	0.37	0.37	0.37
Sat Flow, veh/h	1065	2938	408	1164	1758	1462	1253	1758	1478	904	1668	75
Grp Volume(v), veh/h	21	95	99	14	199	96	52	411	70	48	0	116
Grp Sat Flow(s),veh/h/ln	1065	1670	1675	1164	1758	1462	1253	1758	1478	904	0	1743
Q Serve(g_s), s	0.5	1.2	1.3	0.3	2.6	1.4	0.8	5.3	0.9	1.3	0.0	1.2
Cycle Q Clear(g_c), s	3.0	1.2	1.3	1.5	2.6	1.4	2.0	5.3	0.9	6.6	0.0	1.2
Prop In Lane	1.00		0.24	1.00		1.00	1.00		1.00	1.00		0.04
Lane Grp Cap(c), veh/h	448	451	452	521	475	395	671	656	552	424	0	651
V/C Ratio(X)	0.05	0.21	0.22	0.03	0.42	0.24	0.08	0.63	0.13	0.11	0.00	0.18
Avail Cap(c_a), veh/h	1315	1812	1818	1469	1907	1586	1377	1647	1385	901	0	1571
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	9.6	7.8	7.9	8.4	8.3	7.9	6.5	7.1	5.7	9.8	0.0	5.8
Incr Delay (d2), s/veh	0.0	0.1	0.1	0.0	0.2	0.1	0.0	0.4	0.0	0.0	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	0.3	0.3	0.0	0.6	0.3	0.1	1.1	0.1	0.2	0.0	0.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	9.6	7.9	7.9	8.5	8.6	8.0	6.5	7.5	5.8	9.8	0.0	5.9
LnGrp LOS	A	A	A	A	A	A	A	A	A	A	A	A
Approach Vol, veh/h		215			309			533			164	
Approach Delay, s/veh		8.1			8.4			7.2			7.0	
Approach LOS		A			A			A			A	

Timer - Assigned Phs	2	4	6	8
Phs Duration (G+Y+Rc), s	15.4	12.4	15.4	12.4
Change Period (Y+Rc), s	* 5	* 4.9	* 5	* 4.9
Max Green Setting (Gmax), s	* 26	* 30	* 25	* 30
Max Q Clear Time (g_c+I1), s	7.3	5.0	8.6	4.6
Green Ext Time (p_c), s	1.8	0.7	0.5	0.9

Intersection Summary	
HCM 6th Ctrl Delay	7.6
HCM 6th LOS	A

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Table D-17. HCM Signalized Intersection Capacity Analysis - 112th St E & Portland Ave E (AM Peak)

HCM Signalized Intersection Capacity Analysis
16: 112th St E & Portland Ave E 01/31/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	285	220	2	11	298	325	7	12	7	225	10	261
Future Volume (vph)	285	220	2	11	298	325	7	12	7	225	10	261
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	5.5	5.5		5.5	5.5			4.4		5.3	5.3	5.3
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00		0.95	0.95	1.00
Frpb, ped/bikes	1.00	1.00		1.00	0.99			0.99		1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00		0.98	1.00			1.00		1.00	1.00	1.00
Frt	1.00	1.00		1.00	0.92			0.96		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.99		0.95	0.96	1.00
Satd. Flow (prot)	1613	3222		1609	2997			1703		1577	1588	1485
Flt Permitted	0.16	1.00		0.59	1.00			0.99		0.95	0.96	1.00
Satd. Flow (perm)	263	3222		994	2997			1703		1577	1588	1485
Peak-hour factor, PHF	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Adj. Flow (vph)	343	265	2	13	359	392	8	14	8	271	12	314
RTOR Reduction (vph)	0	0	0	0	169	0	0	8	0	0	0	263
Lane Group Flow (vph)	343	267	0	13	582	0	0	22	0	141	142	51
Confl. Peds. (#/hr)	1		14	14		1			3	3		
Confl. Bikes (#/hr)									1			
Heavy Vehicles (%)	6%	6%	6%	4%	4%	4%	0%	0%	0%	3%	3%	3%
Turn Type	pm+pt	NA		Perm	NA		Split	NA		Split	NA	Perm
Protected Phases	1	6			2		7	7		8	8	
Permitted Phases	6			2								8
Actuated Green, G (s)	45.6	45.6		20.3	20.3			2.9		12.3	12.3	12.3
Effective Green, g (s)	45.6	45.6		20.3	20.3			2.9		12.3	12.3	12.3
Actuated g/C Ratio	0.60	0.60		0.27	0.27			0.04		0.16	0.16	0.16
Clearance Time (s)	5.5	5.5		5.5	5.5			4.4		5.3	5.3	5.3
Vehicle Extension (s)	1.0	2.0		2.0	2.0			1.0		2.0	2.0	2.0
Lane Grp Cap (vph)	509	1933		265	800			64		255	257	240
v/s Ratio Prot	c0.18	0.08			0.19			c0.01		0.09	c0.09	
v/s Ratio Perm	c0.23			0.01								0.03
v/c Ratio	0.67	0.14		0.05	0.73			0.35		0.55	0.55	0.21
Uniform Delay, d1	13.9	6.6		20.7	25.3			35.6		29.3	29.3	27.6
Progression Factor	1.00	1.00		1.00	1.00			1.00		1.00	1.00	1.00
Incremental Delay, d2	2.8	0.0		0.0	2.8			1.2		1.5	1.5	0.2
Delay (s)	16.7	6.6		20.7	28.1			36.8		30.8	30.8	27.8
Level of Service	B	A		C	C			D		C	C	C
Approach Delay (s)		12.3			28.0			36.8			29.2	
Approach LOS		B			C			D			C	

Intersection Summary			
HCM 2000 Control Delay	23.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	76.0	Sum of lost time (s)	20.7
Intersection Capacity Utilization	63.6%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Table D-18. HCM Signalized Intersection Capacity Analysis - Portland Ave E & SR512 EB Off-Ramp (AM Peak)

HCM Signalized Intersection Capacity Analysis
17: Portland Ave E & SR512 EB Off-Ramp 01/31/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	143	0	219	0	0	0	0	448	174	183	277	0
Future Volume (vph)	143	0	219	0	0	0	0	448	174	183	277	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)		4.5	4.5					4.5	4.5		4.5	
Lane Util. Factor		1.00	1.00					1.00	1.00		1.00	
Frt		1.00	0.85					1.00	0.85		1.00	
Flt Protected		0.95	1.00					1.00	1.00		0.98	
Satd. Flow (prot)		1676	1500					1714	1457		1730	
Flt Permitted		0.95	1.00					1.00	1.00		0.47	
Satd. Flow (perm)		1676	1500					1714	1457		829	
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	162	0	249	0	0	0	0	509	198	208	315	0
RTOR Reduction (vph)	0	0	211	0	0	0	0	0	96	0	0	0
Lane Group Flow (vph)	0	163	38	0	0	0	0	509	102	0	523	0
Heavy Vehicles (%)	2%	2%	2%	0%	0%	0%	5%	5%	5%	2%	2%	2%
Turn Type	Perm	NA	Perm					NA	Perm	pm+pt	NA	
Protected Phases		4						2		1	6	
Permitted Phases	4		4						2	6		
Actuated Green, G (s)		11.9	11.9					39.6	39.6		57.1	
Effective Green, g (s)		11.9	11.9					39.6	39.6		57.1	
Actuated g/C Ratio		0.15	0.15					0.51	0.51		0.73	
Clearance Time (s)		4.5	4.5					4.5	4.5		4.5	
Vehicle Extension (s)		3.5	3.5					3.0	3.0		3.5	
Lane Grp Cap (vph)		255	228					870	739		757	
v/s Ratio Prot								0.30			c0.12	
v/s Ratio Perm		0.10	0.03						0.07		c0.39	
v/c Ratio		0.64	0.17					0.59	0.14		0.69	
Uniform Delay, d1		31.0	28.7					13.4	10.2		5.7	
Progression Factor		1.00	1.00					1.00	1.00		1.78	
Incremental Delay, d2		5.4	0.4					2.9	0.4		2.3	
Delay (s)		36.5	29.1					16.3	10.6		12.4	
Level of Service		D	C					B	B		B	
Approach Delay (s)		32.0			0.0			14.7			12.4	
Approach LOS		C			A			B			B	

Intersection Summary			
HCM 2000 Control Delay	18.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	78.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	70.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Table D-19. HCM Signalized Intersection Capacity Analysis - Portland Ave E & SR512 WB Off-Ramp (AM Peak)

HCM Signalized Intersection Capacity Analysis
18: Portland Ave E & SR512 WB Off-Ramp
01/31/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	116	0	202	246	345	0	0	344	169
Future Volume (vph)	0	0	0	116	0	202	246	345	0	0	344	169
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)					4.5			4.5			4.5	4.5
Lane Util. Factor					1.00			1.00			1.00	1.00
Frpb, ped/bikes					0.98			1.00			1.00	1.00
Flpb, ped/bikes					1.00			1.00			1.00	1.00
Frt					0.91			1.00			1.00	0.85
Flt Protected					0.98			0.98			1.00	1.00
Satd. Flow (prot)					1559			1695			1748	1485
Flt Permitted					0.98			0.51			1.00	1.00
Satd. Flow (perm)					1559			885			1748	1485
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	0	0	129	0	224	273	383	0	0	382	188
RTOR Reduction (vph)	0	0	0	0	80	0	0	0	0	0	0	99
Lane Group Flow (vph)	0	0	0	0	273	0	0	656	0	0	382	89
Confl. Peds. (#/hr)						2						
Heavy Vehicles (%)	0%	0%	0%	2%	2%	2%	4%	4%	4%	3%	3%	3%
Turn Type				Perm	NA		pm+pt	NA			NA	Perm
Protected Phases					8		5	2			6	
Permitted Phases				8			2					6
Actuated Green, G (s)					14.5			54.5			37.0	37.0
Effective Green, g (s)					14.5			54.5			37.0	37.0
Actuated g/C Ratio					0.19			0.70			0.47	0.47
Clearance Time (s)					4.5			4.5			4.5	4.5
Vehicle Extension (s)					3.0			3.0			3.0	3.0
Lane Grp Cap (vph)					289			753			829	704
v/s Ratio Prot								c0.15			0.22	
v/s Ratio Perm					0.18			c0.46				0.06
v/c Ratio					0.95			0.87			0.46	0.13
Uniform Delay, d1					31.4			9.0			13.8	11.5
Progression Factor					1.00			2.10			1.00	1.00
Incremental Delay, d2					38.2			9.1			1.8	0.4
Delay (s)					69.5			28.1			15.6	11.8
Level of Service					E			C			B	B
Approach Delay (s)		0.0			69.5			28.1			14.4	
Approach LOS		A			E			C			B	

Intersection Summary			
HCM 2000 Control Delay	32.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	78.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	83.9%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Table D-20. HCM 6th Signalized Intersection Summary - Portland Ave E & 104th St E (AM Peak)

HCM 6th Signalized Intersection Summary
19: Portland Ave E & 104th St E

01/31/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	48	69	112	80	96	55	70	419	58	18	321	59
Future Volume (veh/h)	48	69	112	80	96	55	70	419	58	18	321	59
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		0.99	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758
Adj Flow Rate, veh/h	65	93	151	108	130	74	95	566	78	24	434	80
Peak Hour Factor	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	152	209	255	206	226	102	340	677	93	247	646	119
Arrive On Green	0.34	0.34	0.34	0.34	0.34	0.34	0.45	0.45	0.45	0.45	0.45	0.45
Sat Flow, veh/h	172	618	755	301	669	302	877	1510	208	780	1441	266
Grp Volume(v), veh/h	309	0	0	312	0	0	95	0	644	24	0	514
Grp Sat Flow(s),veh/h/ln	1546	0	0	1272	0	0	877	0	1718	780	0	1707
Q Serve(g_s), s	12.0	0.0	0.0	12.7	0.0	0.0	4.5	0.0	15.4	1.3	0.0	11.0
Cycle Q Clear(g_c), s	12.0	0.0	0.0	12.7	0.0	0.0	15.5	0.0	15.4	16.7	0.0	11.0
Prop In Lane	0.21		0.49	0.35		0.24	1.00		0.12	1.00		0.16
Lane Grp Cap(c), veh/h	0	0	0	0	0	0	340	0	770	247	0	765
V/C Ratio(X)	0.00	0.00	0.00	0.00	0.00	0.00	0.28	0.00	0.84	0.10	0.00	0.67
Avail Cap(c_a), veh/h	0	0	0	0	0	0	612	0	1302	488	0	1294
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	16.2	0.0	11.3	18.6	0.0	10.1
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.9	0.1	0.0	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	4.6	0.2	0.0	3.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	16.4	0.0	12.2	18.7	0.0	10.5
LnGrp LOS	A	A	A	A	A	A	B	A	B	B	A	B
Approach Vol, veh/h		309			312			739			538	
Approach Delay, s/veh		0.0			0.0			12.8			10.9	
Approach LOS		A			A			B			B	
Timer - Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		25.6		20.8		25.6		20.8				
Change Period (Y+Rc), s		* 4.8		5.1		* 4.8		5.1				
Max Green Setting (Gmax), s		* 35		24.9		* 35		24.9				
Max Q Clear Time (g_c+I1), s		18.7		14.7		17.5		14.0				
Green Ext Time (p_c), s		2.2		1.0		3.2		1.0				
Intersection Summary												
HCM 6th Ctrl Delay			8.0									
HCM 6th LOS			A									

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Table D-21. HCM 6th Signalized Intersection Summary - Canyon Rd E & 112th St E (AM Peak)

HCM 6th Signalized Intersection Summary
20: Canyon Rd E & 112th St E

01/31/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	133	127	84	55	205	385	190	2023	66	171	1005	60
Future Volume (veh/h)	133	127	84	55	205	385	190	2023	66	171	1005	60
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		0.99	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758
Adj Flow Rate, veh/h	139	132	88	57	214	401	198	2107	69	178	1047	62
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	103	1013	447	72	950	419	250	1913	62	226	1823	108
Arrive On Green	0.06	0.30	0.30	0.04	0.28	0.28	0.08	0.40	0.40	0.14	0.79	0.79
Sat Flow, veh/h	1674	3340	1475	1674	3340	1474	3248	4772	156	3248	4631	274
Grp Volume(v), veh/h	139	132	88	57	214	401	198	1411	765	178	723	386
Grp Sat Flow(s),veh/h/ln	1674	1670	1475	1674	1670	1474	1624	1600	1728	1624	1600	1706
Q Serve(g_s), s	7.4	3.4	5.3	4.0	5.9	32.1	7.2	48.1	48.1	6.4	10.5	10.6
Cycle Q Clear(g_c), s	7.4	3.4	5.3	4.0	5.9	32.1	7.2	48.1	48.1	6.4	10.5	10.6
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.09	1.00		0.16
Lane Grp Cap(c), veh/h	103	1013	447	72	950	419	250	1283	693	226	1259	671
V/C Ratio(X)	1.35	0.13	0.20	0.79	0.23	0.96	0.79	1.10	1.10	0.79	0.57	0.58
Avail Cap(c_a), veh/h	103	1013	447	75	957	423	341	1283	693	233	1259	671
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96	0.96	0.96
Uniform Delay (d), s/veh	56.3	30.3	31.0	56.9	32.8	42.2	54.4	35.9	35.9	50.8	8.9	8.9
Incr Delay (d2), s/veh	206.9	0.0	0.1	37.9	0.0	32.2	5.9	57.1	66.4	14.1	1.8	3.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	9.1	1.4	1.9	2.5	2.4	15.3	3.1	28.4	32.5	2.9	2.7	3.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	263.2	30.3	31.0	94.8	32.9	74.4	60.4	93.0	102.3	64.9	10.7	12.3
LnGrp LOS	F	C	C	F	C	E	E	F	F	E	B	B
Approach Vol, veh/h		359			672			2374			1287	
Approach Delay, s/veh		120.7			62.9			93.3			18.7	
Approach LOS		F			E			F			B	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	14.6	52.6	13.0	39.7	13.7	53.5	10.7	42.0
Change Period (Y+Rc), s	5.4	* 5.4	5.6	5.6	5.4	* 5.4	5.6	5.6
Max Green Setting (Gmax), s	12.6	* 44	7.4	34.4	8.6	* 48	5.4	36.4
Max Q Clear Time (g_c+I1), s	9.2	12.6	9.4	34.1	8.4	50.1	6.0	7.3
Green Ext Time (p_c), s	0.1	5.7	0.0	0.1	0.0	0.0	0.0	0.5

Intersection Summary	
HCM 6th Ctrl Delay	70.6
HCM 6th LOS	E

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Table D-22. HCM Signalized Intersection Capacity Analysis – Canyon Rd E & SR512 EB Off-Ramp (AM Peak)

HCM Signalized Intersection Capacity Analysis
21: Canyon Rd E & SR512 EB Off-Ramp 01/31/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	99	1	534	0	0	0	0	1652	944	78	737	0
Future Volume (vph)	99	1	534	0	0	0	0	1652	944	78	737	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.7	4.7	4.7					4.8		4.8	4.8	
Lane Util. Factor	1.00	0.95	0.95					0.91		1.00	0.95	
Frpb, ped/bikes	1.00	0.97	0.97					0.98		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00					1.00		1.00	1.00	
Frt	1.00	0.85	0.85					0.95		1.00	1.00	
Flt Protected	0.95	1.00	1.00					1.00		0.95	1.00	
Satd. Flow (prot)	1660	1374	1373					4424		1660	3320	
Flt Permitted	0.95	1.00	1.00					1.00		0.95	1.00	
Satd. Flow (perm)	1660	1374	1373					4424		1660	3320	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	105	1	568	0	0	0	0	1757	1004	83	784	0
RTOR Reduction (vph)	0	232	232	0	0	0	0	65	0	0	0	0
Lane Group Flow (vph)	105	53	52	0	0	0	0	2696	0	83	784	0
Confl. Peds. (#/hr)	10		10						10	10		
Heavy Vehicles (%)	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
Turn Type	Split	NA	Perm					NA		Prot	NA	
Protected Phases	4	4						2		1	6	
Permitted Phases			4									
Actuated Green, G (s)	14.2	14.2	14.2					79.3		12.2	96.3	
Effective Green, g (s)	14.2	14.2	14.2					79.3		12.2	96.3	
Actuated g/C Ratio	0.12	0.12	0.12					0.66		0.10	0.80	
Clearance Time (s)	4.7	4.7	4.7					4.8		4.8	4.8	
Vehicle Extension (s)	2.5	2.5	2.5					3.0		2.5	3.0	
Lane Grp Cap (vph)	196	162	162					2923		168	2664	
v/s Ratio Prot	c0.06	0.04						c0.61		c0.05	0.24	
v/s Ratio Perm			0.04									
v/c Ratio	0.54	0.33	0.32					0.95dr		0.49	0.29	
Uniform Delay, d1	49.8	48.5	48.5					17.7		51.0	3.1	
Progression Factor	1.00	1.00	1.00					0.73		0.88	0.03	
Incremental Delay, d2	2.2	0.9	0.8					4.9		1.4	0.2	
Delay (s)	52.0	49.4	49.3					17.8		46.4	0.3	
Level of Service	D	D	D					B		D	A	
Approach Delay (s)		49.8			0.0			17.8			4.7	
Approach LOS		D			A			B			A	

Intersection Summary			
HCM 2000 Control Delay	20.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	14.3
Intersection Capacity Utilization	87.6%	ICU Level of Service	E
Analysis Period (min)	15		

dr Defacto Right Lane. Recode with 1 though lane as a right lane.

c Critical Lane Group

Table D-23. HCM 6th Signalized Intersection Summary - SR512 WB Off-Ramp & Canyon Rd E (AM Peak)

HCM 6th Signalized Intersection Summary
22: SR512 WB Off-Ramp & Canyon Rd E 01/31/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↰↰	↱		↰↰	↑↑			↓↓	↱
Traffic Volume (veh/h)	0	0	0	494	0	98	1119	632	0	0	321	205
Future Volume (veh/h)	0	0	0	494	0	98	1119	632	0	0	321	205
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		0.98	1.00		1.00	1.00		0.98
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach					No			No			No	
Adj Sat Flow, veh/h/ln				1758	1758	1758	1758	1758	0	0	1758	1758
Adj Flow Rate, veh/h				509	0	101	1154	652	0	0	331	211
Peak Hour Factor				0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %				3	3	3	3	3	0	0	3	3
Cap, veh/h				624	0	282	1612	2409	0	0	612	269
Arrive On Green				0.19	0.00	0.19	0.50	0.72	0.00	0.00	0.18	0.18
Sat Flow, veh/h				3248	0	1466	3248	3428	0	0	3428	1465
Grp Volume(v), veh/h				509	0	101	1154	652	0	0	331	211
Grp Sat Flow(s),veh/h/ln				1624	0	1466	1624	1670	0	0	1670	1465
Q Serve(g_s), s				18.0	0.0	7.2	33.3	8.1	0.0	0.0	10.8	16.5
Cycle Q Clear(g_c), s				18.0	0.0	7.2	33.3	8.1	0.0	0.0	10.8	16.5
Prop In Lane				1.00		1.00	1.00		0.00	0.00		1.00
Lane Grp Cap(c), veh/h				624	0	282	1612	2409	0	0	612	269
V/C Ratio(X)				0.82	0.00	0.36	0.72	0.27	0.00	0.00	0.54	0.79
Avail Cap(c_a), veh/h				774	0	350	1612	2409	0	0	612	269
HCM Platoon Ratio				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)				1.00	0.00	1.00	0.31	0.31	0.00	0.00	0.98	0.98
Uniform Delay (d), s/veh				46.4	0.0	42.1	23.6	5.8	0.0	0.0	44.4	46.7
Incr Delay (d2), s/veh				5.9	0.0	0.9	0.9	0.1	0.0	0.0	3.3	19.9
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				7.8	0.0	2.7	12.6	2.6	0.0	0.0	4.8	7.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh				52.3	0.0	43.0	24.5	5.9	0.0	0.0	47.8	66.7
LnGrp LOS				D	A	D	C	A	A	A	D	E
Approach Vol, veh/h					610			1806			542	
Approach Delay, s/veh					50.8			17.8			55.1	
Approach LOS					D			B			E	
Timer - Assigned Phs		2			5	6		8				
Phs Duration (G+Y+Rc), s		91.5			64.5	27.0		28.5				
Change Period (Y+Rc), s		5.0			5.0	5.0		5.4				
Max Green Setting (Gmax), s		81.0			54.0	22.0		28.6				
Max Q Clear Time (g_c+I1), s		10.1			35.3	18.5		20.0				
Green Ext Time (p_c), s		4.3			4.8	0.9		2.1				
Intersection Summary												
HCM 6th Ctrl Delay			31.4									
HCM 6th LOS			C									

Table D-24. HCM 6th Signalized Intersection Summary - Canyon Rd E & 104th St E (AM Peak)

HCM 6th Signalized Intersection Summary
23: Canyon Rd E & 104th St E 01/31/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	15	25	45	101	69	75	62	617	51	30	380	8
Future Volume (veh/h)	15	25	45	101	69	75	62	617	51	30	380	8
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		0.98	1.00		0.99	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758
Adj Flow Rate, veh/h	16	26	47	106	73	79	65	649	54	32	400	8
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	16	216	179	132	337	281	78	1165	97	35	1166	23
Arrive On Green	0.01	0.12	0.12	0.08	0.19	0.19	0.05	0.37	0.37	0.02	0.35	0.35
Sat Flow, veh/h	1674	1758	1453	1674	1758	1466	1674	3118	259	1674	3348	67
Grp Volume(v), veh/h	16	26	47	106	73	79	65	347	356	32	199	209
Grp Sat Flow(s),veh/h/ln	1674	1758	1453	1674	1758	1466	1674	1670	1707	1674	1670	1745
Q Serve(g_s), s	0.4	0.6	1.3	2.8	1.6	2.1	1.7	7.3	7.4	0.9	3.9	3.9
Cycle Q Clear(g_c), s	0.4	0.6	1.3	2.8	1.6	2.1	1.7	7.3	7.4	0.9	3.9	3.9
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.15	1.00		0.04
Lane Grp Cap(c), veh/h	16	216	179	132	337	281	78	624	638	35	582	608
V/C Ratio(X)	0.98	0.12	0.26	0.80	0.22	0.28	0.84	0.56	0.56	0.91	0.34	0.34
Avail Cap(c_a), veh/h	582	1005	831	582	1005	838	769	1329	1359	769	1329	1389
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	22.1	17.4	17.7	20.2	15.2	15.4	21.1	11.0	11.0	21.8	10.8	10.8
Incr Delay (d2), s/veh	57.0	0.1	0.3	4.3	0.1	0.2	8.6	1.1	1.1	25.7	0.5	0.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	0.2	0.4	1.1	0.6	0.6	0.8	2.3	2.4	0.6	1.3	1.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	79.1	17.5	18.0	24.5	15.3	15.6	29.7	12.2	12.1	47.5	11.2	11.2
LnGrp LOS	E	B	B	C	B	B	C	B	B	D	B	B
Approach Vol, veh/h		89			258			768			440	
Approach Delay, s/veh		28.9			19.2			13.6			13.9	
Approach LOS		C			B			B			B	
Timer - Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	6.6	20.0	4.9	13.1	5.4	21.2	8.0	10.0				
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5				
Max Green Setting (Gmax), s	20.5	35.5	15.5	25.5	20.5	35.5	15.5	25.5				
Max Q Clear Time (g_c+I1), s	3.7	5.9	2.4	4.1	2.9	9.4	4.8	3.3				
Green Ext Time (p_c), s	0.0	3.6	0.0	0.3	0.0	6.7	0.0	0.1				
Intersection Summary												
HCM 6th Ctrl Delay			15.5									
HCM 6th LOS			B									

Table D-25. HCM 6th Signalized Intersection Summary - 94th Ave E & 39th Ave SW (AM Peak)

HCM 6th Signalized Intersection Summary
24: 94th Ave E & 39th Ave SW

01/31/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	216	312	67	27	201	55	79	1130	85	83	549	169
Future Volume (veh/h)	216	312	67	27	201	55	79	1130	85	83	549	169
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1758	1758	1758	1744	1744	1744	1786	1786	1786	1758	1758	1758
Adj Flow Rate, veh/h	237	343	74	30	221	60	87	1242	93	91	603	186
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	3	3	3	4	4	4	1	1	1	3	3	3
Cap, veh/h	223	716	315	45	292	77	109	1600	120	113	1265	390
Arrive On Green	0.13	0.21	0.21	0.03	0.11	0.11	0.06	0.50	0.50	0.07	0.50	0.50
Sat Flow, veh/h	1674	3340	1468	1661	2588	686	1701	3200	239	1674	2514	774
Grp Volume(v), veh/h	237	343	74	30	140	141	87	657	678	91	400	389
Grp Sat Flow(s),veh/h/ln	1674	1670	1468	1661	1657	1618	1701	1697	1743	1674	1670	1618
Q Serve(g_s), s	14.9	10.1	4.7	2.0	9.1	9.5	5.6	35.4	35.6	6.0	17.5	17.6
Cycle Q Clear(g_c), s	14.9	10.1	4.7	2.0	9.1	9.5	5.6	35.4	35.6	6.0	17.5	17.6
Prop In Lane	1.00		1.00	1.00		0.42	1.00		0.14	1.00		0.48
Lane Grp Cap(c), veh/h	223	716	315	45	187	182	109	848	871	113	840	814
V/C Ratio(X)	1.06	0.48	0.24	0.67	0.75	0.78	0.80	0.78	0.78	0.81	0.48	0.48
Avail Cap(c_a), veh/h	223	1072	471	140	450	440	196	848	871	118	840	814
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	48.5	38.5	36.3	53.9	48.1	48.2	51.6	22.8	22.9	51.4	18.1	18.2
Incr Delay (d2), s/veh	77.8	0.2	0.1	6.1	2.2	2.7	5.0	6.9	6.8	29.0	1.9	2.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	11.0	4.1	1.7	0.9	3.9	4.0	2.6	15.2	15.7	3.4	7.1	6.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	126.2	38.6	36.5	60.0	50.3	50.9	56.7	29.7	29.7	80.5	20.1	20.2
LnGrp LOS	F	D	D	E	D	D	E	C	C	F	C	C
Approach Vol, veh/h		654			311			1422			880	
Approach Delay, s/veh		70.1			51.5			31.3			26.4	
Approach LOS		E			D			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	12.6	61.0	8.6	29.6	12.2	61.4	20.0	18.2
Change Period (Y+Rc), s	5.1	5.1	5.6	* 5.6	5.1	5.1	5.1	5.6
Max Green Setting (Gmax), s	7.9	55.9	9.4	* 36	12.9	50.9	14.9	30.4
Max Q Clear Time (g_c+I1), s	8.0	37.6	4.0	12.1	7.6	19.6	16.9	11.5
Green Ext Time (p_c), s	0.0	3.4	0.0	0.9	0.0	1.9	0.0	0.5

Intersection Summary	
HCM 6th Ctrl Delay	39.7
HCM 6th LOS	D

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Table D-26. HCM 6th Signalized Intersection Summary – 94th Ave E & SR512 EB Off-Ramp/South Hill Mall (AM Peak)

HCM 6th Signalized Intersection Summary
25: 94th Ave E & SR512 EB Off-Ramp/South Hill Mall 01/31/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	102	27	322	1	0	25	0	1395	6	23	478	0
Future Volume (veh/h)	102	27	322	1	0	25	0	1395	6	23	478	0
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1758	1758	1758	1800	0	1800	0	1786	1786	1758	1758	0
Adj Flow Rate, veh/h	109	29	343	1	0	27	0	1484	6	24	509	0
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	3	3	3	0	0	0	0	1	1	3	3	0
Cap, veh/h	414	435	363	0	0	0	0	2089	8	39	2231	0
Arrive On Green	0.25	0.25	0.25	0.00	0.00	0.00	0.00	0.60	0.60	0.02	0.67	0.00
Sat Flow, veh/h	1674	1758	1469		0		0	3555	14	1674	3428	0
Grp Volume(v), veh/h	109	29	343		0.0		0	726	764	24	509	0
Grp Sat Flow(s),veh/h/ln	1674	1758	1469				0	1697	1783	1674	1670	0
Q Serve(g_s), s	6.2	1.5	27.1				0.0	35.2	35.2	1.7	7.1	0.0
Cycle Q Clear(g_c), s	6.2	1.5	27.1				0.0	35.2	35.2	1.7	7.1	0.0
Prop In Lane	1.00		1.00				0.00		0.01	1.00		0.00
Lane Grp Cap(c), veh/h	414	435	363				0	1023	1075	39	2231	0
V/C Ratio(X)	0.26	0.07	0.94				0.00	0.71	0.71	0.62	0.23	0.00
Avail Cap(c_a), veh/h	439	461	385				0	1023	1075	71	2231	0
HCM Platoon Ratio	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00				0.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	35.8	34.1	43.7				0.0	16.3	16.3	57.3	7.7	0.0
Incr Delay (d2), s/veh	0.1	0.0	30.3				0.0	4.2	4.0	5.9	0.2	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.6	0.6	12.8				0.0	14.1	14.8	0.8	2.5	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	35.9	34.1	74.0				0.0	20.5	20.3	63.2	7.9	0.0
LnGrp LOS	D	C	E				A	C	C	E	A	A
Approach Vol, veh/h		481						1490			533	
Approach Delay, s/veh		63.0						20.4			10.4	
Approach LOS		E						C			B	
Timer - Assigned Phs	1	2		4		6						
Phs Duration (G+Y+Rc), s	7.7	76.3		34.3		84.0						
Change Period (Y+Rc), s	5.0	5.0		5.0		5.0						
Max Green Setting (Gmax), s	5.0	69.0		31.0		79.0						
Max Q Clear Time (g_c+I1), s	3.7	37.2		29.1		9.1						
Green Ext Time (p_c), s	0.0	4.2		0.1		1.4						
Intersection Summary												
HCM 6th Ctrl Delay			26.5									
HCM 6th LOS			C									

Table D-27. HCM 6th Signalized Intersection Summary – 94th Ave E & SR512 WB On-Ramp/S Hill Park Dr (AM Peak)

HCM 6th Signalized Intersection Summary
26: 94th Ave E & SR512 WB On-Ramp/S Hill Park Dr — 01/31/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	38	69	70	617	781	124	49	463	77
Future Volume (veh/h)	0	0	0	38	69	70	617	781	124	49	463	77
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach					No			No			No	
Adj Sat Flow, veh/h/ln				1744	1744	1744	1786	1786	1786	1772	1772	1772
Adj Flow Rate, veh/h				42	76	77	678	858	136	54	509	85
Peak Hour Factor				0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %				4	4	4	1	1	1	2	2	2
Cap, veh/h				53	96	129	692	2132	338	68	1025	170
Arrive On Green				0.09	0.09	0.09	0.41	0.73	0.73	0.04	0.35	0.35
Sat Flow, veh/h				610	1104	1478	1701	2934	465	1688	2889	480
Grp Volume(v), veh/h				118	0	77	678	496	498	54	296	298
Grp Sat Flow(s),veh/h/ln				1713	0	1478	1701	1697	1702	1688	1683	1685
Q Serve(g_s), s				7.5	0.0	5.6	43.8	12.6	12.6	3.5	15.3	15.4
Cycle Q Clear(g_c), s				7.5	0.0	5.6	43.8	12.6	12.6	3.5	15.3	15.4
Prop In Lane				0.36		1.00	1.00		0.27	1.00		0.28
Lane Grp Cap(c), veh/h				150	0	129	692	1233	1237	68	597	598
V/C Ratio(X)				0.79	0.00	0.60	0.98	0.40	0.40	0.79	0.50	0.50
Avail Cap(c_a), veh/h				446	0	385	692	1233	1237	135	597	598
HCM Platoon Ratio				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)				1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh				49.8	0.0	48.9	32.6	5.9	5.9	53.0	28.1	28.2
Incr Delay (d2), s/veh				3.4	0.0	1.6	29.0	1.0	1.0	7.5	2.9	3.0
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				3.4	0.0	2.1	23.0	4.2	4.3	1.6	6.6	6.7
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh				53.2	0.0	50.5	61.5	6.9	6.9	60.4	31.0	31.1
LnGrp LOS				D	A	D	E	A	A	E	C	C
Approach Vol, veh/h					195			1672			648	
Approach Delay, s/veh					52.2			29.0			33.5	
Approach LOS					D			C			C	
Timer - Assigned Phs	1	2			5	6		8				
Phs Duration (G+Y+Rc), s	9.6	86.6			51.0	45.2		15.1				
Change Period (Y+Rc), s	5.1	5.7			5.7	* 5.7		5.4				
Max Green Setting (Gmax), s	8.9	75.9			45.3	* 40		29.0				
Max Q Clear Time (g_c+I1), s	5.5	14.6			45.8	17.4		9.5				
Green Ext Time (p_c), s	0.0	2.4			0.0	1.3		0.2				
Intersection Summary												
HCM 6th Ctrl Delay			32.0									
HCM 6th LOS			C									

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Table D-28. HCM 6th Signalized Intersection Summary - 94th Ave E/9th St SW & 31st Ave SW (AM Peak)

HCM 6th Signalized Intersection Summary
27: 94th Ave E/9th St SW & 31st Ave SW

01/31/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	108	123	66	232	129	54	60	557	237	15	291	27
Future Volume (veh/h)	108	123	66	232	129	54	60	557	237	15	291	27
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1786	1786	1786	1758	1758	1758	1772	1772	1772	1730	1730	1730
Adj Flow Rate, veh/h	121	138	74	261	145	61	67	626	266	17	327	30
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Percent Heavy Veh, %	1	1	1	3	3	3	2	2	2	5	5	5
Cap, veh/h	147	174	147	286	214	90	85	926	785	31	767	70
Arrive On Green	0.09	0.10	0.10	0.17	0.18	0.18	0.05	0.52	0.52	0.02	0.49	0.49
Sat Flow, veh/h	1701	1786	1514	1674	1175	494	1688	1772	1502	1647	1561	143
Grp Volume(v), veh/h	121	138	74	261	0	206	67	626	266	17	0	357
Grp Sat Flow(s),veh/h/ln	1701	1786	1514	1674	0	1669	1688	1772	1502	1647	0	1704
Q Serve(g_s), s	7.4	8.0	4.9	16.1	0.0	12.1	4.1	27.4	10.8	1.1	0.0	14.2
Cycle Q Clear(g_c), s	7.4	8.0	4.9	16.1	0.0	12.1	4.1	27.4	10.8	1.1	0.0	14.2
Prop In Lane	1.00		1.00	1.00		0.30	1.00		1.00	1.00		0.08
Lane Grp Cap(c), veh/h	147	174	147	286	0	304	85	926	785	31	0	837
V/C Ratio(X)	0.82	0.79	0.50	0.91	0.00	0.68	0.79	0.68	0.34	0.55	0.00	0.43
Avail Cap(c_a), veh/h	194	543	460	286	0	603	160	926	785	78	0	837
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	47.3	46.4	45.1	42.8	0.0	40.2	49.4	18.5	14.6	51.2	0.0	17.2
Incr Delay (d2), s/veh	14.7	3.1	1.0	30.5	0.0	1.0	6.1	3.9	1.2	5.7	0.0	1.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.7	3.7	1.9	9.0	0.0	5.0	1.9	11.7	3.8	0.5	0.0	5.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	62.0	49.5	46.0	73.3	0.0	41.2	55.5	22.5	15.7	56.9	0.0	18.8
LnGrp LOS	E	D	D	E	A	D	E	C	B	E	A	B
Approach Vol, veh/h		333			467			959			374	
Approach Delay, s/veh		53.3			59.1			22.9			20.5	
Approach LOS		D			E			C			C	
Timer - Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	7.0	60.0	23.0	15.2	10.3	56.7	14.1	24.1				
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0				
Max Green Setting (Gmax), s	5.0	55.0	18.0	32.0	10.0	50.0	12.0	38.0				
Max Q Clear Time (g_c+I1), s	3.1	29.4	18.1	10.0	6.1	16.2	9.4	14.1				
Green Ext Time (p_c), s	0.0	1.6	0.0	0.3	0.0	0.8	0.0	0.4				
Intersection Summary												
HCM 6th Ctrl Delay			35.2									
HCM 6th LOS			D									

Table D-29. HCM 6th Signalized Intersection Summary - 31st Ave SW & WB SR512 Off-Ramp (AM Peak)

HCM 6th Signalized Intersection Summary
28: 31st Ave SW & WB SR512 Off-Ramp

01/31/2023

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑	↑	↱	↰	↱
Traffic Volume (veh/h)	0	410	144	559	503	336
Future Volume (veh/h)	0	410	144	559	503	336
Initial Q (Qb), veh	0	0	30	0	30	30
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No	No		No	
Adj Sat Flow, veh/h/ln	0	1786	1772	1772	1730	1730
Adj Flow Rate, veh/h	0	477	167	0	585	0
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86
Percent Heavy Veh, %	0	1	2	2	5	5
Cap, veh/h	0	922	950		721	
Arrive On Green	0.00	0.56	0.18	0.00	0.38	0.00
Sat Flow, veh/h	0	1786	1772	1502	1647	1466
Grp Volume(v), veh/h	0	477	167	0	585	0
Grp Sat Flow(s),veh/h/ln	0	1786	1772	1502	1647	1466
Q Serve(g_s), s	0.0	22.7	11.1	0.0	47.9	0.0
Cycle Q Clear(g_c), s	0.0	22.7	11.1	0.0	47.9	0.0
Prop In Lane	0.00			1.00	1.00	1.00
Lane Grp Cap(c), veh/h	0	922	950		721	
V/C Ratio(X)	0.00	0.52	0.18		0.81	
Avail Cap(c_a), veh/h	0	992	984		793	
HCM Platoon Ratio	1.00	1.00	0.33	0.33	1.00	1.00
Upstream Filter(I)	0.00	1.00	0.76	0.00	1.00	0.00
Uniform Delay (d), s/veh	0.0	22.6	35.5	0.0	38.7	0.0
Incr Delay (d2), s/veh	0.0	2.1	0.3	0.0	6.3	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	8.7	0.0	65.8	0.0
%ile BackOfQ(50%),veh/ln	0.0	10.9	12.4	0.0	37.9	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	0.0	24.7	44.6	0.0	110.8	0.0
LnGrp LOS	A	C	D		F	
Approach Vol, veh/h		477	167	A	585	A
Approach Delay, s/veh		24.7	44.6		110.8	
Approach LOS		C	D		F	
Timer - Assigned Phs		2		4		6
Phs Duration (G+Y+Rc), s		82.4		57.6		82.4
Change Period (Y+Rc), s		4.6		4.6		4.6
Max Green Setting (Gmax), s		63.4		67.4		63.4
Max Q Clear Time (g_c+I1), s		24.7		49.9		13.1
Green Ext Time (p_c), s		3.4		3.1		1.0
Intersection Summary						
HCM 6th Ctrl Delay			68.4			
HCM 6th LOS			E			
Notes						

Unsignalized Delay for [WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Table D-30. HCM 6th Signalized Intersection Summary - EB SR512 Off-Ramp & 31st Ave SW (AM Peak)

HCM 6th Signalized Intersection Summary
29: EB SR512 Off-Ramp & 31st Ave SW

01/31/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	247	666	0	0	701	793	2	0	422	0	0	0
Future Volume (veh/h)	247	666	0	0	701	793	2	0	422	0	0	0
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Work Zone On Approach		No			No			No				
Adj Sat Flow, veh/h/ln	1730	1730	0	0	1772	1772	1758	1758	1758			
Adj Flow Rate, veh/h	274	740	0	0	779	0	2	0	0			
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90			
Percent Heavy Veh, %	5	5	0	0	2	2	3	3	3			
Cap, veh/h	429	1612	0	0	1131		4	0				
Arrive On Green	0.52	1.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00			
Sat Flow, veh/h	1647	1730	0	0	1772	1502	1674	0	1490			
Grp Volume(v), veh/h	274	740	0	0	779	0	2	0	0			
Grp Sat Flow(s),veh/h/ln	1647	1730	0	0	1772	1502	1674	0	1490			
Q Serve(g_s), s	16.7	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0			
Cycle Q Clear(g_c), s	16.7	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0			
Prop In Lane	1.00		0.00	0.00		1.00	1.00		1.00			
Lane Grp Cap(c), veh/h	429	1612	0	0	1131		4	0				
V/C Ratio(X)	0.64	0.46	0.00	0.00	0.69		0.45	0.00				
Avail Cap(c_a), veh/h	429	1612	0	0	1131		124	0				
HCM Platoon Ratio	2.00	2.00	1.00	1.00	1.67	1.67	1.00	1.00	1.00			
Upstream Filter(I)	0.64	0.64	0.00	0.00	0.73	0.00	1.00	0.00	0.00			
Uniform Delay (d), s/veh	28.9	0.0	0.0	0.0	0.0	0.0	69.7	0.0	0.0			
Incr Delay (d2), s/veh	1.9	0.6	0.0	0.0	2.5	0.0	57.1	0.0	0.0			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	5.5	0.3	0.0	0.0	0.8	0.0	0.1	0.0	0.0			
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	30.7	0.6	0.0	0.0	2.5	0.0	126.8	0.0	0.0			
LnGrp LOS	C	A	A	A	A		F	A				
Approach Vol, veh/h		1014			779	A		2	A			
Approach Delay, s/veh		8.7			2.5			126.8				
Approach LOS		A			A			F				
Timer - Assigned Phs		2			5	6		8				
Phs Duration (G+Y+Rc), s		135.0			41.0	94.0		5.0				
Change Period (Y+Rc), s		4.6			4.6	4.6		4.6				
Max Green Setting (Gmax), s		100.4			26.4	89.4		10.4				
Max Q Clear Time (g_c+I1), s		2.0			18.7	2.0		2.2				
Green Ext Time (p_c), s		7.3			0.4	6.5		0.0				
Intersection Summary												
HCM 6th Ctrl Delay			6.2									
HCM 6th LOS			A									
Notes												

Unsignalized Delay for [NBR, WBR] is excluded from calculations of the approach delay and intersection delay.

Table D-31. HCM Signalized Intersection Capacity Analysis – 31st Ave SW & S Meridian (AM Peak)

HCM Signalized Intersection Capacity Analysis
30: 31st Ave SW & S Meridian 01/31/2023

Movement	EBL	EBT	WBT	WBR	SWL	SWR
Lane Configurations						
Traffic Volume (vph)	324	764	1268	718	174	226
Future Volume (vph)	324	764	1268	718	174	226
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width	11	11	11	11	11	11
Total Lost time (s)	4.6	4.6	4.6	4.6	4.6	4.6
Lane Util. Factor	*0.55	*0.55	0.95	*0.95	0.97	*0.95
Frt	1.00	1.00	1.00	0.65	1.00	0.65
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1699	1789	3210	1043	3144	1053
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1699	1789	3210	1043	3144	1053
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	345	813	1349	764	185	240
RTOR Reduction (vph)	0	0	0	202	0	153
Lane Group Flow (vph)	345	813	1349	562	185	87
Heavy Vehicles (%)	7%	7%	3%	3%	2%	2%
Turn Type	Prot	NA	NA	Perm	Prot	Perm
Protected Phases	5	6	6		4	
Permitted Phases				6		4
Actuated Green, G (s)	10.4	99.7	99.7	99.7	16.1	16.1
Effective Green, g (s)	10.4	99.7	99.7	99.7	16.1	16.1
Actuated g/C Ratio	0.07	0.71	0.71	0.71	0.12	0.12
Clearance Time (s)	4.6	4.6	4.6	4.6	4.6	4.6
Vehicle Extension (s)	2.5	2.5	2.5	2.5	2.5	2.5
Lane Grp Cap (vph)	126	1274	2285	742	361	121
v/s Ratio Prot	c0.20	0.45	0.42		0.06	
v/s Ratio Perm				c0.54		c0.08
v/c Ratio	2.74	0.64	0.59	0.76	0.51	0.72
Uniform Delay, d1	64.8	10.6	10.0	12.6	58.3	59.8
Progression Factor	0.98	0.70	1.00	1.00	1.00	1.00
Incremental Delay, d2	802.7	2.3	1.1	7.1	0.9	17.2
Delay (s)	865.9	9.7	11.1	19.7	59.2	77.0
Level of Service	F	A	B	B	E	E
Approach Delay (s)		264.8	14.2		69.2	
Approach LOS		F	B		E	

Intersection Summary			
HCM 2000 Control Delay	99.1	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	13.8
Intersection Capacity Utilization	64.9%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Table D-32. HCM 6th Signalized Intersection Summary - S Meridian & EB SR512 Off-Ramp (AM Peak)

HCM 6th Signalized Intersection Summary
31: S Meridian & EB SR512 Off-Ramp
01/31/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	136	0	116	0	0	0	0	950	495	27	717	0
Future Volume (veh/h)	136	0	116	0	0	0	0	950	495	27	717	0
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No						No			No	
Adj Sat Flow, veh/h/ln	1786	1786	1786				0	1786	1786	1772	1772	0
Adj Flow Rate, veh/h	143	0	0				0	1000	521	28	755	0
Peak Hour Factor	0.95	0.95	0.95				0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	1	1	1				0	1	1	2	2	0
Cap, veh/h	173	0					0	1503	761	77	2658	0
Arrive On Green	0.10	0.00	0.00				0.00	0.69	0.69	0.05	0.79	0.00
Sat Flow, veh/h	1701	0	1514				0	2268	1104	1688	3455	0
Grp Volume(v), veh/h	143	0	0				0	772	749	28	755	0
Grp Sat Flow(s),veh/h/ln	1701	0	1514				0	1697	1586	1688	1683	0
Q Serve(g_s), s	9.1	0.0	0.0				0.0	28.6	30.6	1.8	6.7	0.0
Cycle Q Clear(g_c), s	9.1	0.0	0.0				0.0	28.6	30.6	1.8	6.7	0.0
Prop In Lane	1.00		1.00				0.00		0.70	1.00		0.00
Lane Grp Cap(c), veh/h	173	0					0	1170	1094	77	2658	0
V/C Ratio(X)	0.83	0.00					0.00	0.66	0.68	0.37	0.28	0.00
Avail Cap(c_a), veh/h	478	0					0	1170	1094	77	2658	0
HCM Platoon Ratio	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00				0.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	48.6	0.0	0.0				0.0	9.7	10.1	51.1	3.1	0.0
Incr Delay (d2), s/veh	3.8	0.0	0.0				0.0	2.9	3.5	13.0	0.3	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.0	0.0	0.0				0.0	10.3	10.5	1.0	1.8	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	52.4	0.0	0.0				0.0	12.7	13.5	64.0	3.4	0.0
LnGrp LOS	D	A					A	B	B	E	A	A
Approach Vol, veh/h		143	A					1521			783	
Approach Delay, s/veh		52.4						13.1			5.6	
Approach LOS		D						B			A	
Timer - Assigned Phs		2			5	6		8				
Phs Duration (G+Y+Rc), s		93.0			11.0	82.0		17.2				
Change Period (Y+Rc), s		6.0			6.0	6.0		6.0				
Max Green Setting (Gmax), s		87.0			5.0	76.0		31.0				
Max Q Clear Time (g_c+I1), s		8.7			3.8	32.6		11.1				
Green Ext Time (p_c), s		2.2			0.0	4.8		0.3				
Intersection Summary												
HCM 6th Ctrl Delay			13.0									
HCM 6th LOS			B									

Notes

Unsignalized Delay for [EBR] is excluded from calculations of the approach delay and intersection delay.

Table D-33. HCM 6th Signalized Intersection Summary - S Meridian & WB SR512 Off-Ramp (AM Peak)

HCM 6th Signalized Intersection Summary
32: S Meridian & WB SR512 Off-Ramp 01/31/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	313	2	37	78	1008	0	0	431	105
Future Volume (veh/h)	0	0	0	313	2	37	78	1008	0	0	431	105
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach					No			No			No	
Adj Sat Flow, veh/h/ln				1772	1772	1772	1786	1786	0	0	1772	1772
Adj Flow Rate, veh/h				340	2	40	85	1096	0	0	468	114
Peak Hour Factor				0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %				2	2	2	1	1	0	0	2	2
Cap, veh/h				316	2	283	105	2467	0	0	2097	934
Arrive On Green				0.19	0.19	0.19	0.06	0.73	0.00	0.00	0.62	0.62
Sat Flow, veh/h				1678	10	1502	1701	3483	0	0	3455	1499
Grp Volume(v), veh/h				342	0	40	85	1096	0	0	468	114
Grp Sat Flow(s),veh/h/ln				1688	0	1502	1701	1697	0	0	1683	1499
Q Serve(g_s), s				24.5	0.0	2.9	6.4	16.9	0.0	0.0	7.9	4.0
Cycle Q Clear(g_c), s				24.5	0.0	2.9	6.4	16.9	0.0	0.0	7.9	4.0
Prop In Lane				0.99		1.00	1.00		0.00	0.00		1.00
Lane Grp Cap(c), veh/h				318	0	283	105	2467	0	0	2097	934
V/C Ratio(X)				1.08	0.00	0.14	0.81	0.44	0.00	0.00	0.22	0.12
Avail Cap(c_a), veh/h				318	0	283	203	2467	0	0	2097	934
HCM Platoon Ratio				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)				1.00	0.00	1.00	1.00	1.00	0.00	0.00	1.00	1.00
Uniform Delay (d), s/veh				52.8	0.0	44.0	60.2	7.2	0.0	0.0	10.7	10.0
Incr Delay (d2), s/veh				71.9	0.0	0.1	5.4	0.6	0.0	0.0	0.2	0.3
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				16.7	0.0	1.1	2.9	5.8	0.0	0.0	3.0	1.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh				124.6	0.0	44.1	65.6	7.7	0.0	0.0	11.0	10.3
LnGrp LOS				F	A	D	E	A	A	A	B	B
Approach Vol, veh/h					382			1181			582	
Approach Delay, s/veh					116.2			11.9			10.9	
Approach LOS					F			B			B	

Timer - Assigned Phs	1	2	4	6
Phs Duration (G+Y+Rc), s	13.5	86.5	30.0	100.0
Change Period (Y+Rc), s	5.5	5.5	5.5	5.5
Max Green Setting (Gmax), s	15.5	73.5	24.5	94.5
Max Q Clear Time (g_c+I1), s	8.4	9.9	26.5	18.9
Green Ext Time (p_c), s	0.0	1.3	0.0	3.5

Intersection Summary	
HCM 6th Ctrl Delay	30.2
HCM 6th LOS	C

Table D-34. HCM 6th Signalized Intersection Summary – Canyon Rd E & Summit Country Center/110th St E (AM Peak)

HCM 6th Signalized Intersection Summary
33: Canyon Rd E & Summit Country Center/110th St E 01/31/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	58	4	19	1	1	10	10	2528	3	34	1216	21
Future Volume (veh/h)	58	4	19	1	1	10	10	2528	3	34	1216	21
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		0.99	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758
Adj Flow Rate, veh/h	59	4	19	1	1	10	10	2580	3	35	1241	21
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	58	2	362	45	29	362	11	2967	3	43	3006	51
Arrive On Green	0.25	0.25	0.25	0.25	0.25	0.25	0.01	1.00	1.00	0.05	1.00	1.00
Sat Flow, veh/h	0	8	1472	0	119	1472	1674	4950	6	1674	4859	82
Grp Volume(v), veh/h	63	0	19	2	0	10	10	1667	916	35	817	445
Grp Sat Flow(s),veh/h/ln	8	0	1472	119	0	1472	1674	1600	1757	1674	1600	1742
Q Serve(g_s), s	0.0	0.0	1.2	0.0	0.0	0.6	0.7	0.0	0.0	2.5	0.0	0.0
Cycle Q Clear(g_c), s	29.5	0.0	1.2	29.5	0.0	0.6	0.7	0.0	0.0	2.5	0.0	0.0
Prop In Lane	0.94		1.00	0.50		1.00	1.00		0.00	1.00		0.05
Lane Grp Cap(c), veh/h	60	0	362	74	0	362	11	1917	1053	43	1979	1078
V/C Ratio(X)	1.05	0.00	0.05	0.03	0.00	0.03	0.93	0.87	0.87	0.81	0.41	0.41
Avail Cap(c_a), veh/h	60	0	362	74	0	362	98	1917	1053	98	1979	1078
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	0.12	0.12	0.12	0.92	0.92	0.92
Uniform Delay (d), s/veh	59.0	0.0	34.6	37.3	0.0	34.4	59.2	0.0	0.0	56.6	0.0	0.0
Incr Delay (d2), s/veh	130.0	0.0	0.0	0.1	0.0	0.0	14.7	0.7	1.3	11.7	0.6	1.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.0	0.0	0.4	0.0	0.0	0.2	0.3	0.2	0.4	1.2	0.2	0.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	189.0	0.0	34.6	37.4	0.0	34.4	73.9	0.7	1.3	68.3	0.6	1.1
LnGrp LOS	F	A	C	D	A	C	E	A	A	E	A	A
Approach Vol, veh/h		82			12			2593			1297	
Approach Delay, s/veh		153.2			34.9			1.2			2.6	
Approach LOS		F			C			A			A	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	5.8	79.2		35.0	8.1	76.9		35.0				
Change Period (Y+Rc), s	5.0	5.0		5.5	5.0	5.0		5.5				
Max Green Setting (Gmax), s	7.0	68.0		29.5	7.0	68.0		29.5				
Max Q Clear Time (g_c+I1), s	2.7	2.0		31.5	4.5	2.0		31.5				
Green Ext Time (p_c), s	0.0	7.1		0.0	0.0	28.2		0.0				
Intersection Summary												
HCM 6th Ctrl Delay			4.9									
HCM 6th LOS			A									

Table D-35. HCM 6th Signalized Intersection Summary – 94th Ave E & South Hill P&R East Entrance (AM Peak)

HCM 6th Signalized Intersection Summary
34: 94th Ave E & South Hill P&R East Entrance 01/31/2023

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	3	1	0	851	588	1
Future Volume (veh/h)	3	1	0	851	588	1
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	747	747	1786	1786	1772	1772
Adj Flow Rate, veh/h	3	1	0	915	632	1
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	75	75	1	1	2	2
Cap, veh/h	4	1	0	2851	2898	5
Arrive On Green	0.01	0.01	0.00	0.84	0.84	0.84
Sat Flow, veh/h	420	140	0	3572	3537	5
Grp Volume(v), veh/h	5	0	0	915	308	325
Grp Sat Flow(s),veh/h/ln	700	0	0	1697	1683	1771
Q Serve(g_s), s	0.4	0.0	0.0	3.5	2.2	2.2
Cycle Q Clear(g_c), s	0.4	0.0	0.0	3.5	2.2	2.2
Prop In Lane	0.60	0.20	0.00			0.00
Lane Grp Cap(c), veh/h	7	0	0	2851	1414	1488
V/C Ratio(X)	0.71	0.00	0.00	0.32	0.22	0.22
Avail Cap(c_a), veh/h	297	0	0	2851	1414	1488
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	29.7	0.0	0.0	1.0	0.9	0.9
Incr Delay (d2), s/veh	84.1	0.0	0.0	0.3	0.4	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	0.0	0.0	0.1	0.1	0.1
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	113.8	0.0	0.0	1.3	1.3	1.3
LnGrp LOS	F	A	A	A	A	A
Approach Vol, veh/h	5			915	633	
Approach Delay, s/veh	113.8			1.3	1.3	
Approach LOS	F			A	A	
Timer - Assigned Phs		2		4		6
Phs Duration (G+Y+Rc), s		55.0		5.1		55.0
Change Period (Y+Rc), s		4.5		4.5		4.5
Max Green Setting (Gmax), s		50.5		25.5		50.5
Max Q Clear Time (g_c+I1), s		5.5		2.4		4.2
Green Ext Time (p_c), s		10.0		0.0		5.5
Intersection Summary						
HCM 6th Ctrl Delay			1.7			
HCM 6th LOS			A			

Table D-36. HCM 6th TWSC – South Hill P&R North Entrance & 31st Ave SW (AM Peak)

HCM 6th TWSC
35: South Hill P&R North Entrance & 31st Ave SW 01/31/2023

Intersection	
Int Delay, s/veh	0.4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	288	2	14	202	0	9
Future Vol, veh/h	288	2	14	202	0	9
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Yield
Storage Length	-	-	120	-	0	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	87	87	87	87	87	87
Heavy Vehicles, %	0	0	3	3	11	11
Mvmt Flow	331	2	16	232	0	10

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	333	0	596	332
Stage 1	-	-	-	-	332	-
Stage 2	-	-	-	-	264	-
Critical Hdwy	-	-	4.13	-	6.51	6.31
Critical Hdwy Stg 1	-	-	-	-	5.51	-
Critical Hdwy Stg 2	-	-	-	-	5.51	-
Follow-up Hdwy	-	-	2.227	-	3.599	3.399
Pot Cap-1 Maneuver	-	-	1221	-	452	689
Stage 1	-	-	-	-	707	-
Stage 2	-	-	-	-	760	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1221	-	446	689
Mov Cap-2 Maneuver	-	-	-	-	446	-
Stage 1	-	-	-	-	707	-
Stage 2	-	-	-	-	750	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.5	10.3
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	-	689	-	-	1221	-
HCM Lane V/C Ratio	-	0.015	-	-	0.013	-
HCM Control Delay (s)	0	10.3	-	-	8	-
HCM Lane LOS	A	B	-	-	A	-
HCM 95th %tile Q(veh)	-	0	-	-	0	-

Table D-37. HCM 6th TWSC – South Hill Park Dr & 31str Ave SW (AM Peak)

HCM 6th TWSC
36: South Hill Park Dr & 31st Ave SW 01/31/2023

Intersection												
Int Delay, s/veh	1.4											

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	8	363	4	61	408	11	3	0	45	2	0	4
Future Vol, veh/h	8	363	4	61	408	11	3	0	45	2	0	4
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	180	-	300	140	-	140	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	81	81	81	81	81	81	81	81	81	81	81	81
Heavy Vehicles, %	1	1	1	2	2	2	0	0	0	0	0	0
Mvmt Flow	10	448	5	75	504	14	4	0	56	2	0	5

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	518	0	0	453	0	0	1132	1136	448	1153	1127	504
Stage 1	-	-	-	-	-	-	468	468	-	654	654	-
Stage 2	-	-	-	-	-	-	664	668	-	499	473	-
Critical Hdwy	4.11	-	-	4.12	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.209	-	-	2.218	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	1053	-	-	1108	-	-	182	204	615	176	206	572
Stage 1	-	-	-	-	-	-	579	565	-	459	466	-
Stage 2	-	-	-	-	-	-	453	459	-	557	562	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1053	-	-	1108	-	-	170	188	615	151	190	572
Mov Cap-2 Maneuver	-	-	-	-	-	-	170	188	-	151	190	-
Stage 1	-	-	-	-	-	-	574	560	-	455	434	-
Stage 2	-	-	-	-	-	-	419	428	-	502	557	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.2	1.1	12.7	17.5
HCM LOS			B	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	529	1053	-	-	1108	-	-	296
HCM Lane V/C Ratio	0.112	0.009	-	-	0.068	-	-	0.025
HCM Control Delay (s)	12.7	8.5	-	-	8.5	-	-	17.5
HCM Lane LOS	B	A	-	-	A	-	-	C
HCM 95th %tile Q(veh)	0.4	0	-	-	0.2	-	-	0.1

Table D-38. HCM 6th Signalized Intersection Summary - S Meridian & 15th Ave SW/15th Ave SE (AM Peak)

HCM 6th Signalized Intersection Summary
37: S Meridian & 15th Ave SW/15th Ave SE 01/31/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↑	↱	↰	↑↑↱		↰	↑↑↱	
Traffic Volume (veh/h)	210	136	70	63	75	115	117	1120	66	282	509	42
Future Volume (veh/h)	210	136	70	63	75	115	117	1120	66	282	509	42
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1772	1772	1772	1786	1786	1786	1772	1772	1772	1772	1772	1772
Adj Flow Rate, veh/h	231	149	77	69	82	126	129	1231	73	310	559	46
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	2	2	2	1	1	1	2	2	2	2	2	2
Cap, veh/h	273	168	87	163	259	220	485	1398	83	334	1666	137
Arrive On Green	0.05	0.15	0.15	0.05	0.15	0.15	0.04	0.43	0.43	0.14	0.53	0.53
Sat Flow, veh/h	1688	1101	569	1701	1786	1514	1688	3229	191	1688	3150	259
Grp Volume(v), veh/h	231	0	226	69	82	126	129	641	663	310	298	307
Grp Sat Flow(s),veh/h/ln	1688	0	1670	1701	1786	1514	1688	1683	1737	1688	1683	1725
Q Serve(g_s), s	6.3	0.0	15.6	4.0	4.8	9.1	5.1	41.1	41.2	14.6	11.9	12.0
Cycle Q Clear(g_c), s	6.3	0.0	15.6	4.0	4.8	9.1	5.1	41.1	41.2	14.6	11.9	12.0
Prop In Lane	1.00		0.34	1.00		1.00	1.00		0.11	1.00		0.15
Lane Grp Cap(c), veh/h	273	0	255	163	259	220	485	729	752	334	890	912
V/C Ratio(X)	0.84	0.00	0.89	0.42	0.32	0.57	0.27	0.88	0.88	0.93	0.33	0.34
Avail Cap(c_a), veh/h	273	0	415	176	444	376	485	729	752	373	890	912
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	47.8	0.0	48.9	41.2	45.1	47.0	17.4	30.6	30.6	32.0	15.9	15.9
Incr Delay (d2), s/veh	19.9	0.0	7.7	0.7	0.3	0.9	0.1	14.3	14.1	26.4	1.0	1.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.4	0.0	7.0	1.7	2.2	3.5	2.0	19.1	19.8	11.3	4.8	4.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	67.7	0.0	56.6	41.8	45.4	47.8	17.5	44.9	44.7	58.4	16.9	16.9
LnGrp LOS	E	A	E	D	D	D	B	D	D	E	B	B
Approach Vol, veh/h		457			277			1433			915	
Approach Delay, s/veh		62.2			45.6			42.4			31.0	
Approach LOS		E			D			D			C	
Timer - Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	12.0	69.0	13.0	23.8	23.3	57.7	12.1	24.7				
Change Period (Y+Rc), s	* 6.7	* 6.7	* 6.7	* 6.7	* 6.7	* 6.7	* 6.7	* 6.7				
Max Green Setting (Gmax), s	* 5.3	* 62	* 6.3	* 29	* 19	* 48	* 6.3	* 29				
Max Q Clear Time (g_c+I1), s	7.1	14.0	8.3	11.1	16.6	43.2	6.0	17.6				
Green Ext Time (p_c), s	0.0	1.3	0.0	0.2	0.1	1.9	0.0	0.4				
Intersection Summary												
HCM 6th Ctrl Delay			42.2									
HCM 6th LOS			D									
Notes												

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

2.0 PM Peak Hour (4:00-5:00 PM)

Table D-39. HCM 6th Signalized Intersection Summary - SR 512 & I-5 SB Off-Ramp (PM Peak)

HCM 6th Signalized Intersection Summary
1: SR 512 & 1-5 SB Off-Ramp

01/31/2023

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	1515	845	0	2312	478
Future Volume (veh/h)	0	1515	845	0	2312	478
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No	No		No	
Adj Sat Flow, veh/h/ln	0	1730	1716	0	1744	1744
Adj Flow Rate, veh/h	0	1562	871	0	2384	493
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	0	5	6	0	4	4
Cap, veh/h	0	2293	2274	0	1983	1101
Arrive On Green	0.00	0.49	0.49	0.00	0.42	0.42
Sat Flow, veh/h	0	5034	4993	0	4683	2601
Grp Volume(v), veh/h	0	1562	871	0	2384	493
Grp Sat Flow(s),veh/h/ln	0	1574	1561	0	1561	1300
Q Serve(g_s), s	0.0	31.5	14.6	0.0	52.5	16.7
Cycle Q Clear(g_c), s	0.0	31.5	14.6	0.0	52.5	16.7
Prop In Lane	0.00			0.00	1.00	1.00
Lane Grp Cap(c), veh/h	0	2293	2274	0	1983	1101
V/C Ratio(X)	0.00	0.68	0.38	0.00	1.20	0.45
Avail Cap(c_a), veh/h	0	2293	2274	0	1983	1101
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	1.00	0.00	1.00	1.00
Uniform Delay (d), s/veh	0.0	24.5	20.2	0.0	35.8	25.4
Incr Delay (d2), s/veh	0.0	1.7	0.5	0.0	96.1	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	11.9	5.4	0.0	37.1	5.2
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	0.0	26.2	20.7	0.0	131.9	25.8
LnGrp LOS	A	C	C	A	F	C
Approach Vol, veh/h		1562	871		2877	
Approach Delay, s/veh		26.2	20.7		113.7	
Approach LOS		C	C		F	

Timer - Assigned Phs	2	6	8
Phs Duration (G+Y+Rc), s	67.0	67.0	57.0
Change Period (Y+Rc), s	6.8	6.8	4.5
Max Green Setting (Gmax), s	60.2	60.2	52.5
Max Q Clear Time (g_c+I1), s	16.6	33.5	54.5
Green Ext Time (p_c), s	9.5	18.6	0.0

Intersection Summary	
HCM 6th Ctrl Delay	72.7
HCM 6th LOS	E

Table D-40. HCM Signalized Intersection Capacity Analysis - S Tacoma Way & Perkins Ln SW (PM Peak)

HCM Signalized Intersection Capacity Analysis
2: S Tacoma Way & Perkins Ln SW 01/31/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	63	124	20	564	19	740	34	521	622	985	516	24
Future Volume (vph)	63	124	20	564	19	740	34	521	622	985	516	24
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)		4.0		4.8	4.8	4.8	4.0	4.6	4.0	4.8	4.8	
Lane Util. Factor		0.95		0.95	0.95	0.88	1.00	0.86	1.00	0.97	0.95	
Frpb, ped/bikes		1.00		1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00	
Flpb, ped/bikes		1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt		0.99		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99	
Flt Protected		0.99		0.95	0.96	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		3233		1562	1571	2589	1676	6071	1478	3221	3287	
Flt Permitted		0.76		0.95	0.96	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)		2499		1562	1571	2589	1676	6071	1478	3221	3287	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	67	132	21	600	20	787	36	554	662	1048	549	26
RTOR Reduction (vph)	0	6	0	0	0	171	0	0	0	0	3	0
Lane Group Flow (vph)	0	214	0	312	308	616	36	554	662	1048	572	0
Confl. Peds. (#/hr)	10		10	10		10	10		10	10		10
Heavy Vehicles (%)	2%	2%	2%	4%	4%	4%	2%	2%	2%	3%	3%	3%
Turn Type	Perm	NA		Split	NA	custom	Prot	NA	Free	Prot	NA	
Protected Phases		4		3	3	3 5	1	6		5	2	
Permitted Phases	4					3			Free			
Actuated Green, G (s)		14.5		32.6	32.6	79.5	14.2	16.6	124.0	42.1	45.1	
Effective Green, g (s)		14.5		32.6	32.6	79.5	14.2	16.6	124.0	42.1	45.1	
Actuated g/C Ratio		0.12		0.26	0.26	0.64	0.11	0.13	1.00	0.34	0.36	
Clearance Time (s)		4.0		4.8	4.8		4.0	4.6		4.8	4.8	
Vehicle Extension (s)		3.0		3.8	3.8		3.0	3.8		3.8	3.8	
Lane Grp Cap (vph)		292		410	413	1659	191	812	1478	1093	1195	
v/s Ratio Prot				c0.20	0.20	0.24	0.02	c0.09		c0.33	0.17	
v/s Ratio Perm		c0.09							0.45			
v/c Ratio		0.73		0.76	0.75	0.37	0.19	0.68	0.45	0.96	0.48	
Uniform Delay, d1		52.9		42.1	41.9	10.5	49.7	51.2	0.0	40.1	30.4	
Progression Factor		1.00		1.09	1.08	1.10	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2		9.1		11.8	11.0	0.2	0.5	2.5	1.0	18.1	0.4	
Delay (s)		62.0		57.6	56.4	11.7	50.2	53.7	1.0	58.2	30.8	
Level of Service		E		E	E	B	D	D	A	E	C	
Approach Delay (s)		62.0			31.6			25.7			48.5	
Approach LOS		E			C			C			D	

Intersection Summary			
HCM 2000 Control Delay	37.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	124.0	Sum of lost time (s)	18.2
Intersection Capacity Utilization	82.8%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Table D-41. HCM Signalized Intersection Capacity Analysis - S Tacoma Way & 100th St SW (PM Peak)

HCM Signalized Intersection Capacity Analysis
3: S Tacoma Way & 100th St SW 01/31/2023

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	0	664	483	841	861	25
Future Volume (vph)	0	664	483	841	861	25
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)		5.4	5.4	5.4	5.6	
Lane Util. Factor		0.88	0.97	0.95	0.91	
Frpb, ped/bikes		1.00	1.00	1.00	1.00	
Flpb, ped/bikes		1.00	1.00	1.00	1.00	
Frt		0.85	1.00	1.00	1.00	
Flt Protected		1.00	0.95	1.00	1.00	
Satd. Flow (prot)		2614	3159	3257	4749	
Flt Permitted		1.00	0.95	1.00	1.00	
Satd. Flow (perm)		2614	3159	3257	4749	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	722	525	914	936	27
RTOR Reduction (vph)	0	0	0	0	3	0
Lane Group Flow (vph)	0	722	525	914	960	0
Confl. Peds. (#/hr)			4			4
Heavy Vehicles (%)	3%	3%	5%	5%	3%	3%
Turn Type		pm+ov	Prot	NA	NA	
Protected Phases		5	5	2	6	
Permitted Phases		2 6				
Actuated Green, G (s)		40.0	15.9	45.4	18.5	
Effective Green, g (s)		40.0	15.9	45.4	18.5	
Actuated g/C Ratio		0.88	0.35	1.00	0.41	
Clearance Time (s)		5.4	5.4	5.4	5.6	
Vehicle Extension (s)		3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		2614	1106	3257	1935	
v/s Ratio Prot		0.10	c0.17	0.28	c0.20	
v/s Ratio Perm		0.18				
v/c Ratio		0.28	0.47	0.28	0.50	
Uniform Delay, d1		0.4	11.5	0.0	10.0	
Progression Factor		1.00	1.00	1.00	1.00	
Incremental Delay, d2		0.1	0.3	0.0	0.2	
Delay (s)		0.5	11.8	0.0	10.2	
Level of Service		A	B	A	B	
Approach Delay (s)	0.5			4.3	10.2	
Approach LOS	A			A	B	

Intersection Summary			
HCM 2000 Control Delay	5.3	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	45.4	Sum of lost time (s)	11.0
Intersection Capacity Utilization	52.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Table D-42. HCM Signalized Intersection Capacity Analysis - Pacific Hwy SW & S Tacoma Way (PM Peak)

HCM Signalized Intersection Capacity Analysis
4: Pacific Hwy SW & S Tacoma Way 01/31/2023

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	334	359	818	433	429	671
Future Volume (vph)	334	359	818	433	429	671
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	4.0	4.9	4.9	5.1	4.9
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frpb, ped/bikes	1.00	0.98	1.00	0.96	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1644	1444	3320	1429	1660	3320
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1644	1444	3320	1429	1660	3320
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	367	395	899	476	471	737
RTOR Reduction (vph)	0	276	0	267	0	0
Lane Group Flow (vph)	367	119	899	209	471	737
Confl. Peds. (#/hr)	2	4		7	7	
Confl. Bikes (#/hr)		2		2		
Heavy Vehicles (%)	4%	4%	3%	3%	3%	3%
Turn Type	Prot	Perm	NA	Perm	Prot	NA
Protected Phases	4		2		1	6
Permitted Phases		4		2		
Actuated Green, G (s)	30.6	30.6	34.5	34.5	34.3	73.9
Effective Green, g (s)	30.6	30.6	34.5	34.5	34.3	73.9
Actuated g/C Ratio	0.27	0.27	0.30	0.30	0.30	0.65
Clearance Time (s)	4.0	4.0	4.9	4.9	5.1	4.9
Vehicle Extension (s)	4.0	4.0	3.0	3.0	2.0	3.0
Lane Grp Cap (vph)	443	389	1010	434	502	2163
v/s Ratio Prot	c0.22		c0.27		c0.28	0.22
v/s Ratio Perm		0.08		0.15		
v/c Ratio	0.83	0.31	0.89	0.48	0.94	0.34
Uniform Delay, d1	38.9	32.9	37.6	32.2	38.5	8.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	12.6	0.6	9.9	0.8	25.0	0.1
Delay (s)	51.5	33.6	47.5	33.0	63.6	8.9
Level of Service	D	C	D	C	E	A
Approach Delay (s)	42.2		42.5			30.2
Approach LOS	D		D			C

Intersection Summary			
HCM 2000 Control Delay	38.0	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	113.4	Sum of lost time (s)	14.0
Intersection Capacity Utilization	80.6%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Table D-43. HCM Signalized Intersection Capacity Analysis - Steele St S & SR512 EB Ramps (PM Peak)

HCM Signalized Intersection Capacity Analysis
5: Steele St S & SR512 EB Ramps 01/31/2023

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	967	164	888	116	153	456
Future Volume (vph)	967	164	888	116	153	456
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.5	4.5	3.5	3.5	4.5	3.5
Lane Util. Factor	0.97	1.00	0.95	1.00	1.00	0.95
Frpb, ped/bikes	1.00	1.00	1.00	0.97	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3190	1471	3288	1434	1676	3353
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3190	1471	3288	1434	1676	3353
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	997	169	915	120	158	470
RTOR Reduction (vph)	0	106	0	70	0	0
Lane Group Flow (vph)	997	63	915	51	158	470
Confl. Peds. (#/hr)				2	2	
Heavy Vehicles (%)	4%	4%	4%	4%	2%	2%
Turn Type	Prot	Perm	NA	Perm	Prot	NA
Protected Phases	4		6		5	2
Permitted Phases		4		6		
Actuated Green, G (s)	44.5	44.5	50.5	50.5	12.5	67.5
Effective Green, g (s)	44.5	44.5	50.5	50.5	12.5	67.5
Actuated g/C Ratio	0.37	0.37	0.42	0.42	0.10	0.56
Clearance Time (s)	4.5	4.5	3.5	3.5	4.5	3.5
Vehicle Extension (s)	2.5	2.5	2.5	2.5	2.0	2.5
Lane Grp Cap (vph)	1182	545	1383	603	174	1886
v/s Ratio Prot	c0.31		c0.28		c0.09	0.14
v/s Ratio Perm		0.04		0.04		
v/c Ratio	0.84	0.11	0.66	0.08	0.91	0.25
Uniform Delay, d1	34.6	24.8	27.9	20.9	53.2	13.4
Progression Factor	1.00	1.00	0.87	2.10	1.00	1.00
Incremental Delay, d2	5.6	0.1	2.2	0.2	41.7	0.3
Delay (s)	40.1	24.9	26.5	44.1	94.9	13.7
Level of Service	D	C	C	D	F	B
Approach Delay (s)	37.9		28.6			34.1
Approach LOS	D		C			C

Intersection Summary			
HCM 2000 Control Delay	33.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.5
Intersection Capacity Utilization	74.8%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Table D-44. HCM 6th Signalized Intersection Summary - Steele St S & SR512 WB Ramps (PM Peak)

HCM 6th Signalized Intersection Summary
6: Steele St S & SR512 WB Ramps 01/31/2023

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	66	145	518	534	144	543
Future Volume (veh/h)	66	145	518	534	144	543
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No		No			No
Adj Sat Flow, veh/h/ln	1569	1569	1557	1557	1595	1595
Adj Flow Rate, veh/h	70	154	551	568	153	578
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	4	4	5	5	2	2
Cap, veh/h	237	211	684	611	194	2043
Arrive On Green	0.16	0.16	0.46	0.46	0.13	0.67
Sat Flow, veh/h	1495	1330	1557	1319	1519	3110
Grp Volume(v), veh/h	70	154	551	568	153	578
Grp Sat Flow(s),veh/h/ln	1495	1330	1479	1319	1519	1515
Q Serve(g_s), s	2.2	5.9	17.2	21.9	5.3	4.1
Cycle Q Clear(g_c), s	2.2	5.9	17.2	21.9	5.3	4.1
Prop In Lane	1.00	1.00		1.00	1.00	
Lane Grp Cap(c), veh/h	237	211	684	611	194	2043
V/C Ratio(X)	0.30	0.73	0.81	0.93	0.79	0.28
Avail Cap(c_a), veh/h	986	877	701	625	578	3124
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	20.0	21.5	12.4	13.6	22.8	3.5
Incr Delay (d2), s/veh	0.8	5.8	6.5	20.3	8.3	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.8	0.3	5.8	8.6	2.2	0.7
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	20.8	27.3	18.9	33.9	31.0	3.6
LnGrp LOS	C	C	B	C	C	A
Approach Vol, veh/h	224		1119			731
Approach Delay, s/veh	25.3		26.5			9.3
Approach LOS	C		C			A
Timer - Assigned Phs		2		4	5	6
Phs Duration (G+Y+Rc), s		40.8		13.0	11.4	29.4
Change Period (Y+Rc), s		4.5		4.5	4.5	4.5
Max Green Setting (Gmax), s		55.5		35.5	20.5	25.5
Max Q Clear Time (g_c+I1), s		6.1		7.9	7.3	23.9
Green Ext Time (p_c), s		3.7		0.9	0.4	1.0
Intersection Summary						
HCM 6th Ctrl Delay			20.3			
HCM 6th LOS			C			

Table D-45. HCM Signalized Intersection Capacity Analysis – Steele St S & Sales Rd S & 104th St S (PM Peak)

HCM Signalized Intersection Capacity Analysis
7: Steele St S & Sales Rd S & 104th St S 01/31/2023

Movement	EBL	EBR	EBR2	NBL	NBT	NBR	SBL	SBT	SBR	NWL2	NWL	NWR
Lane Configurations												
Traffic Volume (vph)	10	4	51	13	539	111	169	582	6	54	7	105
Future Volume (vph)	10	4	51	13	539	111	169	582	6	54	7	105
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	5.5	5.5		5.1	5.1	4.0	5.1	5.1			5.5	5.5
Lane Util. Factor	1.00	1.00		1.00	0.95	1.00	1.00	0.95			1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98	1.00	1.00			1.00	0.98
Flpb, ped/bikes	0.99	1.00		0.99	1.00	1.00	1.00	1.00			0.98	1.00
Frt	1.00	0.85		1.00	1.00	0.85	1.00	1.00			1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00			0.95	1.00
Satd. Flow (prot)	1649	1485		1651	3320	1448	1660	3314			1622	1457
Flt Permitted	0.71	1.00		0.95	1.00	1.00	0.95	1.00			0.71	1.00
Satd. Flow (perm)	1237	1485		1651	3320	1448	1660	3314			1209	1457
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	11	4	57	14	599	123	188	647	7	60	8	117
RTOR Reduction (vph)	0	54	0	0	0	0	0	0	0	0	0	103
Lane Group Flow (vph)	11	7	0	14	599	123	188	654	0	0	68	14
Confl. Peds. (#/hr)	10	10	10	10		10	10		10	10	10	10
Heavy Vehicles (%)	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
Turn Type	Perm	Prot		Prot	NA	Free	Prot	NA		Perm	Prot	Perm
Protected Phases		8		1	6		5	2			4	
Permitted Phases	8					Free				4		4
Actuated Green, G (s)	6.2	6.2		0.9	20.9	52.5	9.7	29.7			6.2	6.2
Effective Green, g (s)	6.2	6.2		0.9	20.9	52.5	9.7	29.7			6.2	6.2
Actuated g/C Ratio	0.12	0.12		0.02	0.40	1.00	0.18	0.57			0.12	0.12
Clearance Time (s)	5.5	5.5		5.1	5.1		5.1	5.1			5.5	5.5
Vehicle Extension (s)	2.0	2.0		2.0	2.0		1.0	2.0			2.0	2.0
Lane Grp Cap (vph)	146	175		28	1321	1448	306	1874			142	172
v/s Ratio Prot		0.00		0.01	c0.18		c0.11	0.20				
v/s Ratio Perm	0.01					0.08					c0.06	0.01
v/c Ratio	0.08	0.04		0.50	0.45	0.08	0.61	0.35			0.48	0.08
Uniform Delay, d1	20.6	20.5		25.6	11.6	0.0	19.7	6.2			21.6	20.6
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00			1.00	1.00
Incremental Delay, d2	0.1	0.0		5.0	0.1	0.1	2.6	0.0			0.9	0.1
Delay (s)	20.7	20.6		30.6	11.7	0.1	22.2	6.2			22.6	20.7
Level of Service	C	C		C	B	A	C	A			C	C
Approach Delay (s)	20.6				10.1			9.8			21.4	
Approach LOS	C				B			A			C	

Intersection Summary			
HCM 2000 Control Delay	11.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	52.5	Sum of lost time (s)	15.7
Intersection Capacity Utilization	58.9%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Table D-46. HCM 6th TWSC – Steele St S & 109th St S (PM Peak)

HCM 6th TWSC
8: Steele St S & 109th St S 01/31/2023

Intersection	
Int Delay, s/veh	0.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	5	30	974	6	8	1415
Future Vol, veh/h	5	30	974	6	8	1415
Conflicting Peds, #/hr	0	0	0	2	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	500	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	98	98	98	98	98	98
Heavy Vehicles, %	6	6	3	3	3	3
Mvmt Flow	5	31	994	6	8	1444

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1737	502	0	0	1002	0
Stage 1	999	-	-	-	-	-
Stage 2	738	-	-	-	-	-
Critical Hdwy	6.37	7.22	-	-	5.36	-
Critical Hdwy Stg 1	6.72	-	-	-	-	-
Critical Hdwy Stg 2	5.92	-	-	-	-	-
Follow-up Hdwy	3.71	3.96	-	-	3.13	-
Pot Cap-1 Maneuver	96	432	-	-	388	-
Stage 1	241	-	-	-	-	-
Stage 2	412	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	86	431	-	-	387	-
Mov Cap-2 Maneuver	170	-	-	-	-	-
Stage 1	241	-	-	-	-	-
Stage 2	369	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	16.3	0	0.1
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	353	387	-
HCM Lane V/C Ratio	-	-	0.101	0.021	-
HCM Control Delay (s)	-	-	16.3	14.5	-
HCM Lane LOS	-	-	C	B	-
HCM 95th %tile Q(veh)	-	-	0.3	0.1	-

Table D-47. HCM 6th Signalized Intersection Summary – 112th St S & Steele St S (PM Peak)

HCM 6th Signalized Intersection Summary
9: 112th St S & Steele St S

01/31/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	134	239	525	46	178	108	233	738	22	126	1248	46
Future Volume (veh/h)	134	239	525	46	178	108	233	738	22	126	1248	46
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.98	1.00		0.99	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758
Adj Flow Rate, veh/h	138	246	541	47	184	111	240	761	23	130	1287	47
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	152	394	329	59	296	384	264	1582	48	155	1357	50
Arrive On Green	0.09	0.22	0.22	0.04	0.17	0.17	0.16	0.48	0.48	0.06	0.28	0.28
Sat Flow, veh/h	1674	1758	1470	1674	1758	1463	1674	3309	100	1674	3285	120
Grp Volume(v), veh/h	138	246	541	47	184	111	240	384	400	130	654	680
Grp Sat Flow(s),veh/h/ln	1674	1758	1470	1674	1758	1463	1674	1670	1739	1674	1670	1735
Q Serve(g_s), s	9.8	15.1	26.9	3.3	11.7	7.3	16.9	18.7	18.7	9.2	46.0	46.2
Cycle Q Clear(g_c), s	9.8	15.1	26.9	3.3	11.7	7.3	16.9	18.7	18.7	9.2	46.0	46.2
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.06	1.00		0.07
Lane Grp Cap(c), veh/h	152	394	329	59	296	384	264	798	831	155	690	717
V/C Ratio(X)	0.91	0.62	1.64	0.80	0.62	0.29	0.91	0.48	0.48	0.84	0.95	0.95
Avail Cap(c_a), veh/h	152	394	329	68	308	394	264	798	831	222	690	717
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.67	0.67	0.67
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	54.1	42.0	46.5	57.5	46.3	35.5	49.7	21.2	21.2	55.4	42.1	42.2
Incr Delay (d2), s/veh	45.8	2.3	302.3	36.4	2.6	0.2	32.2	2.1	2.0	12.4	23.6	23.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.1	6.8	37.4	2.0	5.3	2.6	9.4	7.7	8.0	4.5	24.2	25.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	99.9	44.3	348.8	93.8	48.9	35.6	81.9	23.3	23.2	67.8	65.7	65.4
LnGrp LOS	F	D	F	F	D	D	F	C	C	E	E	E
Approach Vol, veh/h		925			342			1024			1464	
Approach Delay, s/veh		230.7			50.7			37.0			65.7	
Approach LOS		F			D			D			E	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	24.0	54.7	16.0	25.3	16.2	62.5	9.3	32.0
Change Period (Y+Rc), s	5.1	5.1	5.1	* 5.1	5.1	5.1	5.1	5.1
Max Green Setting (Gmax), s	18.9	48.9	10.9	* 21	15.9	51.9	4.9	26.9
Max Q Clear Time (g_c+I1), s	18.9	48.2	11.8	13.7	11.2	20.7	5.3	28.9
Green Ext Time (p_c), s	0.0	0.5	0.0	0.5	0.0	3.4	0.0	0.0

Intersection Summary	
HCM 6th Ctrl Delay	97.2
HCM 6th LOS	F

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Table D-48. HCM Signalized Intersection Capacity Analysis – SR 7 (Pacific Ave) & NB Bus Q Jump & 112th St S (PM Peak) A

HCM Signalized Intersection Capacity Analysis
10: SR 7 (Pacific Ave) & NB Bus Q Jump & 112th St S 01/31/2023

Movement	EBL	EBT	EBR2	WBL	WBT	WBR	NBL	NBT	NBR	NBR2	SBL2	SBT
Lane Configurations												
Traffic Volume (vph)	136	226	73	129	212	187	125	908	64	0	554	1571
Future Volume (vph)	136	226	73	129	212	187	125	908	64	0	554	1571
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	12	12	12	12	12	12	11	12	12	11	11
Total Lost time (s)	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.9			4.6	4.9
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95			0.97	0.95
Frpb, ped/bikes	1.00	1.00	0.96	1.00	1.00	0.96	1.00	1.00			1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99			1.00	0.99
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00			0.95	1.00
Satd. Flow (prot)	1676	1765	1443	1676	1765	1447	1660	3171			3175	3248
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00			0.95	1.00
Satd. Flow (perm)	1676	1765	1443	1676	1765	1447	1660	3171			3175	3248
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	142	235	76	134	221	195	130	946	67	0	577	1636
RTOR Reduction (vph)	0	0	63	0	0	123	0	0	0	0	0	2
Lane Group Flow (vph)	142	235	13	134	221	72	130	1013	0	0	577	1701
Confl. Peds. (#/hr)	10		10	10		10	10		10		10	
Confl. Bikes (#/hr)			10			10			10			
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	3%	3%	3%	3%	1%	1%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Perm	Prot	NA
Protected Phases	3	8		7	4		5	2			1	6
Permitted Phases			8			4				2		
Actuated Green, G (s)	12.4	26.5	26.5	14.4	28.5	28.5	16.1	53.3			37.1	74.3
Effective Green, g (s)	12.4	26.5	26.5	14.4	28.5	28.5	16.1	53.3			37.1	74.3
Actuated g/C Ratio	0.08	0.18	0.18	0.10	0.19	0.19	0.11	0.36			0.25	0.50
Clearance Time (s)	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.9			4.6	4.9
Vehicle Extension (s)	2.5	2.8	2.8	2.5	2.8	2.8	2.5	2.8			2.5	2.8
Lane Grp Cap (vph)	138	311	254	160	335	274	178	1126			785	1608
v/s Ratio Prot	c0.08	c0.13		0.08	0.13		0.08	0.32			c0.18	c0.52
v/s Ratio Perm			0.01			0.05						
v/c Ratio	1.03	0.76	0.05	0.84	0.66	0.26	0.73	0.90			0.74	1.06
Uniform Delay, d1	68.8	58.7	51.3	66.6	56.3	51.8	64.8	45.8			51.9	37.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.04	1.02
Incremental Delay, d2	84.5	9.8	0.1	29.5	4.5	0.5	13.5	11.4			2.0	34.9
Delay (s)	153.3	68.5	51.4	96.1	60.7	52.2	78.4	57.3			56.2	73.7
Level of Service	F	E	D	F	E	D	E	E			E	E
Approach Delay (s)		92.2			66.3			59.7				69.2
Approach LOS		F			E			E				E

Intersection Summary			
HCM 2000 Control Delay	68.8	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	23.2
Intersection Capacity Utilization	96.1%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Table D-49. HCM Signalized Intersection Capacity Analysis – SR 7 (Pacific Ave) & NB Bus Q Jump & 112th St S (PM Peak) B

HCM Signalized Intersection Capacity Analysis
10: SR 7 (Pacific Ave) & NB Bus Q Jump & 112th St S 01/31/2023

Movement	SBR	NWR
Lane Configurations		
Traffic Volume (vph)	64	0
Future Volume (vph)	64	0
Ideal Flow (vphpl)	1800	1800
Lane Width	12	12
Total Lost time (s)		
Lane Util. Factor		
Frpb, ped/bikes		
Flpb, ped/bikes		
Frt		
Flt Protected		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Peak-hour factor, PHF	0.96	0.96
Adj. Flow (vph)	67	0
RTOR Reduction (vph)	0	0
Lane Group Flow (vph)	0	0
Confl. Peds. (#/hr)	10	
Confl. Bikes (#/hr)	10	
Heavy Vehicles (%)	1%	2%
Turn Type		Prot
Protected Phases		9
Permitted Phases		
Actuated Green, G (s)		
Effective Green, g (s)		
Actuated g/C Ratio		
Clearance Time (s)		
Vehicle Extension (s)		
Lane Grp Cap (vph)		
v/s Ratio Prot		
v/s Ratio Perm		
v/c Ratio		
Uniform Delay, d1		
Progression Factor		
Incremental Delay, d2		
Delay (s)		
Level of Service		
Approach Delay (s)		
Approach LOS		
Intersection Summary		

Table D-50. HCM 6th Signalized Intersection Summary - SR 7 (Pacific Ave) & SR 512 EB Off (PM Peak)

HCM 6th Signalized Intersection Summary
11: SR 7 (Pacific Ave) & SR 512 EB Off

01/31/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	152	8	822	0	0	0	0	924	307	220	1367	0
Future Volume (veh/h)	152	8	822	0	0	0	0	924	307	220	1367	0
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98				1.00		0.97	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No						No			No	
Adj Sat Flow, veh/h/ln	1730	1730	1730				0	1758	1758	1744	1744	0
Adj Flow Rate, veh/h	158	8	700				0	962	247	229	1424	0
Peak Hour Factor	0.96	0.96	0.96				0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	5	5	5				0	3	3	4	4	0
Cap, veh/h	413	21	665				0	1184	514	483	2240	0
Arrive On Green	0.26	0.26	0.26				0.00	0.12	0.12	0.39	0.90	0.00
Sat Flow, veh/h	1572	80	2531				0	3428	1450	1661	3400	0
Grp Volume(v), veh/h	166	0	700				0	962	247	229	1424	0
Grp Sat Flow(s),veh/h/ln	1651	0	1265				0	1670	1450	1661	1657	0
Q Serve(g_s), s	12.4	0.0	39.4				0.0	42.2	23.9	15.5	15.2	0.0
Cycle Q Clear(g_c), s	12.4	0.0	39.4				0.0	42.2	23.9	15.5	15.2	0.0
Prop In Lane	0.95		1.00				0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	434	0	665				0	1184	514	483	2240	0
V/C Ratio(X)	0.38	0.00	1.05				0.00	0.81	0.48	0.47	0.64	0.00
Avail Cap(c_a), veh/h	434	0	665				0	1679	729	483	2240	0
HCM Platoon Ratio	1.00	1.00	1.00				1.00	0.33	0.33	1.33	1.33	1.00
Upstream Filter(I)	1.00	0.00	1.00				0.00	0.40	0.40	1.00	1.00	0.00
Uniform Delay (d), s/veh	45.3	0.0	55.3				0.0	61.4	53.3	37.4	3.2	0.0
Incr Delay (d2), s/veh	0.8	0.0	49.7				0.0	2.6	1.3	1.5	1.4	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.2	0.0	17.0				0.0	19.4	9.5	6.2	3.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	46.1	0.0	105.0				0.0	63.9	54.6	38.9	4.6	0.0
LnGrp LOS	D	A	F				A	E	D	D	A	A
Approach Vol, veh/h		866						1209			1653	
Approach Delay, s/veh		93.7						62.0			9.4	
Approach LOS		F						E			A	
Timer - Assigned Phs	1	2		4		6						
Phs Duration (G+Y+Rc), s	48.2	57.8		44.0		106.0						
Change Period (Y+Rc), s	4.6	* 4.6		4.6		4.6						
Max Green Setting (Gmax), s	21.5	* 75		39.4		101.4						
Max Q Clear Time (g_c+I1), s	17.5	44.2		41.4		17.2						
Green Ext Time (p_c), s	0.5	9.0		0.0		16.9						
Intersection Summary												
HCM 6th Ctrl Delay			46.0									
HCM 6th LOS			D									

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

User approved changes to right turn type.

Table D-51. HCM 6th Signalized Intersection Summary - SR 7 (Pacific Ave) & 108th St S (PM Peak)

HCM 6th Signalized Intersection Summary
12: SR 7 (Pacific Ave) & 108th St S

01/31/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	61	12	125	404	190	148	41	620	415	7	1105	54
Future Volume (veh/h)	61	12	125	404	190	148	41	620	415	7	1105	54
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.90	1.00		0.97	1.00		0.95	1.00		0.96
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1730	1730	1730	1772	1772	1772	1772	1772	1772	1772	1772	1772
Adj Flow Rate, veh/h	64	13	58	312	357	88	43	653	426	7	1163	52
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	5	5	5	2	2	2	2	2	2	2	2	2
Cap, veh/h	83	17	79	390	409	335	368	891	723	548	1216	54
Arrive On Green	0.06	0.06	0.06	0.23	0.23	0.23	0.07	0.09	0.09	0.32	0.37	0.37
Sat Flow, veh/h	1380	280	1327	1688	1772	1450	1688	3367	1423	1688	3275	146
Grp Volume(v), veh/h	77	0	58	312	357	88	43	653	426	7	597	618
Grp Sat Flow(s),veh/h/ln	1661	0	1327	1688	1772	1450	1688	1683	1423	1688	1683	1738
Q Serve(g_s), s	6.9	0.0	6.4	26.2	29.1	7.5	3.6	28.4	31.2	0.4	51.9	52.0
Cycle Q Clear(g_c), s	6.9	0.0	6.4	26.2	29.1	7.5	3.6	28.4	31.2	0.4	51.9	52.0
Prop In Lane	0.83		1.00	1.00		1.00	1.00		1.00	1.00		0.08
Lane Grp Cap(c), veh/h	99	0	79	390	409	335	368	891	723	548	625	645
V/C Ratio(X)	0.77	0.00	0.73	0.80	0.87	0.26	0.12	0.73	0.59	0.01	0.96	0.96
Avail Cap(c_a), veh/h	138	0	111	613	644	527	368	1291	892	548	634	655
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	0.33	0.33	0.33	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	69.5	0.0	69.3	54.4	55.5	47.2	56.1	63.3	33.4	34.4	46.0	46.0
Incr Delay (d2), s/veh	16.3	0.0	14.0	4.1	8.0	0.4	0.1	5.3	3.5	0.0	26.6	26.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.4	0.0	2.5	11.6	13.9	2.8	1.6	13.6	18.0	0.2	26.0	26.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	85.8	0.0	83.3	58.5	63.5	47.6	56.3	68.6	36.9	34.4	72.6	72.3
LnGrp LOS	F	A	F	E	E	D	E	E	D	C	E	E
Approach Vol, veh/h		135			757			1122			1222	
Approach Delay, s/veh		84.7			59.6			56.1			72.2	
Approach LOS		F			E			E			E	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	53.2	44.2		39.1	37.2	60.2		13.5
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5
Max Green Setting (Gmax), s	7.5	57.5		54.5	8.5	56.5		12.5
Max Q Clear Time (g_c+I1), s	2.4	33.2		31.1	5.6	54.0		8.9
Green Ext Time (p_c), s	0.0	6.5		3.5	0.0	1.7		0.2

Intersection Summary	
HCM 6th Ctrl Delay	64.2
HCM 6th LOS	E

Notes

User approved volume balancing among the lanes for turning movement.

Table D-52. HCM 6th Signalized Intersection Summary – 108th St S & A St S (PM Peak)

HCM 6th TWSC
13: 108th St S & A St S

01/31/2023

Intersection	
Int Delay, s/veh	16.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	50	15	369	0	62	2	612	39	14	1	0	68
Future Vol, veh/h	50	15	369	0	62	2	612	39	14	1	0	68
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Yield	Yield	Yield
RT Channelized	-	-	Free	-	-	None	-	-	None	-	-	None
Storage Length	-	-	75	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	4	4	4	0	0	0	1	1	1	1	1	1
Mvmt Flow	54	16	401	0	67	2	665	42	15	1	0	74

Major/Minor	Minor2			Minor1			Major1		
Conflicting Flow All	1414	1387	-	-	1380	50	0	0	0
Stage 1	0	0	-	-	1380	-	-	-	-
Stage 2	1414	1387	-	-	0	-	-	-	-
Critical Hdwy	7.14	6.54	-	-	6.5	6.2	4.11	-	-
Critical Hdwy Stg 1	-	-	-	-	5.5	-	-	-	-
Critical Hdwy Stg 2	6.14	5.54	-	-	-	-	-	-	-
Follow-up Hdwy	3.536	4.036	-	-	4	3.3	2.209	-	-
Pot Cap-1 Maneuver	114	142	0	0	146	1024	-	-	-
Stage 1	-	-	0	0	214	-	-	-	-
Stage 2	169	208	0	0	-	-	-	-	-
Platoon blocked, %								-	-
Mov Cap-1 Maneuver	73	142	-	-	146	1024	-	-	-
Mov Cap-2 Maneuver	73	142	-	-	146	-	-	-	-
Stage 1	-	-	-	-	214	-	-	-	-
Stage 2	116	208	-	-	-	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	151.9	48.2	
HCM LOS	F	E	

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1
Capacity (veh/h)	-	-	-	82	-	150
HCM Lane V/C Ratio	-	-	-	0.862	-	0.464
HCM Control Delay (s)	-	-	-	151.9	0	48.2
HCM Lane LOS	-	-	-	F	A	E
HCM 95th %tile Q(veh)	-	-	-	4.5	-	2.1

Table D-53. HCM 6th Signalized Intersection Summary - A St S & 112th St S (PM Peak)

HCM 6th Signalized Intersection Summary
14: A St S & 112th St S 01/31/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	34	750	60	100	459	39	44	21	129	58	31	25
Future Volume (veh/h)	34	750	60	100	459	39	44	21	129	58	31	25
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.99	1.00		0.99	0.99		0.99	0.99		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758
Adj Flow Rate, veh/h	36	798	64	106	488	41	47	22	137	62	33	27
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	109	1086	86	339	1689	141	146	62	220	260	129	76
Arrive On Green	0.37	0.37	0.37	0.06	0.54	0.54	0.22	0.22	0.22	0.22	0.22	0.22
Sat Flow, veh/h	64	2949	233	1674	3117	261	219	280	991	630	581	344
Grp Volume(v), veh/h	470	0	428	106	261	268	206	0	0	122	0	0
Grp Sat Flow(s),veh/h/ln	1691	0	1554	1674	1670	1708	1490	0	0	1556	0	0
Q Serve(g_s), s	2.6	0.0	10.9	1.6	3.8	3.9	2.1	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	10.7	0.0	10.9	1.6	3.8	3.9	5.5	0.0	0.0	2.7	0.0	0.0
Prop In Lane	0.08		0.15	1.00		0.15	0.23		0.67	0.51		0.22
Lane Grp Cap(c), veh/h	708	0	572	339	905	926	428	0	0	465	0	0
V/C Ratio(X)	0.66	0.00	0.75	0.31	0.29	0.29	0.48	0.00	0.00	0.26	0.00	0.00
Avail Cap(c_a), veh/h	1360	0	1194	418	1283	1313	877	0	0	890	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	12.4	0.0	12.5	9.0	5.6	5.6	15.8	0.0	0.0	14.8	0.0	0.0
Incr Delay (d2), s/veh	0.4	0.0	0.7	0.2	0.1	0.1	0.3	0.0	0.0	0.1	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.2	0.0	3.0	0.4	0.8	0.9	1.7	0.0	0.0	0.9	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	12.8	0.0	13.2	9.1	5.7	5.7	16.1	0.0	0.0	14.9	0.0	0.0
LnGrp LOS	B	A	B	A	A	A	B	A	A	B	A	A
Approach Vol, veh/h		898			635			206			122	
Approach Delay, s/veh		13.0			6.3			16.1			14.9	
Approach LOS		B			A			B			B	
Timer - Assigned Phs		2		4	5	6		8				
Phs Duration (G+Y+Rc), s		29.7		15.5	7.9	21.9		15.5				
Change Period (Y+Rc), s		5.2		5.5	* 5.2	5.2		5.5				
Max Green Setting (Gmax), s		34.8		24.0	* 4.8	34.8		24.0				
Max Q Clear Time (g_c+I1), s		5.9		7.5	3.6	12.9		4.7				
Green Ext Time (p_c), s		2.0		0.7	0.0	3.8		0.4				
Intersection Summary												
HCM 6th Ctrl Delay			11.2									
HCM 6th LOS			B									

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Table D-54. HCM 6th Signalized Intersection Summary - C St S & 112th St S (PM Peak)

HCM 6th Signalized Intersection Summary
15: C St S & 112th St S

01/31/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	34	263	63	61	238	102	46	290	79	93	454	8
Future Volume (veh/h)	34	263	63	61	238	102	46	290	79	93	454	8
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.98	0.99		0.98	1.00		0.99	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758
Adj Flow Rate, veh/h	40	306	73	71	277	119	53	337	92	108	528	9
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	366	791	186	407	520	433	347	740	622	475	725	12
Arrive On Green	0.30	0.30	0.30	0.30	0.30	0.30	0.42	0.42	0.42	0.42	0.42	0.42
Sat Flow, veh/h	973	2675	627	988	1758	1465	858	1758	1479	948	1723	29
Grp Volume(v), veh/h	40	189	190	71	277	119	53	337	92	108	0	537
Grp Sat Flow(s),veh/h/ln	973	1670	1632	988	1758	1465	858	1758	1479	948	0	1752
Q Serve(g_s), s	1.3	3.1	3.2	2.2	4.6	2.2	1.9	4.8	1.3	3.2	0.0	8.9
Cycle Q Clear(g_c), s	5.9	3.1	3.2	5.4	4.6	2.2	10.9	4.8	1.3	8.0	0.0	8.9
Prop In Lane	1.00		0.38	1.00		1.00	1.00		1.00	1.00		0.02
Lane Grp Cap(c), veh/h	366	494	483	407	520	433	347	740	622	475	0	737
V/C Ratio(X)	0.11	0.38	0.39	0.17	0.53	0.27	0.15	0.46	0.15	0.23	0.00	0.73
Avail Cap(c_a), veh/h	916	1439	1406	966	1515	1262	600	1258	1059	754	0	1254
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	12.7	9.8	9.8	12.0	10.3	9.4	13.0	7.2	6.2	10.1	0.0	8.4
Incr Delay (d2), s/veh	0.0	0.2	0.2	0.1	0.3	0.1	0.1	0.2	0.0	0.1	0.0	0.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	0.8	0.8	0.4	1.3	0.5	0.3	1.2	0.3	0.5	0.0	2.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	12.8	9.9	10.0	12.0	10.6	9.6	13.1	7.4	6.3	10.2	0.0	9.0
LnGrp LOS	B	A	A	B	B	A	B	A	A	B	A	A
Approach Vol, veh/h		419			467			482			645	
Approach Delay, s/veh		10.2			10.5			7.8			9.2	
Approach LOS		B			B			A			A	
Timer - Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		19.7		15.2		19.7		15.2				
Change Period (Y+Rc), s		* 5		* 4.9		* 5		* 4.9				
Max Green Setting (Gmax), s		* 25		* 30		* 25		* 30				
Max Q Clear Time (g_c+I1), s		12.9		7.9		10.9		7.4				
Green Ext Time (p_c), s		1.4		1.5		2.3		1.4				
Intersection Summary												
HCM 6th Ctrl Delay			9.4									
HCM 6th LOS			A									
Notes												

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Table D-55. HCM Signalized Intersection Capacity Analysis - 112th St E & Portland Ave E (PM Peak)

HCM Signalized Intersection Capacity Analysis
16: 112th St E & Portland Ave E

01/31/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	222	537	2	5	353	274	4	4	7	429	3	312
Future Volume (vph)	222	537	2	5	353	274	4	4	7	429	3	312
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	5.5	5.5		5.5	5.5			4.4		5.3	5.3	5.3
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00		0.95	0.95	1.00
Frpb, ped/bikes	1.00	1.00		1.00	0.99			0.99		1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00		1.00	1.00	1.00
Frt	1.00	1.00		1.00	0.93			0.94		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.99		0.95	0.95	1.00
Satd. Flow (prot)	1676	3351		1692	3126			1654		1577	1582	1485
Flt Permitted	0.21	1.00		0.44	1.00			0.99		0.95	0.95	1.00
Satd. Flow (perm)	374	3351		786	3126			1654		1577	1582	1485
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	231	559	2	5	368	285	4	4	7	447	3	325
RTOR Reduction (vph)	0	0	0	0	119	0	0	7	0	0	0	245
Lane Group Flow (vph)	231	561	0	5	534	0	0	8	0	223	227	80
Confl. Peds. (#/hr)	5		1	1		5			1	1		
Confl. Bikes (#/hr)						1						
Heavy Vehicles (%)	2%	2%	2%	1%	1%	1%	0%	0%	0%	3%	3%	3%
Turn Type	pm+pt	NA		Perm	NA		Split	NA		Split	NA	Perm
Protected Phases	1	6			2		7	7		8	8	
Permitted Phases	6			2								8
Actuated Green, G (s)	32.7	32.7		17.7	17.7			0.7		15.8	15.8	15.8
Effective Green, g (s)	32.7	32.7		17.7	17.7			0.7		15.8	15.8	15.8
Actuated g/C Ratio	0.51	0.51		0.27	0.27			0.01		0.25	0.25	0.25
Clearance Time (s)	5.5	5.5		5.5	5.5			4.4		5.3	5.3	5.3
Vehicle Extension (s)	1.0	2.0		2.0	2.0			1.0		2.0	2.0	2.0
Lane Grp Cap (vph)	381	1701		216	859			17		386	388	364
v/s Ratio Prot	c0.09	0.17			0.17			c0.00		0.14	c0.14	
v/s Ratio Perm	c0.22			0.01								0.05
v/c Ratio	0.61	0.33		0.02	0.62			0.48		0.58	0.59	0.22
Uniform Delay, d1	10.4	9.4		17.0	20.4			31.7		21.4	21.4	19.4
Progression Factor	1.00	1.00		1.00	1.00			1.00		1.00	1.00	1.00
Incremental Delay, d2	1.9	0.0		0.0	1.0			7.4		1.3	1.5	0.1
Delay (s)	12.3	9.4		17.1	21.4			39.1		22.7	22.9	19.5
Level of Service	B	A		B	C			D		C	C	B
Approach Delay (s)		10.3			21.4			39.1			21.4	
Approach LOS		B			C			D			C	

Intersection Summary			
HCM 2000 Control Delay	17.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	64.4	Sum of lost time (s)	20.7
Intersection Capacity Utilization	65.7%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Table D-56. HCM Signalized Intersection Capacity Analysis - Portland Ave E & SR512 EB Off-Ramp (PM Peak)

HCM Signalized Intersection Capacity Analysis
17: Portland Ave E & SR512 EB Off-Ramp 01/31/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	129	2	235	0	0	0	0	364	136	252	509	0
Future Volume (vph)	129	2	235	0	0	0	0	364	136	252	509	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)		4.5	4.5					4.5	4.5		4.5	
Lane Util. Factor		1.00	1.00					1.00	1.00		1.00	
Frpb, ped/bikes		1.00	1.00					1.00	0.98		1.00	
Flpb, ped/bikes		1.00	1.00					1.00	1.00		1.00	
Frt		1.00	0.85					1.00	0.85		1.00	
Flt Protected		0.95	1.00					1.00	1.00		0.98	
Satd. Flow (prot)		1661	1485					1782	1481		1736	
Flt Permitted		0.95	1.00					1.00	1.00		0.56	
Satd. Flow (perm)		1661	1485					1782	1481		988	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	140	2	255	0	0	0	0	396	148	274	553	0
RTOR Reduction (vph)	0	0	217	0	0	0	0	0	72	0	0	0
Lane Group Flow (vph)	0	142	38	0	0	0	0	396	76	0	827	0
Confl. Peds. (#/hr)	1								1	1		
Heavy Vehicles (%)	3%	3%	3%	0%	0%	0%	1%	1%	1%	2%	2%	2%
Turn Type	Perm	NA	Perm					NA	Perm	pm+pt	NA	
Protected Phases		4						2		1	6	
Permitted Phases	4		4						2	6		
Actuated Green, G (s)		11.5	11.5					40.0	40.0		57.5	
Effective Green, g (s)		11.5	11.5					40.0	40.0		57.5	
Actuated g/C Ratio		0.15	0.15					0.51	0.51		0.74	
Clearance Time (s)		4.5	4.5					4.5	4.5		4.5	
Vehicle Extension (s)		3.5	3.5					3.0	3.0		3.5	
Lane Grp Cap (vph)		244	218					913	759		853	
v/s Ratio Prot								0.22			c0.16	
v/s Ratio Perm		0.09	0.03						0.05		c0.55	
v/c Ratio		0.58	0.17					0.43	0.10		0.97	
Uniform Delay, d1		31.0	29.1					11.9	9.8		9.4	
Progression Factor		1.00	1.00					1.00	1.00		1.90	
Incremental Delay, d2		3.7	0.4					1.5	0.3		19.2	
Delay (s)		34.8	29.5					13.4	10.0		37.1	
Level of Service		C	C					B	B		D	
Approach Delay (s)		31.4			0.0			12.5			37.1	
Approach LOS		C			A			B			D	

Intersection Summary			
HCM 2000 Control Delay	28.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	78.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	82.1%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Table D-57. HCM Signalized Intersection Capacity Analysis - Portland Ave E & SR512 WB Off-Ramp (PM Peak)

HCM Signalized Intersection Capacity Analysis
18: Portland Ave E & SR512 WB Off-Ramp 01/31/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	214	1	195	225	268	0	0	547	207
Future Volume (vph)	0	0	0	214	1	195	225	268	0	0	547	207
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)					4.5			4.5			4.5	4.5
Lane Util. Factor					1.00			1.00			1.00	1.00
Frpb, ped/bikes					0.99			1.00			1.00	1.00
Flpb, ped/bikes					1.00			1.00			1.00	1.00
Frt					0.94			1.00			1.00	0.85
Flt Protected					0.97			0.98			1.00	1.00
Satd. Flow (prot)					1590			1742			1765	1500
Flt Permitted					0.97			0.53			1.00	1.00
Satd. Flow (perm)					1590			949			1765	1500
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	0	0	225	1	205	237	282	0	0	576	218
RTOR Reduction (vph)	0	0	0	0	42	0	0	0	0	0	0	57
Lane Group Flow (vph)	0	0	0	0	389	0	0	519	0	0	576	161
Confl. Peds. (#/hr)						1						
Confl. Bikes (#/hr)						1						
Heavy Vehicles (%)	0%	0%	0%	2%	2%	2%	1%	1%	1%	2%	2%	2%
Turn Type				Perm	NA		pm+pt	NA			NA	Perm
Protected Phases					8		5	2			6	
Permitted Phases				8			2					6
Actuated Green, G (s)					14.5			54.5			54.5	54.5
Effective Green, g (s)					14.5			54.5			54.5	54.5
Actuated g/C Ratio					0.19			0.70			0.70	0.70
Clearance Time (s)					4.5			4.5			4.5	4.5
Vehicle Extension (s)					3.0			3.0			3.0	3.0
Lane Grp Cap (vph)					295			663			1233	1048
v/s Ratio Prot											0.33	
v/s Ratio Perm					0.24			c0.55				0.11
v/c Ratio					1.32			0.78			0.47	0.15
Uniform Delay, d1					31.8			7.8			5.3	4.0
Progression Factor					1.00			2.48			1.00	1.00
Incremental Delay, d2					166.0			5.5			1.3	0.3
Delay (s)					197.7			24.9			6.5	4.3
Level of Service					F			C			A	A
Approach Delay (s)		0.0			197.7			24.9			5.9	
Approach LOS		A			F			C			A	

Intersection Summary			
HCM 2000 Control Delay	59.0	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	78.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	94.9%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Table D-58. HCM 6th Signalized Intersection Summary - Portland Ave E & 104th St E (PM Peak)

HCM 6th Signalized Intersection Summary
19: Portland Ave E & 104th St E

01/31/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	12	71	58	107	99	41	37	363	63	53	589	23
Future Volume (veh/h)	12	71	58	107	99	41	37	363	63	53	589	23
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.97	1.00		0.97	1.00		0.99	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758
Adj Flow Rate, veh/h	12	73	60	110	102	42	38	374	65	55	607	24
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	56	176	124	140	115	36	487	980	170	629	1129	45
Arrive On Green	0.19	0.19	0.19	0.19	0.19	0.19	0.67	0.67	0.67	0.67	0.67	0.67
Sat Flow, veh/h	1	946	669	357	616	193	789	1457	253	941	1679	66
Grp Volume(v), veh/h	145	0	0	254	0	0	38	0	439	55	0	631
Grp Sat Flow(s),veh/h/ln	1616	0	0	1166	0	0	789	0	1710	941	0	1745
Q Serve(g_s), s	4.5	0.0	0.0	9.5	0.0	0.0	1.8	0.0	7.9	1.9	0.0	13.0
Cycle Q Clear(g_c), s	4.5	0.0	0.0	9.5	0.0	0.0	14.8	0.0	7.9	9.8	0.0	13.0
Prop In Lane	0.08		0.41	0.43		0.17	1.00		0.15	1.00		0.04
Lane Grp Cap(c), veh/h	0	0	0	0	0	0	487	0	1150	629	0	1174
V/C Ratio(X)	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.38	0.09	0.00	0.54
Avail Cap(c_a), veh/h	0	0	0	0	0	0	487	0	1150	629	0	1174
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	0.53	0.00	0.53	1.00	0.00	1.00
Uniform Delay (d), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	9.7	0.0	5.0	7.2	0.0	5.9
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.5	0.3	0.0	1.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	2.2	0.4	0.0	4.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	9.8	0.0	5.6	7.5	0.0	7.6
LnGrp LOS	A	A	A	A	A	A	A	A	A	A	A	A
Approach Vol, veh/h		145			254			477			686	
Approach Delay, s/veh		0.0			0.0			5.9			7.6	
Approach LOS		A			A			A			A	
Timer - Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		51.9		18.1		51.9		18.1				
Change Period (Y+Rc), s		* 4.8		5.1		* 4.8		5.1				
Max Green Setting (Gmax), s		* 35		24.9		* 35		24.9				
Max Q Clear Time (g_c+I1), s		15.0		11.5		16.8		6.5				
Green Ext Time (p_c), s		3.0		0.8		1.9		0.5				
Intersection Summary												
HCM 6th Ctrl Delay			5.2									
HCM 6th LOS			A									
Notes												

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Table D-59. HCM 6th Signalized Intersection Summary - Canyon Rd E & 112th St E (PM Peak)

HCM 6th Signalized Intersection Summary
20: Canyon Rd E & 112th St E
01/31/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	129	425	354	246	371	240	213	1240	92	283	1860	46
Future Volume (veh/h)	129	425	354	246	371	240	213	1240	92	283	1860	46
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		0.99	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758
Adj Flow Rate, veh/h	134	443	369	256	386	250	222	1292	96	295	1938	48
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	121	898	396	95	846	373	240	1815	135	346	2077	51
Arrive On Green	0.07	0.27	0.27	0.06	0.25	0.25	0.07	0.40	0.40	0.04	0.14	0.14
Sat Flow, veh/h	1674	3340	1473	1674	3340	1472	3248	4555	338	3248	4816	119
Grp Volume(v), veh/h	134	443	369	256	386	250	222	907	481	295	1287	699
Grp Sat Flow(s),veh/h/ln	1674	1670	1473	1674	1670	1472	1624	1600	1694	1624	1600	1735
Q Serve(g_s), s	9.4	14.5	31.8	7.4	12.7	19.9	8.8	31.0	31.0	11.7	51.7	51.8
Cycle Q Clear(g_c), s	9.4	14.5	31.8	7.4	12.7	19.9	8.8	31.0	31.0	11.7	51.7	51.8
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.20	1.00		0.07
Lane Grp Cap(c), veh/h	121	898	396	95	846	373	240	1275	675	346	1380	748
V/C Ratio(X)	1.11	0.49	0.93	2.69	0.46	0.67	0.93	0.71	0.71	0.85	0.93	0.93
Avail Cap(c_a), veh/h	121	935	412	95	884	390	240	1275	675	440	1380	748
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.33	0.33	0.33
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.59	0.59	0.59
Uniform Delay (d), s/veh	60.3	40.1	46.4	61.3	41.0	43.6	59.8	32.8	32.8	61.7	53.9	53.9
Incr Delay (d2), s/veh	113.4	0.2	26.8	787.8	0.1	3.3	37.8	3.4	6.3	6.4	8.4	13.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	7.8	6.0	14.5	24.0	5.3	7.6	4.9	12.5	13.8	5.5	23.9	27.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	173.7	40.2	73.2	849.1	41.1	46.9	97.7	36.2	39.1	68.1	62.2	67.7
LnGrp LOS	F	D	E	F	D	D	F	D	D	E	E	E
Approach Vol, veh/h		946			892			1610			2281	
Approach Delay, s/veh		72.0			274.6			45.6			64.7	
Approach LOS		E			F			D			E	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	15.0	61.5	15.0	38.5	19.2	57.2	13.0	40.5
Change Period (Y+Rc), s	5.4	* 5.4	5.6	5.6	5.4	* 5.4	5.6	5.6
Max Green Setting (Gmax), s	9.6	* 55	9.4	34.4	17.6	* 47	7.4	36.4
Max Q Clear Time (g_c+I1), s	10.8	53.8	11.4	21.9	13.7	33.0	9.4	33.8
Green Ext Time (p_c), s	0.0	0.7	0.0	1.4	0.1	5.8	0.0	0.7

Intersection Summary	
HCM 6th Ctrl Delay	93.2
HCM 6th LOS	F

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Table D-60. HCM Signalized Intersection Capacity Analysis – Canyon Rd E & SR512 EB Off-Ramp (PM Peak)

HCM Signalized Intersection Capacity Analysis
21: Canyon Rd E & SR512 EB Off-Ramp 01/31/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	167	0	887	0	0	0	0	1018	779	64	1402	0
Future Volume (vph)	167	0	887	0	0	0	0	1018	779	64	1402	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.7	4.7	4.7					4.8		4.8	4.8	
Lane Util. Factor	1.00	0.95	0.95					0.91		1.00	0.95	
Frpb, ped/bikes	1.00	0.97	0.97					0.98		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00					1.00		1.00	1.00	
Frt	1.00	0.85	0.85					0.93		1.00	1.00	
Flt Protected	0.95	1.00	1.00					1.00		0.95	1.00	
Satd. Flow (prot)	1660	1372	1372					4353		1660	3320	
Flt Permitted	0.95	1.00	1.00					1.00		0.95	1.00	
Satd. Flow (perm)	1660	1372	1372					4353		1660	3320	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	178	0	944	0	0	0	0	1083	829	68	1491	0
RTOR Reduction (vph)	0	36	36	0	0	0	0	98	0	0	0	0
Lane Group Flow (vph)	178	436	436	0	0	0	0	1814	0	68	1491	0
Confl. Peds. (#/hr)	10		10						10	10		
Heavy Vehicles (%)	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
Turn Type	Split	NA	Perm					NA		Prot	NA	
Protected Phases	4	4						2		1	6	
Permitted Phases			4									
Actuated Green, G (s)	45.1	45.1	45.1					60.0		10.6	75.4	
Effective Green, g (s)	45.1	45.1	45.1					60.0		10.6	75.4	
Actuated g/C Ratio	0.35	0.35	0.35					0.46		0.08	0.58	
Clearance Time (s)	4.7	4.7	4.7					4.8		4.8	4.8	
Vehicle Extension (s)	2.5	2.5	2.5					3.0		2.5	3.0	
Lane Grp Cap (vph)	575	475	475					2009		135	1925	
v/s Ratio Prot	0.11	c0.32						c0.42		0.04	c0.45	
v/s Ratio Perm			0.32									
v/c Ratio	0.31	0.92	0.92					1.05dr		0.50	0.77	
Uniform Delay, d1	31.1	40.7	40.7					32.3		57.2	20.8	
Progression Factor	1.00	1.00	1.00					0.51		1.42	2.06	
Incremental Delay, d2	0.2	22.6	22.6					6.2		1.5	2.3	
Delay (s)	31.3	63.2	63.2					22.8		83.0	45.1	
Level of Service	C	E	E					C		F	D	
Approach Delay (s)		58.2			0.0			22.8			46.8	
Approach LOS		E			A			C			D	

Intersection Summary			
HCM 2000 Control Delay	39.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	14.3
Intersection Capacity Utilization	120.0%	ICU Level of Service	H
Analysis Period (min)	15		

dr Defacto Right Lane. Recode with 1 though lane as a right lane.
c Critical Lane Group

Table D-61. HCM 6th Signalized Intersection Summary - SR512 WB Off-Ramp & Canyon Rd E (PM Peak)

HCM 6th Signalized Intersection Summary
22: SR512 WB Off-Ramp & Canyon Rd E 01/31/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	909	0	101	543	642	0	0	557	142
Future Volume (veh/h)	0	0	0	909	0	101	543	642	0	0	557	142
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		0.99	1.00		1.00	1.00		0.99
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach					No			No			No	
Adj Sat Flow, veh/h/ln				1758	1758	1758	1758	1758	0	0	1758	1758
Adj Flow Rate, veh/h				977	0	109	584	690	0	0	599	153
Peak Hour Factor				0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %				3	3	3	3	3	0	0	3	3
Cap, veh/h				1103	0	501	1093	1939	0	0	686	301
Arrive On Green				0.34	0.00	0.34	0.67	1.00	0.00	0.00	0.21	0.21
Sat Flow, veh/h				3248	0	1477	3248	3428	0	0	3428	1468
Grp Volume(v), veh/h				977	0	109	584	690	0	0	599	153
Grp Sat Flow(s),veh/h/ln				1624	0	1477	1624	1670	0	0	1670	1468
Q Serve(g_s), s				36.9	0.0	6.8	11.9	0.0	0.0	0.0	22.6	12.0
Cycle Q Clear(g_c), s				36.9	0.0	6.8	11.9	0.0	0.0	0.0	22.6	12.0
Prop In Lane				1.00		1.00	1.00		0.00	0.00		1.00
Lane Grp Cap(c), veh/h				1103	0	501	1093	1939	0	0	686	301
V/C Ratio(X)				0.89	0.00	0.22	0.53	0.36	0.00	0.00	0.87	0.51
Avail Cap(c_a), veh/h				1339	0	609	1093	1939	0	0	796	350
HCM Platoon Ratio				1.00	1.00	1.00	2.00	2.00	1.00	1.00	1.00	1.00
Upstream Filter(I)				1.00	0.00	1.00	0.42	0.42	0.00	0.00	0.94	0.94
Uniform Delay (d), s/veh				40.6	0.0	30.6	16.0	0.0	0.0	0.0	50.0	45.8
Incr Delay (d2), s/veh				6.7	0.0	0.3	0.2	0.2	0.0	0.0	13.7	5.6
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				15.7	0.0	2.5	3.4	0.1	0.0	0.0	10.7	4.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh				47.3	0.0	30.9	16.3	0.2	0.0	0.0	63.7	51.5
LnGrp LOS				D	A	C	B	A	A	A	E	D
Approach Vol, veh/h					1086			1274			752	
Approach Delay, s/veh					45.6			7.6			61.2	
Approach LOS					D			A			E	
Timer - Assigned Phs		2			5	6		8				
Phs Duration (G+Y+Rc), s		80.5			48.8	31.7		49.5				
Change Period (Y+Rc), s		5.0			5.0	5.0		5.4				
Max Green Setting (Gmax), s		66.0			30.0	31.0		53.6				
Max Q Clear Time (g_c+I1), s		2.0			13.9	24.6		38.9				
Green Ext Time (p_c), s		4.6			2.0	2.1		5.2				
Intersection Summary												
HCM 6th Ctrl Delay			33.8									
HCM 6th LOS			C									

Table D-62. HCM 6th Signalized Intersection Summary - Canyon Rd E & 104th St E (PM Peak)

HCM 6th Signalized Intersection Summary
23: Canyon Rd E & 104th St E

01/31/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	37	131	42	95	93	72	77	546	120	86	562	21
Future Volume (veh/h)	37	131	42	95	93	72	77	546	120	86	562	21
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.97	1.00		0.98	1.00		0.99	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758
Adj Flow Rate, veh/h	39	138	44	100	98	76	81	575	126	91	592	22
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	49	189	156	121	266	221	99	1672	365	112	2042	76
Arrive On Green	0.03	0.11	0.11	0.07	0.15	0.15	0.12	1.00	1.00	0.07	0.62	0.62
Sat Flow, veh/h	1674	1758	1448	1674	1758	1460	1674	2721	594	1674	3263	122
Grp Volume(v), veh/h	39	138	44	100	98	76	81	352	349	91	301	313
Grp Sat Flow(s),veh/h/ln	1674	1758	1448	1674	1758	1460	1674	1670	1645	1674	1670	1735
Q Serve(g_s), s	3.0	9.9	3.6	7.7	6.5	6.1	6.1	0.0	0.0	7.0	10.8	10.8
Cycle Q Clear(g_c), s	3.0	9.9	3.6	7.7	6.5	6.1	6.1	0.0	0.0	7.0	10.8	10.8
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.36	1.00		0.07
Lane Grp Cap(c), veh/h	49	189	156	121	266	221	99	1026	1011	112	1039	1079
V/C Ratio(X)	0.80	0.73	0.28	0.82	0.37	0.34	0.82	0.34	0.34	0.82	0.29	0.29
Avail Cap(c_a), veh/h	200	291	240	264	358	298	187	1026	1011	277	1039	1079
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	0.93	0.93	0.93	1.00	1.00	1.00
Uniform Delay (d), s/veh	62.7	56.2	53.4	59.5	49.6	49.4	56.6	0.0	0.0	59.9	11.3	11.3
Incr Delay (d2), s/veh	10.5	2.0	0.4	5.2	0.3	0.3	5.6	0.8	0.9	5.4	0.7	0.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.4	4.5	1.3	3.4	2.9	2.2	2.6	0.2	0.2	3.1	4.2	4.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	73.2	58.2	53.7	64.7	49.9	49.8	62.2	0.8	0.9	65.2	12.0	12.0
LnGrp LOS	E	E	D	E	D	D	E	A	A	E	B	B
Approach Vol, veh/h		221			274			782			705	
Approach Delay, s/veh		59.9			55.3			7.2			18.9	
Approach LOS		E			E			A			B	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	12.2	85.4	8.3	24.1	13.2	84.4	13.9	18.5
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	14.5	55.5	15.5	26.5	21.5	48.5	20.5	21.5
Max Q Clear Time (g_c+I1), s	8.1	12.8	5.0	8.5	9.0	2.0	9.7	11.9
Green Ext Time (p_c), s	0.0	6.3	0.0	0.4	0.0	7.7	0.0	0.4

Intersection Summary	
HCM 6th Ctrl Delay	23.9
HCM 6th LOS	C

Table D-63. HCM 6th Signalized Intersection Summary - 94th Ave E & 39th Ave SW (PM Peak)

HCM 6th Signalized Intersection Summary
24: 94th Ave E & 39th Ave SW 01/31/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	197	644	226	148	666	65	135	700	122	119	1095	398
Future Volume (veh/h)	197	644	226	148	666	65	135	700	122	119	1095	398
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		0.98	1.00		0.98	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1786	1786	1786	1772	1772	1772	1786	1786	1786	1786	1786	1786
Adj Flow Rate, veh/h	199	651	228	149	673	66	136	707	123	120	1106	402
Peak Hour Factor	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Percent Heavy Veh, %	1	1	1	2	2	2	1	1	1	1	1	1
Cap, veh/h	182	911	400	108	706	69	106	1346	234	137	1186	422
Arrive On Green	0.11	0.27	0.27	0.06	0.23	0.23	0.06	0.47	0.47	0.08	0.49	0.49
Sat Flow, veh/h	1701	3393	1489	1688	3092	303	1701	2881	501	1701	2440	869
Grp Volume(v), veh/h	199	651	228	149	366	373	136	416	414	120	762	746
Grp Sat Flow(s),veh/h/ln	1701	1697	1489	1688	1683	1711	1701	1697	1686	1701	1697	1612
Q Serve(g_s), s	19.1	31.1	23.6	11.4	38.4	38.5	11.1	31.0	31.0	12.5	75.0	79.2
Cycle Q Clear(g_c), s	19.1	31.1	23.6	11.4	38.4	38.5	11.1	31.0	31.0	12.5	75.0	79.2
Prop In Lane	1.00		1.00	1.00		0.18	1.00		0.30	1.00		0.54
Lane Grp Cap(c), veh/h	182	911	400	108	384	391	106	793	788	137	824	783
V/C Ratio(X)	1.10	0.71	0.57	1.39	0.95	0.95	1.29	0.52	0.53	0.87	0.92	0.95
Avail Cap(c_a), veh/h	182	943	414	108	395	402	106	793	788	144	824	783
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	79.9	59.2	56.5	83.7	68.0	68.1	83.9	33.6	33.6	81.3	42.9	44.0
Incr Delay (d2), s/veh	94.6	2.1	1.0	220.6	32.3	32.4	183.5	2.5	2.5	37.9	17.6	22.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	13.2	13.7	9.1	11.6	20.0	20.4	10.3	13.5	13.5	7.0	35.4	36.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	174.5	61.3	57.5	304.3	100.3	100.5	267.4	36.1	36.1	119.2	60.5	66.4
LnGrp LOS	F	E	E	F	F	F	F	D	D	F	E	E
Approach Vol, veh/h		1078			888			966			1628	
Approach Delay, s/veh		81.4			134.6			68.7			67.5	
Approach LOS		F			F			E			E	
Timer - Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	19.5	88.7	17.0	53.6	16.2	92.0	24.2	46.4				
Change Period (Y+Rc), s	5.1	5.1	5.6	* 5.6	5.1	5.1	5.1	5.6				
Max Green Setting (Gmax), s	15.1	82.9	11.4	* 50	11.1	86.9	19.1	42.0				
Max Q Clear Time (g_c+I1), s	14.5	33.0	13.4	33.1	13.1	81.2	21.1	40.5				
Green Ext Time (p_c), s	0.0	2.0	0.0	1.8	0.0	2.5	0.0	0.4				
Intersection Summary												
HCM 6th Ctrl Delay			84.1									
HCM 6th LOS			F									
Notes												

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Table D-64. HCM 6th Signalized Intersection Summary – 94th Ave E & SR512 EB Off-Ramp/South Hill Mall (PM Peak)

HCM 6th Signalized Intersection Summary
25: 94th Ave E & SR512 EB Off-Ramp/South Hill Mall 01/31/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	114	117	491	75	0	153	0	832	130	116	1046	0
Future Volume (veh/h)	114	117	491	75	0	153	0	832	130	116	1046	0
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1786	1786	1786	1800	0	1800	0	1772	1772	1786	1786	0
Adj Flow Rate, veh/h	118	121	506	77	0	158	0	858	134	120	1078	0
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	1	1	1	0	0	0	0	2	2	1	1	0
Cap, veh/h	334	351	293	0	0	0	0	1879	293	115	2519	0
Arrive On Green	0.20	0.20	0.20	0.00	0.00	0.00	0.00	0.64	0.64	0.07	0.74	0.00
Sat Flow, veh/h	1701	1786	1494		0		0	3006	456	1701	3483	0
Grp Volume(v), veh/h	118	121	506		0.0		0	495	497	120	1078	0
Grp Sat Flow(s),veh/h/ln	1701	1786	1494				0	1683	1690	1701	1697	0
Q Serve(g_s), s	9.8	9.5	32.0				0.0	24.2	24.2	11.0	19.6	0.0
Cycle Q Clear(g_c), s	9.8	9.5	32.0				0.0	24.2	24.2	11.0	19.6	0.0
Prop In Lane	1.00		1.00				0.00		0.27	1.00		0.00
Lane Grp Cap(c), veh/h	334	351	293				0	1084	1088	115	2519	0
V/C Ratio(X)	0.35	0.35	1.73				0.00	0.46	0.46	1.05	0.43	0.00
Avail Cap(c_a), veh/h	334	351	293				0	1084	1088	115	2519	0
HCM Platoon Ratio	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00				0.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	56.6	56.5	65.5				0.0	14.6	14.6	76.0	7.9	0.0
Incr Delay (d2), s/veh	0.2	0.2	340.5				0.0	1.4	1.4	96.7	0.5	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.3	4.4	40.0				0.0	9.7	9.7	7.9	7.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	56.8	56.7	406.0				0.0	16.0	16.0	172.7	8.5	0.0
LnGrp LOS	E	E	F				A	B	B	F	A	A
Approach Vol, veh/h		745						992			1198	
Approach Delay, s/veh		294.0						16.0			24.9	
Approach LOS		F						B			C	

Timer - Assigned Phs	1	2	4	6
Phs Duration (G+Y+Rc), s	16.0	110.0	37.0	126.0
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	11.0	105.0	32.0	121.0
Max Q Clear Time (g_c+I1), s	13.0	26.2	34.0	21.6
Green Ext Time (p_c), s	0.0	2.4	0.0	3.4

Intersection Summary	
HCM 6th Ctrl Delay	90.2
HCM 6th LOS	F

Table D-65. HCM 6th Signalized Intersection Summary – 94th Ave E & SR512 WB On-Ramp/S Hill Park Dr (PM Peak)

HCM 6th Signalized Intersection Summary
26: 94th Ave E & SR512 WB On-Ramp/S Hill Park Dr 01/31/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	193	30	60	351	640	108	31	969	53
Future Volume (veh/h)	0	0	0	193	30	60	351	640	108	31	969	53
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach					No			No			No	
Adj Sat Flow, veh/h/ln				1800	1800	1800	1786	1786	1786	1786	1786	1786
Adj Flow Rate, veh/h				197	31	61	358	653	110	32	989	54
Peak Hour Factor				0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %				0	0	0	1	1	1	1	1	1
Cap, veh/h				214	34	219	215	2152	362	40	2076	113
Arrive On Green				0.14	0.14	0.14	0.13	0.74	0.74	0.02	0.63	0.63
Sat Flow, veh/h				1491	235	1522	1701	2905	489	1701	3272	179
Grp Volume(v), veh/h				228	0	61	358	381	382	32	513	530
Grp Sat Flow(s),veh/h/ln				1725	0	1522	1701	1697	1697	1701	1697	1753
Q Serve(g_s), s				23.0	0.0	6.3	22.3	13.2	13.3	3.3	27.9	27.9
Cycle Q Clear(g_c), s				23.0	0.0	6.3	22.3	13.2	13.3	3.3	27.9	27.9
Prop In Lane				0.86		1.00	1.00		0.29	1.00		0.10
Lane Grp Cap(c), veh/h				248	0	219	215	1257	1257	40	1077	1113
V/C Ratio(X)				0.92	0.00	0.28	1.66	0.30	0.30	0.79	0.48	0.48
Avail Cap(c_a), veh/h				290	0	256	215	1257	1257	96	1077	1113
HCM Platoon Ratio				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)				1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh				74.5	0.0	67.4	77.0	7.6	7.6	85.6	16.9	16.9
Incr Delay (d2), s/veh				28.4	0.0	0.3	318.6	0.6	0.6	11.9	1.5	1.5
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				12.2	0.0	2.5	28.9	5.0	5.1	1.6	11.5	11.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh				102.9	0.0	67.6	395.6	8.3	8.3	97.5	18.4	18.3
LnGrp LOS				F	A	E	F	A	A	F	B	B
Approach Vol, veh/h					289			1121			1075	
Approach Delay, s/veh					95.5			132.0			20.7	
Approach LOS					F			F			C	
Timer - Assigned Phs	1	2			5	6		8				
Phs Duration (G+Y+Rc), s	9.3	136.3			28.0	117.6		30.7				
Change Period (Y+Rc), s	5.1	5.7			5.7	* 5.7		5.4				
Max Green Setting (Gmax), s	9.9	124.3			22.3	* 1.1E2		29.6				
Max Q Clear Time (g_c+I1), s	5.3	15.3			24.3	29.9		25.0				
Green Ext Time (p_c), s	0.0	1.8			0.0	2.5		0.2				
Intersection Summary												
HCM 6th Ctrl Delay			79.6									
HCM 6th LOS			E									

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Table D-66. CM 6th Signalized Intersection Summary - 94th Ave E/9th St SW & 31st Ave SW (PM Peak)

HCM 6th Signalized Intersection Summary
27: 94th Ave E/9th St SW & 31st Ave SW

01/31/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	52	139	91	386	346	46	129	368	204	35	581	81
Future Volume (veh/h)	52	139	91	386	346	46	129	368	204	35	581	81
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1786	1786	1786	1772	1772	1772	1758	1758	1758	1786	1786	1786
Adj Flow Rate, veh/h	55	148	97	411	368	49	137	391	217	37	618	86
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	1	1	1	2	2	2	3	3	3	1	1	1
Cap, veh/h	69	171	145	392	440	59	51	918	777	47	796	111
Arrive On Green	0.04	0.10	0.10	0.23	0.29	0.29	0.03	0.52	0.52	0.03	0.52	0.52
Sat Flow, veh/h	1701	1786	1514	1688	1531	204	1674	1758	1487	1701	1534	213
Grp Volume(v), veh/h	55	148	97	411	0	417	137	391	217	37	0	704
Grp Sat Flow(s),veh/h/ln	1701	1786	1514	1688	0	1735	1674	1758	1487	1701	0	1747
Q Serve(g_s), s	5.2	13.4	10.1	38.0	0.0	36.9	5.0	22.4	13.4	3.5	0.0	53.1
Cycle Q Clear(g_c), s	5.2	13.4	10.1	38.0	0.0	36.9	5.0	22.4	13.4	3.5	0.0	53.1
Prop In Lane	1.00		1.00	1.00		0.12	1.00		1.00	1.00		0.12
Lane Grp Cap(c), veh/h	69	171	145	392	0	498	51	918	777	47	0	907
V/C Ratio(X)	0.80	0.87	0.67	1.05	0.00	0.84	2.68	0.43	0.28	0.79	0.00	0.78
Avail Cap(c_a), veh/h	83	349	296	392	0	657	51	918	777	52	0	907
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	77.8	73.0	71.5	62.8	0.0	54.7	79.3	24.0	21.9	79.1	0.0	31.7
Incr Delay (d2), s/veh	29.0	5.0	2.0	58.9	0.0	5.6	807.9	1.4	0.9	45.7	0.0	6.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.9	6.4	4.0	22.7	0.0	17.0	13.7	9.8	5.0	2.2	0.0	24.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	106.9	78.0	73.5	121.7	0.0	60.3	887.2	25.5	22.8	124.8	0.0	38.1
LnGrp LOS	F	E	E	F	A	E	F	C	C	F	A	D
Approach Vol, veh/h		300			828			745			741	
Approach Delay, s/veh		81.8			90.8			183.1			42.5	
Approach LOS		F			F			F			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	9.5	90.5	43.0	20.7	10.0	90.0	11.7	52.0
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	5.0	85.0	38.0	32.0	5.0	85.0	8.0	62.0
Max Q Clear Time (g_c+I1), s	5.5	24.4	40.0	15.4	7.0	55.1	7.2	38.9
Green Ext Time (p_c), s	0.0	0.9	0.0	0.3	0.0	1.8	0.0	0.9

Intersection Summary	
HCM 6th Ctrl Delay	102.4
HCM 6th LOS	F

Table D-67. HCM 6th Signalized Intersection Summary - 31st Ave SW & WB SR512 Off-Ramp (PM Peak)

HCM 6th Signalized Intersection Summary
28: 31st Ave SW & WB SR512 Off-Ramp 01/31/2023

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	426	282	393	779	688
Future Volume (veh/h)	0	426	282	393	779	688
Initial Q (Qb), veh	0	30	0	0	20	0
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No	No		No	
Adj Sat Flow, veh/h/ln	0	1772	1786	1786	1786	1786
Adj Flow Rate, veh/h	0	439	291	0	803	0
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	0	2	1	1	1	1
Cap, veh/h	0	674	701		908	
Arrive On Green	0.00	0.44	0.74	0.00	0.50	0.00
Sat Flow, veh/h	0	1772	1786	1514	1701	1514
Grp Volume(v), veh/h	0	439	291	0	803	0
Grp Sat Flow(s),veh/h/ln	0	1772	1786	1514	1701	1514
Q Serve(g_s), s	0.0	27.6	8.8	0.0	67.5	0.0
Cycle Q Clear(g_c), s	0.0	27.6	8.8	0.0	67.5	0.0
Prop In Lane	0.00			1.00	1.00	1.00
Lane Grp Cap(c), veh/h	0	674	701		908	
V/C Ratio(X)	0.00	0.65	0.42		0.88	
Avail Cap(c_a), veh/h	0	783	789		1002	
HCM Platoon Ratio	1.00	1.00	1.67	1.67	1.00	1.00
Upstream Filter(I)	0.00	1.00	0.63	0.00	1.00	0.00
Uniform Delay (d), s/veh	0.0	42.9	18.1	0.0	33.9	0.0
Incr Delay (d2), s/veh	0.0	4.8	1.1	0.0	9.3	0.0
Initial Q Delay(d3),s/veh	0.0	41.0	0.0	0.0	30.2	0.0
%ile BackOfQ(50%),veh/ln	0.0	27.9	4.3	0.0	40.4	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	0.0	88.7	19.2	0.0	73.4	0.0
LnGrp LOS	A	F	B		E	
Approach Vol, veh/h		439	291	A	803	A
Approach Delay, s/veh		88.7	19.2		73.4	
Approach LOS		F	B		E	
Timer - Assigned Phs		2		4		6
Phs Duration (G+Y+Rc), s		70.9		79.1		70.9
Change Period (Y+Rc), s		4.6		4.6		4.6
Max Green Setting (Gmax), s		52.4		88.4		52.4
Max Q Clear Time (g_c+I1), s		29.6		69.5		10.8
Green Ext Time (p_c), s		2.8		5.0		1.9
Intersection Summary						
HCM 6th Ctrl Delay			67.5			
HCM 6th LOS			E			

Notes

Unsignalized Delay for [WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Table D-68. HCM 6th Signalized Intersection Summary - EB SR512 Off-Ramp & 31st Ave SW (PM Peak)

HCM 6th Signalized Intersection Summary
29: EB SR512 Off-Ramp & 31st Ave SW

01/31/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑			↑	↱		↰	↱			
Traffic Volume (veh/h)	247	958	0	0	673	754	2	0	503	0	0	0
Future Volume (veh/h)	247	958	0	0	673	754	2	0	503	0	0	0
Initial Q (Qb), veh	30	30	0	0	30	0	0	30	30			
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Work Zone On Approach		No			No			No				
Adj Sat Flow, veh/h/ln	1786	1786	0	0	1758	1758	1786	1786	1786			
Adj Flow Rate, veh/h	263	1019	0	0	716	0	2	0	0			
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94			
Percent Heavy Veh, %	1	1	0	0	3	3	1	1	1			
Cap, veh/h	311	1670	0	0	1293		7	0				
Arrive On Green	0.33	1.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00			
Sat Flow, veh/h	1701	1786	0	0	1758	1490	1701	0	1514			
Grp Volume(v), veh/h	263	1019	0	0	716	0	2	0	0			
Grp Sat Flow(s),veh/h/ln	1701	1786	0	0	1758	1490	1701	0	1514			
Q Serve(g_s), s	22.5	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0			
Cycle Q Clear(g_c), s	22.5	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0			
Prop In Lane	1.00		0.00	0.00		1.00	1.00		1.00			
Lane Grp Cap(c), veh/h	311	1670	0	0	1293		7	0				
V/C Ratio(X)	0.85	0.61	0.00	0.00	0.55		0.30	0.00				
Avail Cap(c_a), veh/h	311	1670	0	0	1300		118	0				
HCM Platoon Ratio	2.00	2.00	1.00	1.00	1.67	1.67	1.00	1.00	1.00			
Upstream Filter(I)	0.53	0.53	0.00	0.00	0.73	0.00	1.00	0.00	0.00			
Uniform Delay (d), s/veh	47.6	0.0	0.0	0.0	0.0	0.0	74.5	0.0	0.0			
Incr Delay (d2), s/veh	10.9	0.9	0.0	0.0	1.3	0.0	23.9	0.0	0.0			
Initial Q Delay(d3),s/veh	278.5	6.0	0.0	0.0	8.7	0.0	16090.7	0.0	0.0			
%ile BackOfQ(50%),veh/ln	35.1	3.2	0.0	0.0	3.6	0.0	29.5	0.0	0.0			
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	337.0	6.9	0.0	0.0	9.9	0.0	16189.2	0.0	0.0			
LnGrp LOS	F	A	A	A	A		F	A				
Approach Vol, veh/h		1282			716	A		2	A			
Approach Delay, s/veh		74.6			9.9			16189.2				
Approach LOS		E			A			F				
Timer - Assigned Phs		2			5	6		8				
Phs Duration (G+Y+Rc), s		144.8			29.3	115.5		5.2				
Change Period (Y+Rc), s		4.6			4.6	4.6		4.6				
Max Green Setting (Gmax), s		110.4			27.4	98.4		10.4				
Max Q Clear Time (g_c+I1), s		2.0			24.5	2.0		2.2				
Green Ext Time (p_c), s		13.9			0.2	5.7		0.0				
Intersection Summary												
HCM 6th Ctrl Delay			67.6									
HCM 6th LOS			E									
Notes												

Unsignalized Delay for [NBR, WBR] is excluded from calculations of the approach delay and intersection delay.

Table D-69. HCM Signalized Intersection Capacity Analysis – 31st Ave SW & S Meridian (PM Peak)

HCM Signalized Intersection Capacity Analysis
30: 31st Ave SW & S Meridian 01/31/2023

Movement	EBL	EBT	WBT	WBR	SWL	SWR
Lane Configurations						
Traffic Volume (vph)	252	1209	1162	388	567	265
Future Volume (vph)	252	1209	1162	388	567	265
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width	11	11	11	11	11	11
Total Lost time (s)	4.6	4.6	4.6	4.6	4.6	4.6
Lane Util. Factor	*0.55	*0.55	0.95	*0.95	0.97	*0.95
Frpb, ped/bikes	1.00	1.00	1.00	0.96	1.00	0.97
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.65	1.00	0.65
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1783	1876	3210	1002	3175	1037
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1783	1876	3210	1002	3175	1037
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	255	1221	1174	392	573	268
RTOR Reduction (vph)	0	0	0	139	0	178
Lane Group Flow (vph)	255	1221	1174	253	573	90
Confl. Peds. (#/hr)	10			10	10	10
Heavy Vehicles (%)	2%	2%	3%	3%	1%	1%
Turn Type	Prot	NA	NA	Perm	Prot	Perm
Protected Phases	5	6	6		4	
Permitted Phases				6		4
Actuated Green, G (s)	16.4	87.2	87.2	87.2	32.6	32.6
Effective Green, g (s)	16.4	87.2	87.2	87.2	32.6	32.6
Actuated g/C Ratio	0.11	0.58	0.58	0.58	0.22	0.22
Clearance Time (s)	4.6	4.6	4.6	4.6	4.6	4.6
Vehicle Extension (s)	2.5	2.5	2.5	2.5	2.5	2.5
Lane Grp Cap (vph)	194	1090	1866	582	690	225
v/s Ratio Prot	c0.14	c0.65	0.37		c0.18	
v/s Ratio Perm				0.25		0.09
v/c Ratio	1.31	1.12	0.63	0.43	0.83	0.40
Uniform Delay, d1	66.8	31.4	20.7	17.6	56.1	50.3
Progression Factor	0.99	0.93	1.00	1.00	1.00	1.00
Incremental Delay, d2	158.6	60.8	1.6	2.4	8.2	0.9
Delay (s)	224.8	90.0	22.3	19.9	64.3	51.2
Level of Service	F	F	C	B	E	D
Approach Delay (s)		113.2	21.7		60.1	
Approach LOS		F	C		E	

Intersection Summary			
HCM 2000 Control Delay	64.8	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.07		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	13.8
Intersection Capacity Utilization	70.1%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Table D-70. HCM 6th Signalized Intersection Summary - S Meridian & EB SR512 Off-Ramp (PM Peak)

HCM 6th Signalized Intersection Summary
31: S Meridian & EB SR512 Off-Ramp 01/31/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	102	1	83	0	0	0	0	728	418	53	1339	0
Future Volume (veh/h)	102	1	83	0	0	0	0	728	418	53	1339	0
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No						No			No	
Adj Sat Flow, veh/h/ln	1786	1786	1786				0	1786	1786	1786	1786	0
Adj Flow Rate, veh/h	110	1	0				0	783	449	57	1440	0
Peak Hour Factor	0.93	0.93	0.93				0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	1	1	1				0	1	1	1	1	0
Cap, veh/h	139	1					0	1435	817	72	2694	0
Arrive On Green	0.08	0.08	0.00				0.00	0.69	0.69	0.04	0.79	0.00
Sat Flow, veh/h	1686	15	1514				0	2170	1185	1701	3483	0
Grp Volume(v), veh/h	111	0	0				0	637	595	57	1440	0
Grp Sat Flow(s),veh/h/ln	1702	0	1514				0	1697	1569	1701	1697	0
Q Serve(g_s), s	6.2	0.0	0.0				0.0	18.1	18.4	3.2	14.7	0.0
Cycle Q Clear(g_c), s	6.2	0.0	0.0				0.0	18.1	18.4	3.2	14.7	0.0
Prop In Lane	0.99		1.00				0.00		0.76	1.00		0.00
Lane Grp Cap(c), veh/h	140	0					0	1170	1082	72	2694	0
V/C Ratio(X)	0.79	0.00					0.00	0.54	0.55	0.79	0.53	0.00
Avail Cap(c_a), veh/h	544	0					0	1170	1082	88	2694	0
HCM Platoon Ratio	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00				0.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	43.7	0.0	0.0				0.0	7.5	7.5	46.0	3.6	0.0
Incr Delay (d2), s/veh	3.8	0.0	0.0				0.0	1.8	2.0	26.6	0.8	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.7	0.0	0.0				0.0	6.2	5.8	1.9	3.6	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	47.5	0.0	0.0				0.0	9.3	9.5	72.6	4.3	0.0
LnGrp LOS	D	A					A	A	A	E	A	A
Approach Vol, veh/h		111	A					1232			1497	
Approach Delay, s/veh		47.5						9.4			6.9	
Approach LOS		D						A			A	
Timer - Assigned Phs		2			5	6		8				
Phs Duration (G+Y+Rc), s		83.0			10.1	72.9		14.0				
Change Period (Y+Rc), s		6.0			6.0	6.0		6.0				
Max Green Setting (Gmax), s		77.0			5.0	66.0		31.0				
Max Q Clear Time (g_c+I1), s		16.7			5.2	20.4		8.2				
Green Ext Time (p_c), s		5.2			0.0	3.5		0.2				
Intersection Summary												
HCM 6th Ctrl Delay			9.6									
HCM 6th LOS			A									
Notes												

Unsignalized Delay for [EBR] is excluded from calculations of the approach delay and intersection delay.

Table D-71.HCM 6th Signalized Intersection Summary - S Meridian & WB SR512 Off-Ramp (PM Peak)

HCM 6th Signalized Intersection Summary
32: S Meridian & WB SR512 Off-Ramp 01/31/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	279	2	18	170	660	0	0	1113	174
Future Volume (veh/h)	0	0	0	279	2	18	170	660	0	0	1113	174
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach					No			No			No	
Adj Sat Flow, veh/h/ln				1800	1800	1800	1786	1786	0	0	1800	1800
Adj Flow Rate, veh/h				300	2	19	183	710	0	0	1197	187
Peak Hour Factor				0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %				0	0	0	1	1	0	0	0	0
Cap, veh/h				326	2	292	137	2428	0	0	2013	896
Arrive On Green				0.19	0.19	0.19	0.08	0.72	0.00	0.00	0.59	0.59
Sat Flow, veh/h				1703	11	1523	1701	3483	0	0	3510	1523
Grp Volume(v), veh/h				302	0	19	183	710	0	0	1197	187
Grp Sat Flow(s),veh/h/ln				1715	0	1523	1701	1697	0	0	1710	1523
Q Serve(g_s), s				20.4	0.0	1.2	9.5	8.9	0.0	0.0	26.2	6.8
Cycle Q Clear(g_c), s				20.4	0.0	1.2	9.5	8.9	0.0	0.0	26.2	6.8
Prop In Lane				0.99		1.00	1.00		0.00	0.00		1.00
Lane Grp Cap(c), veh/h				328	0	292	137	2428	0	0	2013	896
V/C Ratio(X)				0.92	0.00	0.07	1.34	0.29	0.00	0.00	0.59	0.21
Avail Cap(c_a), veh/h				356	0	316	137	2428	0	0	2013	896
HCM Platoon Ratio				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)				1.00	0.00	1.00	1.00	1.00	0.00	0.00	1.00	1.00
Uniform Delay (d), s/veh				46.9	0.0	39.1	54.3	6.0	0.0	0.0	15.4	11.4
Incr Delay (d2), s/veh				26.3	0.0	0.0	192.9	0.3	0.0	0.0	1.3	0.5
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				11.1	0.0	0.5	11.4	3.0	0.0	0.0	10.2	2.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh				73.2	0.0	39.1	247.2	6.4	0.0	0.0	16.7	11.9
LnGrp LOS				E	A	D	F	A	A	A	B	B
Approach Vol, veh/h					321			893			1384	
Approach Delay, s/veh					71.2			55.7			16.0	
Approach LOS					E			E			B	
Timer - Assigned Phs	1	2		4		6						
Phs Duration (G+Y+Rc), s	15.0	75.0		28.1		90.0						
Change Period (Y+Rc), s	5.5	5.5		5.5		5.5						
Max Green Setting (Gmax), s	9.5	69.5		24.5		84.5						
Max Q Clear Time (g_c+I1), s	11.5	28.2		22.4		10.9						
Green Ext Time (p_c), s	0.0	3.9		0.2		2.0						
Intersection Summary												
HCM 6th Ctrl Delay			36.5									
HCM 6th LOS			D									

Table D-72. HCM 6th Signalized Intersection Summary – Canyon Rd E & Summit Country Center/110th St E (PM Peak)

HCM 6th Signalized Intersection Summary
33: Canyon Rd E & Summit Country Center/110th St E 01/31/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	207	2	49	14	3	30	41	1560	8	66	2126	97
Future Volume (veh/h)	207	2	49	14	3	30	41	1560	8	66	2126	97
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		0.99	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758
Adj Flow Rate, veh/h	216	2	51	15	3	31	43	1625	8	69	2215	101
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	55	0	334	51	5	334	54	2970	15	86	2923	133
Arrive On Green	0.23	0.23	0.23	0.23	0.23	0.23	0.01	0.20	0.20	0.10	1.00	1.00
Sat Flow, veh/h	0	0	1470	0	24	1470	1674	4928	24	1674	4703	213
Grp Volume(v), veh/h	218	0	51	18	0	31	43	1055	578	69	1503	813
Grp Sat Flow(s),veh/h/ln	0	0	1470	24	0	1470	1674	1600	1753	1674	1600	1717
Q Serve(g_s), s	0.0	0.0	3.6	0.0	0.0	2.2	3.3	38.5	38.5	5.2	0.0	0.0
Cycle Q Clear(g_c), s	29.5	0.0	3.6	29.5	0.0	2.2	3.3	38.5	38.5	5.2	0.0	0.0
Prop In Lane	0.99		1.00	0.83		1.00	1.00		0.01	1.00		0.12
Lane Grp Cap(c), veh/h	55	0	334	56	0	334	54	1928	1057	86	1988	1067
V/C Ratio(X)	3.95	0.00	0.15	0.32	0.00	0.09	0.79	0.55	0.55	0.81	0.76	0.76
Avail Cap(c_a), veh/h	55	0	334	56	0	334	116	1928	1057	167	1988	1067
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	0.33	0.33	0.33	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	0.69	0.69	0.69	0.48	0.48	0.48
Uniform Delay (d), s/veh	65.0	0.0	40.2	56.2	0.0	39.7	63.9	36.1	36.1	57.7	0.0	0.0
Incr Delay (d2), s/veh	1371.8	0.0	0.1	1.2	0.0	0.0	6.6	0.8	1.4	3.2	1.3	2.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	22.8	0.0	1.3	0.6	0.0	0.8	1.5	16.8	18.6	2.2	0.4	0.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	1436.8	0.0	40.3	57.4	0.0	39.7	70.5	36.9	37.5	60.9	1.3	2.5
LnGrp LOS	F	A	D	E	A	D	E	D	D	E	A	A
Approach Vol, veh/h		269			49			1676			2385	
Approach Delay, s/veh		1172.0			46.2			38.0			3.5	
Approach LOS		F			D			D			A	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	9.2	85.8		35.0	11.7	83.3		35.0
Change Period (Y+Rc), s	5.0	5.0		5.5	5.0	5.0		5.5
Max Green Setting (Gmax), s	9.0	76.0		29.5	13.0	72.0		29.5
Max Q Clear Time (g_c+I1), s	5.3	2.0		31.5	7.2	40.5		31.5
Green Ext Time (p_c), s	0.0	22.8		0.0	0.0	9.8		0.0

Intersection Summary	
HCM 6th Ctrl Delay	88.9
HCM 6th LOS	F

Table D-73. HCM 6th Signalized Intersection Summary – 94th Ave E & South Hill P&R East Entrance (PM Peak)

HCM 6th Signalized Intersection Summary
34: 94th Ave E & South Hill P&R East Entrance — 01/31/2023

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	2	0	1	699	1053	5
Future Volume (veh/h)	2	0	1	699	1053	5
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	396	396	1786	1786	1786	1786
Adj Flow Rate, veh/h	706	1	1	706	1064	5
Peak Hour Factor	0.99	0.99	0.99	0.99	0.99	0.99
Percent Heavy Veh, %	100	100	1	1	1	1
Cap, veh/h	9999	9999	56	2591	2696	13
Arrive On Green	0.08	0.08	0.78	0.78	0.78	0.78
Sat Flow, veh/h	4014740[illegible]0633216		0	3410	3553	16
Grp Volume(v), veh/h	706	1	379	328	521	548
Grp Sat Flow(s),veh/h/ln	377	336	1785	1544	1697	1783
Q Serve(g_s), s	0.0	0.0	0.0	3.9	6.4	6.4
Cycle Q Clear(g_c), s	0.0	0.0	3.9	3.9	6.4	6.4
Prop In Lane	1.00	1.00	0.00			0.01
Lane Grp Cap(c), veh/h	3328721[illegible]5297024		1445	1202	1321	1388
V/C Ratio(X)	0.00	0.00	0.26	0.27	0.39	0.39
Avail Cap(c_a), veh/h	15779435[illegible]03717120		1445	1202	1321	1388
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	0.0	0.0	2.0	2.0	2.3	2.3
Incr Delay (d2), s/veh	0.0	0.0	0.4	0.6	0.9	0.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	0.7	0.6	1.2	1.2
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	0.0	0.0	2.5	2.6	3.2	3.1
LnGrp LOS	A	A	A	A	A	A
Approach Vol, veh/h	707			707	1069	
Approach Delay, s/veh	0.0			2.5	3.2	
Approach LOS	A			A	A	

Timer - Assigned Phs		2		4		6
Phs Duration (G+Y+Rc), s		55.0		9.9		55.0
Change Period (Y+Rc), s		4.5		4.5		4.5
Max Green Setting (Gmax), s		50.5		25.5		50.5
Max Q Clear Time (g_c+I1), s		5.9		2.0		8.4
Green Ext Time (p_c), s		6.3		3.4		8.9

Intersection Summary			
HCM 6th Ctrl Delay			2.1
HCM 6th LOS			A

Table D-74. HCM 6th TWSC – South Hill P&R North Entrance & 31st Ave SW (PM Peak)

HCM 6th TWSC
35: South Hill P&R North Entrance & 31st Ave SW

01/31/2023

Intersection	
Int Delay, s/veh	0.4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	260	1	10	546	6	22
Future Vol, veh/h	260	1	10	546	6	22
Conflicting Peds, #/hr	0	1	1	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Yield
Storage Length	-	-	120	-	0	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	1	1	1	1	4	4
Mvmt Flow	280	1	11	587	6	24

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	282	0	891	282
Stage 1	-	-	-	-	282	-
Stage 2	-	-	-	-	609	-
Critical Hdwy	-	-	4.11	-	6.44	6.24
Critical Hdwy Stg 1	-	-	-	-	5.44	-
Critical Hdwy Stg 2	-	-	-	-	5.44	-
Follow-up Hdwy	-	-	2.209	-	3.536	3.336
Pot Cap-1 Maneuver	-	-	1286	-	310	752
Stage 1	-	-	-	-	761	-
Stage 2	-	-	-	-	539	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1285	-	307	751
Mov Cap-2 Maneuver	-	-	-	-	307	-
Stage 1	-	-	-	-	760	-
Stage 2	-	-	-	-	534	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.1	11.4
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	307	751	-	-	1285	-
HCM Lane V/C Ratio	0.021	0.031	-	-	0.008	-
HCM Control Delay (s)	17	9.9	-	-	7.8	-
HCM Lane LOS	C	A	-	-	A	-
HCM 95th %tile Q(veh)	0.1	0.1	-	-	0	-

Table D-75. HCM 6th TWSC – South Hill Park Dr & 31str Ave SW (PM Peak)

HCM 6th TWSC
36: South Hill Park Dr & 31st Ave SW 01/31/2023

Intersection	
Int Delay, s/veh	2.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	11	358	9	203	756	11	2	0	65	3	0	20
Future Vol, veh/h	11	358	9	203	756	11	2	0	65	3	0	20
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	180	-	300	140	-	140	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	94	94	94	94	94	94	94	94	94	94	94	94
Heavy Vehicles, %	2	2	2	1	1	1	2	2	2	0	0	0
Mvmt Flow	12	381	10	216	804	12	2	0	69	3	0	21

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	816	0	0	391	0	0	1658	1653	381	1681	1651	804
Stage 1	-	-	-	-	-	-	405	405	-	1236	1236	-
Stage 2	-	-	-	-	-	-	1253	1248	-	445	415	-
Critical Hdwy	4.12	-	-	4.11	-	-	7.12	6.52	6.22	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.1	5.5	-
Follow-up Hdwy	2.218	-	-	2.209	-	-	3.518	4.018	3.318	3.5	4	3.3
Pot Cap-1 Maneuver	812	-	-	1173	-	-	78	98	666	76	100	386
Stage 1	-	-	-	-	-	-	622	598	-	218	250	-
Stage 2	-	-	-	-	-	-	211	245	-	596	596	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	812	-	-	1173	-	-	63	79	666	58	80	386
Mov Cap-2 Maneuver	-	-	-	-	-	-	63	79	-	58	80	-
Stage 1	-	-	-	-	-	-	613	589	-	215	204	-
Stage 2	-	-	-	-	-	-	163	200	-	526	587	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.3	1.8	13.1	23.2
HCM LOS			B	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	518	812	-	-	1173	-	-	222
HCM Lane V/C Ratio	0.138	0.014	-	-	0.184	-	-	0.11
HCM Control Delay (s)	13.1	9.5	-	-	8.8	-	-	23.2
HCM Lane LOS	B	A	-	-	A	-	-	C
HCM 95th %tile Q(veh)	0.5	0	-	-	0.7	-	-	0.4

Table D-76. HCM 6th Signalized Intersection Summary - S Meridian & 15th Ave SW/15th Ave SE (PM Peak)

HCM 6th Signalized Intersection Summary
37: S Meridian & 15th Ave SW/15th Ave SE

01/31/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	114	40	144	139	138	281	110	751	40	150	1141	131
Future Volume (veh/h)	114	40	144	139	138	281	110	751	40	150	1141	131
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1786	1786	1786	1786	1786	1786	1786	1786	1786	1786	1786	1786
Adj Flow Rate, veh/h	123	43	155	149	148	302	118	808	43	161	1227	141
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	1	1	1	1	1	1	1	1	1	1	1	1
Cap, veh/h	320	70	253	264	384	326	189	1438	77	345	1391	159
Arrive On Green	0.05	0.21	0.21	0.05	0.22	0.22	0.05	0.44	0.44	0.07	0.45	0.45
Sat Flow, veh/h	1701	340	1225	1701	1786	1514	1701	3276	174	1701	3067	351
Grp Volume(v), veh/h	123	0	198	149	148	302	118	418	433	161	677	691
Grp Sat Flow(s),veh/h/ln	1701	0	1565	1701	1786	1514	1701	1697	1754	1701	1697	1722
Q Serve(g_s), s	5.3	0.0	13.3	6.3	8.2	22.6	4.4	21.3	21.3	6.0	42.0	42.4
Cycle Q Clear(g_c), s	5.3	0.0	13.3	6.3	8.2	22.6	4.4	21.3	21.3	6.0	42.0	42.4
Prop In Lane	1.00		0.78	1.00		1.00	1.00		0.10	1.00		0.20
Lane Grp Cap(c), veh/h	320	0	323	264	384	326	189	745	770	345	770	781
V/C Ratio(X)	0.38	0.00	0.61	0.56	0.39	0.93	0.63	0.56	0.56	0.47	0.88	0.88
Avail Cap(c_a), veh/h	320	0	380	264	449	381	190	745	770	380	770	781
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	36.4	0.0	41.7	38.2	38.9	44.5	25.6	24.2	24.2	18.1	28.7	28.9
Incr Delay (d2), s/veh	0.3	0.0	1.0	1.7	0.2	24.9	4.7	3.1	3.0	0.4	13.6	13.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.6	0.0	5.2	1.2	3.6	10.7	1.9	9.0	9.3	2.3	19.5	20.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	36.7	0.0	42.7	39.9	39.1	69.4	30.4	27.2	27.1	18.5	42.4	42.8
LnGrp LOS	D	A	D	D	D	E	C	C	C	B	D	D
Approach Vol, veh/h		321			599			969			1529	
Approach Delay, s/veh		40.4			54.6			27.6			40.1	
Approach LOS		D			D			C			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	12.9	59.2	12.0	31.6	14.6	57.5	13.0	30.6
Change Period (Y+Rc), s	* 6.7	* 6.7	* 6.7	* 6.7	* 6.7	* 6.7	* 6.7	* 6.7
Max Green Setting (Gmax), s	* 6.3	* 53	* 5.3	* 29	* 10	* 49	* 6.3	* 28
Max Q Clear Time (g_c+I1), s	6.4	44.4	7.3	24.6	8.0	23.3	8.3	15.3
Green Ext Time (p_c), s	0.0	2.6	0.0	0.3	0.0	1.9	0.0	0.4

Intersection Summary	
HCM 6th Ctrl Delay	39.1
HCM 6th LOS	D

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Appendix E SimTraffic Queue Results

1.0 Network: SR 512

Year: 2019

Table E-1. Legend

Label	Item
	= Queue > Storage
R	*= Right*
L	*= Left*
T	*= Through*
TR	*= Through + Right*
LT	*= Left + Through*
LTR	*= Left + Through + Right*

Table E-2. SimTraffic Queue Results

ID	Intersection	Approach	Lane Group	Vehicle Storage (ft)	95th % Queue Length (ft) AM Peak Hour	95th % Queue Length (ft) PM Peak Hour
1	Southbound I-5 Off-ramp/SR 512	Eastbound	TR	169	191	216
1	Southbound I-5 Off-ramp/SR 512	Southbound	L	1573	1495	0
1	Southbound I-5 Off-ramp/SR 512	Southbound	R	800	1003	0
1	Southbound I-5 Off-ramp/SR 512	Westbound	TR	2280	552	353
2	SR 512/S Tacoma Way	Northbound	L	140	30	71
2	SR 512/S Tacoma Way	Northbound	T	643	128	216
2	SR 512/S Tacoma Way	Northbound	R	500	319	490
2	SR 512/S Tacoma Way	Eastbound	LT	326	202	240
2	SR 512/S Tacoma Way	Eastbound	TR	326	137	189
2	SR 512/S Tacoma Way	Southbound	L	795	432	915
2	SR 512/S Tacoma Way	Southbound	T	795	146	971
2	SR 512/S Tacoma Way	Southbound	TR	795	127	642
2	SR 512/S Tacoma Way	Westbound	L	181	223	215
2	SR 512/S Tacoma Way	Westbound	LT	181	226	219

ID	Intersection	Approach	Lane Group	Vehicle Storage (ft)	95th % Queue Length (ft) AM Peak Hour	95th % Queue Length (ft) PM Peak Hour
2	SR 512/S Tacoma Way	Westbound	R	181	202	141
3	100th Street SW/S Tacoma Way	Northbound	L	795	179	179
3	100th Street SW/S Tacoma Way	Northbound	TR	795	14	0
3	100th Street SW/S Tacoma Way	Eastbound	TR	364	76	322
3	100th Street SW/S Tacoma Way	Southbound	TR	1308	115	294
4	Pacific Hwy SW/S Tacoma Way	Northbound	T	1001	301	1302
4	Pacific Hwy SW/S Tacoma Way	Northbound	R	200	209	306
4	Pacific Hwy SW/S Tacoma Way	Southbound	L	150	203	188
4	Pacific Hwy SW/S Tacoma Way	Southbound	T	193	305	351
4	Pacific Hwy SW/S Tacoma Way	Westbound	L	2604	614	573
4	Pacific Hwy SW/S Tacoma Way	Westbound	R	180	288	284
5	Eastbound SR 512/Steele Street S	Northbound	T	92	135	133
5	Eastbound SR 512/Steele Street S	Northbound	R	92	62	77
5	Eastbound SR 512/Steele Street S	Southbound	L	300	235	230
5	Eastbound SR 512/Steele Street S	Southbound	T	807	64	168
5	Eastbound SR 512/Steele Street S	Westbound	L	300	292	357
5	Eastbound SR 512/Steele Street S	Westbound	R	1122	193	1177
6	Westbound SR 512/Steele Street S	Northbound	T	807	109	261
6	Westbound SR 512/Steele Street S	Northbound	TR	807	229	495
6	Westbound SR 512/Steele Street S	Northbound	L	250	162	124
6	Westbound SR 512/Steele Street S	Northbound	T	452	84	96
6	Westbound SR 512/Steele Street S	Westbound	L	1270	145	81
6	Westbound SR 512/Steele Street S	Westbound	R	300	124	77
7	Sales Road South/Steele Street S	Northbound	L	150	84	21
7	Sales Road South/Steele Street S	Northbound	T	452	173	179

ID	Intersection	Approach	Lane Group	Vehicle Storage (ft)	95th % Queue Length (ft) AM Peak Hour	95th % Queue Length (ft) PM Peak Hour
7	Sales Road South/Steele Street S	Northbound	R	250	39	38
7	Sales Road South/Steele Street S	Eastbound	R	636	41	73
7	Sales Road South/Steele Street S	Southbound	L	220	58	144
7	Sales Road South/Steele Street S	Southbound	T	354	144	187
7	Sales Road South/Steele Street S	Southbound	TR	354	61	111
7	Sales Road South/Steele Street S	Westbound	L	467	87	65
7	Sales Road South/Steele Street S	Westbound	TR	150	55	63
8	109th Street South/Steele Street S	Northbound	T	819	341	471
8	109th Street South/Steele Street S	Northbound	TR	500	19	153
8	109th Street South/Steele Street S	Southbound	LT	92	32	85
8	109th Street South/Steele Street S	Southbound	T	92	9	85
8	109th Street South/Steele Street S	Westbound	LR	308	38	134
9	112th Street South/Steele Street S	Northbound	L	200	226	263
9	112th Street South/Steele Street S	Northbound	T	816	881	587
9	112th Street South/Steele Street S	Northbound	TR	816	938	514
9	112th Street South/Steele Street S	Eastbound	L	200	55	257
9	112th Street South/Steele Street S	Eastbound	T	814	98	866
9	112th Street South/Steele Street S	Eastbound	R	814	83	910
9	112th Street South/Steele Street S	Southbound	L	200	129	254
9	112th Street South/Steele Street S	Southbound	T	819	294	835
9	112th Street South/Steele Street S	Southbound	TR	819	311	846
9	112th Street South/Steele Street S	Westbound	L	200	141	109
9	112th Street South/Steele Street S	Westbound	T	623	516	236
9	112th Street South/Steele Street S	Westbound	R	200	248	129
10	112th Street S/SR 7	Northbound	L	250	223	299
10	112th Street S/SR 7	Northbound	T	2765	1212	1169

ID	Intersection	Approach	Lane Group	Vehicle Storage (ft)	95th % Queue Length (ft) AM Peak Hour	95th % Queue Length (ft) PM Peak Hour
10	112th Street S/SR 7	Northbound	TR	2765	1231	1168
10	112th Street S/SR 7	Eastbound	L	770	636	427
10	112th Street S/SR 7	Southbound	TR	805	294	863
10	112th Street S/SR 7	Westbound	L	554	290	253
10	112th Street S/SR 7	Westbound	T	554	598	488
10	112th Street S/SR 7	Westbound	R	110	170	173
11	Eastbound SR 512 Ramps/SR 7	Northbound	T	805	896	784
11	Eastbound SR 512 Ramps/SR 7	Northbound	R	150	241	227
11	Eastbound SR 512 Ramps/SR 7	Eastbound	LT	1392	197	1786
11	Eastbound SR 512 Ramps/SR 7	Eastbound	R	450	330	535
11	Eastbound SR 512 Ramps/SR 7	Southbound	L	190	231	264
11	Eastbound SR 512 Ramps/SR 7	Southbound	T	235	241	273
12	108th Street S/SR 7	Northbound	L	125	40	145
12	108th Street S/SR 7	Northbound	T	196	241	242
12	108th Street S/SR 7	Northbound	R	196	115	187
12	108th Street S/SR 7	Eastbound	LT	922	119	620
12	108th Street S/SR 7	Eastbound	R	50	83	91
12	108th Street S/SR 7	Southbound	L	275	35	125
12	108th Street S/SR 7	Southbound	T	3877	156	4057
12	108th Street S/SR 7	Southbound	TR	3877	150	4025
12	108th Street S/SR 7	Westbound	L	200	192	249
12	108th Street S/SR 7	Westbound	LT	565	307	673
12	108th Street S/SR 7	Westbound	R	300	189	443
13	108th Street E/ Westbound SR 512 Off-ramp	Northbound	LTR	1051	5	1345
13	108th Street E/ Westbound SR 512 Off-ramp	Eastbound	LT	565	90	116
13	108th Street E/ Westbound SR 512 Off-ramp	Eastbound	R	75	55	75
13	108th Street E/ Westbound SR 512 Off-ramp	Southbound	LTR	1765	52	1178
13	108th Street E/ Westbound SR 512 Off-ramp	Westbound	TR	1281	57	1127
14	112th Street E/A Street S	Northbound	LTR	295	141	141
14	112th Street E/A Street S	Eastbound	LT	554	132	268

ID	Intersection	Approach	Lane Group	Vehicle Storage (ft)	95th % Queue Length (ft) AM Peak Hour	95th % Queue Length (ft) PM Peak Hour
14	112th Street E/A Street S	Eastbound	TR	554	148	304
14	112th Street E/A Street S	Southbound	LTR	431	44	129
14	112th Street E/A Street S	Westbound	L	150	53	96
14	112th Street E/A Street S	Westbound	T	1759	178	82
14	112th Street E/A Street S	Westbound	TR	1759	354	181
15	112th Street E/C Street S	Northbound	L	250	37	52
15	112th Street E/C Street S	Northbound	T	363	162	147
15	112th Street E/C Street S	Northbound	R	250	53	56
15	112th Street E/C Street S	Eastbound	L	100	32	50
15	112th Street E/C Street S	Eastbound	T	1168	43	61
15	112th Street E/C Street S	Eastbound	TR	1168	57	107
15	112th Street E/C Street S	Southbound	L	200	65	167
15	112th Street E/C Street S	Southbound	TR	267	80	271
15	112th Street E/C Street S	Westbound	L	200	20	68
15	112th Street E/C Street S	Westbound	T	770	116	159
15	112th Street E/C Street S	Westbound	R	200	49	55
16	112th Street E/ Portland Avenue E	Northbound	LTR	195	54	44
16	112th Street E/ Portland Avenue E	Eastbound	L	250	194	134
16	112th Street E/ Portland Avenue E	Eastbound	T	676	119	136
16	112th Street E/ Portland Avenue E	Eastbound	TR	676	59	94
16	112th Street E/ Portland Avenue E	Southbound	L	250	96	145
16	112th Street E/ Portland Avenue E	Southbound	LT	1162	126	166
16	112th Street E/ Portland Avenue E	Southbound	R	1162	103	111
16	112th Street E/ Portland Avenue E	Westbound	L	150	30	18
16	112th Street E/ Portland Avenue E	Westbound	T	624	176	171

ID	Intersection	Approach	Lane Group	Vehicle Storage (ft)	95th % Queue Length (ft) AM Peak Hour	95th % Queue Length (ft) PM Peak Hour
16	112th Street E/ Portland Avenue E	Westbound	TR	624	198	179
17	Eastbound SR 512 Ramps/Portland Avenue E	Northbound	T	1162	307	307
17	Eastbound SR 512 Ramps/Portland Avenue E	Northbound	R	150	177	152
17	Eastbound SR 512 Ramps/Portland Avenue E	Eastbound	LT	985	141	177
17	Eastbound SR 512 Ramps/Portland Avenue E	Eastbound	R	300	93	167
17	Eastbound SR 512 Ramps/Portland Avenue E	Southbound	LT	327	217	384
18	Westbound SR 512 Ramps/Portland Avenue E	Northbound	LT	327	327	383
18	Westbound SR 512 Ramps/Portland Avenue E	Southbound	T	1227	217	404
18	Westbound SR 512 Ramps/Portland Avenue E	Southbound	R	150	133	172
18	Westbound SR 512 Ramps/Portland Avenue E	Westbound	LTR	1190	309	1505
19	104th Street E/Portland Avenue E	Northbound	L	200	102	58
19	104th Street E/Portland Avenue E	Northbound	TR	1227	229	203
19	104th Street E/Portland Avenue E	Eastbound	LTR	692	149	123
19	104th Street E/Portland Avenue E	Southbound	L	150	53	104
19	104th Street E/Portland Avenue E	Southbound	TR	592	169	347
19	104th Street E/Portland Avenue E	Westbound	LTR	497	146	212
20	112th Street E/Canyon Road E	Northbound	L	250	360	298
20	112th Street E/Canyon Road E	Northbound	T	968	1045	626
20	112th Street E/Canyon Road E	Northbound	TR	968	1065	699
20	112th Street E/Canyon Road E	Eastbound	L	200	239	282
20	112th Street E/Canyon Road E	Eastbound	T	5117	1298	993

ID	Intersection	Approach	Lane Group	Vehicle Storage (ft)	95th % Queue Length (ft) AM Peak Hour	95th % Queue Length (ft) PM Peak Hour
20	112th Street E/Canyon Road E	Eastbound	R	120	87	172
20	112th Street E/Canyon Road E	Southbound	L	250	148	337
20	112th Street E/Canyon Road E	Southbound	T	479	261	551
20	112th Street E/Canyon Road E	Southbound	TR	479	297	540
20	112th Street E/Canyon Road E	Westbound	L	250	144	278
20	112th Street E/Canyon Road E	Westbound	T	5187	405	4974
20	112th Street E/Canyon Road E	Westbound	R	250	315	278
21	Eastbound SR 512 Ramps/Canyon Road	Northbound	T	439	589	344
21	Eastbound SR 512 Ramps/Canyon Road	Northbound	TR	439	538	518
21	Eastbound SR 512 Ramps/Canyon Road	Eastbound	L	350	154	210
21	Eastbound SR 512 Ramps/Canyon Road	Eastbound	TR	1451	168	362
21	Eastbound SR 512 Ramps/Canyon Road	Eastbound	R	350	139	319
21	Eastbound SR 512 Ramps/Canyon Road	Southbound	L	200	140	206
21	Eastbound SR 512 Ramps/Canyon Road	Southbound	TR	463	54	599
22	Westbound SR 512 Ramps/ Canyon Road E	Northbound	L	463	500	338
22	Westbound SR 512 Ramps /Canyon Road E	Northbound	T	463	326	156
22	Westbound SR 512 Ramps/ Canyon Road E	Southbound	T	924	188	1069
22	Westbound SR 512 Ramps/ Canyon Road E	Southbound	R	300	161	440
22	Westbound SR 512 Ramps/ Canyon Road E	Westbound	L	400	279	446
22	Westbound SR 512 Ramps/ Canyon Road E	Westbound	TR	1605	87	544
23	104th Street E/ Canyon Road E	Northbound	L	150	87	166
23	104th Street E/ Canyon Road E	Northbound	T	924	169	303

ID	Intersection	Approach	Lane Group	Vehicle Storage (ft)	95th % Queue Length (ft) AM Peak Hour	95th % Queue Length (ft) PM Peak Hour
23	104th Street E/ Canyon Road E	Northbound	TR	924	201	329
23	104th Street E/ Canyon Road E	Eastbound	L	160	44	109
23	104th Street E/ Canyon Road E	Eastbound	T	528	52	308
23	104th Street E/ Canyon Road E	Eastbound	R	160	58	139
23	104th Street E/ Canyon Road E	Southbound	L	180	53	192
23	104th Street E/ Canyon Road E	Southbound	T	1030	105	346
23	104th Street E/ Canyon Road E	Southbound	TR	1030	113	357
23	104th Street E/ Canyon Road E	Westbound	L	200	97	204
23	104th Street E/ Canyon Road E	Westbound	T	598	87	339
23	104th Street E/ Canyon Road E	Westbound	R	200	65	76
24	39th Avenue SW/94th Avenue E	Northbound	L	200	221	305
24	39th Avenue SW/94th Avenue E	Northbound	T	1928	1994	2310
24	39th Avenue SW/94th Avenue E	Northbound	TR	1928	1987	2305
24	39th Avenue SW/94th Avenue E	Eastbound	L	400	499	512
24	39th Avenue SW/94th Avenue E	Eastbound	T	2639	1980	2697
24	39th Avenue SW/94th Avenue E	Eastbound	R	200	88	305
24	39th Avenue SW/94th Avenue E	Southbound	L	300	190	283
24	39th Avenue SW/94th Avenue E	Southbound	T	995	298	678
24	39th Avenue SW/94th Avenue E	Southbound	TR	995	340	727
24	39th Avenue SW/94th Avenue E	Westbound	L	300	75	394
24	39th Avenue SW/94th Avenue E	Westbound	T	2663	226	2291
24	39th Avenue SW/94th Avenue E	Westbound	TR	2663	352	2256
25	SR 512 Eastbound Off-ramp/94th Avenue	Northbound	T	995	1174	1312
25	SR 512 Eastbound Off-ramp/94th Avenue	Northbound	TR	995	1174	1324

ID	Intersection	Approach	Lane Group	Vehicle Storage (ft)	95th % Queue Length (ft) AM Peak Hour	95th % Queue Length (ft) PM Peak Hour
25	SR 512 Eastbound Off-ramp/94th Avenue	Eastbound	L	350	359	504
25	SR 512 Eastbound Off-ramp/94th Avenue	Eastbound	T	2503	1380	3460
25	SR 512 Eastbound Off-ramp/94th Avenue	Eastbound	R	400	308	576
25	SR 512 Eastbound Off-ramp/94th Avenue	Southbound	L	200	50	270
25	SR 512 Eastbound Off-ramp/94th Avenue	Southbound	T	975	121	596
25	SR 512 Eastbound Off-ramp/94th Avenue	Westbound	L	658	14	717
25	SR 512 Eastbound Off-ramp/94th Avenue	Westbound	R	658	122	844
26	SR 512 Westbound On-ramp/94th Avenue E	Northbound	L	400	587	558
26	SR 512 Westbound On-ramp/94th Avenue E	Northbound	T	975	1287	1111
26	SR 512 Westbound On-ramp/94th Avenue E	Northbound	TR	975	1239	1256
26	SR 512 Westbound On-ramp/94th Avenue E	Southbound	L	170	196	107
26	SR 512 Westbound On-ramp/94th Avenue E	Southbound	T	262	284	287
26	SR 512 Westbound On-ramp/94th Avenue E	Southbound	TR	262	244	303
26	SR 512 Westbound On-ramp/94th Avenue E	Westbound	LT	509	253	571
26	SR 512 Westbound On-ramp/94th Avenue E	Westbound	R	150	123	224
27	31st Avenue SW/9th Street SW/94th Avenue E	Northbound	L	140	95	144
27	31st Avenue SW/9th Street SW/94th Avenue E	Northbound	T	136	196	216

ID	Intersection	Approach	Lane Group	Vehicle Storage (ft)	95th % Queue Length (ft) AM Peak Hour	95th % Queue Length (ft) PM Peak Hour
27	31st Avenue SW/9th Street SW/94th Avenue E	Northbound	R	136	186	84
27	31st Avenue SW/9th Street SW/94th Avenue E	Eastbound	L	120	183	150
27	31st Avenue SW/9th Street SW/94th Avenue E	Eastbound	T	336	431	282
27	31st Avenue SW/9th Street SW/94th Avenue E	Eastbound	R	336	173	133
27	31st Avenue SW/9th Street SW/94th Avenue E	Southbound	L	160	150	142
27	31st Avenue SW/9th Street SW/94th Avenue E	Southbound	TR	1236	962	728
27	31st Avenue SW/9th Street SW/94th Avenue E	Westbound	L	400	433	512
27	31st Avenue SW/9th Street SW/94th Avenue E	Westbound	TR	662	623	868
28	31st Avenue SW/Westbound SR 512 Ramps	Eastbound	LT	572	694	623
28	31st Avenue SW/Westbound SR 512 Ramps	Southbound	L	1969	2490	2420
28	31st Avenue SW/Westbound SR 512 Ramps	Southbound	R	1000	1440	1311
28	31st Avenue SW/Westbound SR 512 Ramps	Westbound	T	631	438	793
28	31st Avenue SW/Westbound SR 512 Ramps	Westbound	R	130	92	226
29	31st Avenue SW/Eastbound SR 512 Ramps	Northbound	LT	1362	1380	1767
29	31st Avenue SW/Eastbound SR 512 Ramps	Northbound	R	200	318	281
29	31st Avenue SW/Eastbound SR 512 Ramps	Eastbound	L	150	196	203
29	31st Avenue SW/Eastbound SR 512 Ramps	Eastbound	T	631	712	819

ID	Intersection	Approach	Lane Group	Vehicle Storage (ft)	95th % Queue Length (ft) AM Peak Hour	95th % Queue Length (ft) PM Peak Hour
29	31st Avenue SW/Eastbound SR 512 Ramps	Westbound	T	483	329	516
29	31st Avenue SW/Eastbound SR 512 Ramps	Westbound	R	483	212	638
30	31st Avenue SW/South Meridian	Eastbound	L	250	320	253
30	31st Avenue SW/South Meridian	Eastbound	T	483	725	414
30	31st Avenue SW/South Meridian	Southbound	L	677	410	452
30	31st Avenue SW/South Meridian	Southbound	R	200	211	310
30	31st Avenue SW/South Meridian	Westbound	T	914	645	703
30	31st Avenue SW/South Meridian	Westbound	R	914	503	276
31	Eastbound SR 512 Ramps/South Meridian	Northbound	T	563	376	563
31	Eastbound SR 512 Ramps/South Meridian	Northbound	TR	563	459	579
31	Eastbound SR 512 Ramps/South Meridian	Eastbound	LT	1137	180	424
31	Eastbound SR 512 Ramps/South Meridian	Southbound	L	200	58	120
31	Eastbound SR 512 Ramps/South Meridian	Southbound	T	467	128	238
32	Westbound SR 512 Ramps/South Meridian	Northbound	L	170	152	227
32	Westbound SR 512 Ramps/South Meridian	Northbound	T	467	240	641
32	Westbound SR 512 Ramps/South Meridian	Southbound	T	741	178	341
32	Westbound SR 512 Ramps/South Meridian	Southbound	R	50	63	91
32	Westbound SR 512 Ramps/South Meridian	Westbound	LT	1218	1267	385
32	Westbound SR 512 Ramps/South Meridian	Westbound	R	320	372	41

ID	Intersection	Approach	Lane Group	Vehicle Storage (ft)	95th % Queue Length (ft) AM Peak Hour	95th % Queue Length (ft) PM Peak Hour
33	Summit Country Center (110th)/ Canyon Road E	Northbound	L	120	99	88
33	Summit Country Center (110th)/ Canyon Road E	Northbound	T	479	634	501
33	Summit Country Center (110th)/ Canyon Road E	Northbound	TR	479	611	551
33	Summit Country Center (110th)/ Canyon Road E	Eastbound	LT	328	129	342
33	Summit Country Center (110th)/ Canyon Road E	Eastbound	R	328	48	208
33	Summit Country Center (110th)/ Canyon Road E	Southbound	L	270	75	179
33	Summit Country Center (110th)/ Canyon Road E	Southbound	T	439	179	471
33	Summit Country Center (110th)/ Canyon Road E	Southbound	TR	439	206	470
33	Summit Country Center (110th)/ Canyon Road E	Westbound	LT	352	11	67
33	Summit Country Center (110th)/ Canyon Road E	Westbound	R	50	39	64
34	South Hill Park and Ride/94th Avenue E	Northbound	LT	262	296	364
34	South Hill Park and Ride/94th Avenue E	Northbound	T	262	262	35
34	South Hill Park and Ride/94th Avenue E	Eastbound	LR	287	37	58
34	South Hill Park and Ride/94th Avenue E	Southbound	T	136	129	115
34	South Hill Park and Ride/94th Avenue E	Southbound	TR	136	66	114
35	31st Avenue SW/ South Hill Park and Ride	Eastbound	TR	388	511	16
35	31st Avenue SW/ South Hill Park and Ride	Westbound	L	120	20	18
36	31st Avenue SW/South Hill Park Drive	Northbound	LTR	319	423	97

ID	Intersection	Approach	Lane Group	Vehicle Storage (ft)	95th % Queue Length (ft) AM Peak Hour	95th % Queue Length (ft) PM Peak Hour
36	31st Avenue SW/South Hill Park Drive	Eastbound	L	180	84	37
36	31st Avenue SW/South Hill Park Drive	Eastbound	T	662	919	130
36	31st Avenue SW/South Hill Park Drive	Eastbound	R	300	84	5
36	31st Avenue SW/South Hill Park Drive	Southbound	LTR	119	52	94
36	31st Avenue SW/South Hill Park Drive	Southbound	L	140	72	173
36	31st Avenue SW/South Hill Park Drive	Westbound	T	572	458	768
36	31st Avenue SW/South Hill Park Drive	Westbound	R	140	24	42
37	15th Avenue SW/South Meridian	Northbound	L	250	281	182
37	15th Avenue SW/South Meridian	Northbound	T	401	501	342
37	15th Avenue SW/South Meridian	Northbound	TR	401	511	353
37	15th Avenue SW/South Meridian	Eastbound	L	200	269	226
37	15th Avenue SW/South Meridian	Eastbound	TR	434	579	327
37	15th Avenue SW/South Meridian	Southbound	L	200	247	236
37	15th Avenue SW/South Meridian	Southbound	T	563	270	496
37	15th Avenue SW/South Meridian	Southbound	TR	563	225	515
37	15th Avenue SW/South Meridian	Westbound	L	180	122	171
37	15th Avenue SW/South Meridian	Westbound	T	434	131	259
37	15th Avenue SW/South Meridian	Westbound	R	150	123	184

Appendix F Cell Phone Data

1.0 Freeway Origins and Destinations – General Traffic

Figure F-1. SR 512 Between I-5 and Steele Street S, AM Peak Period

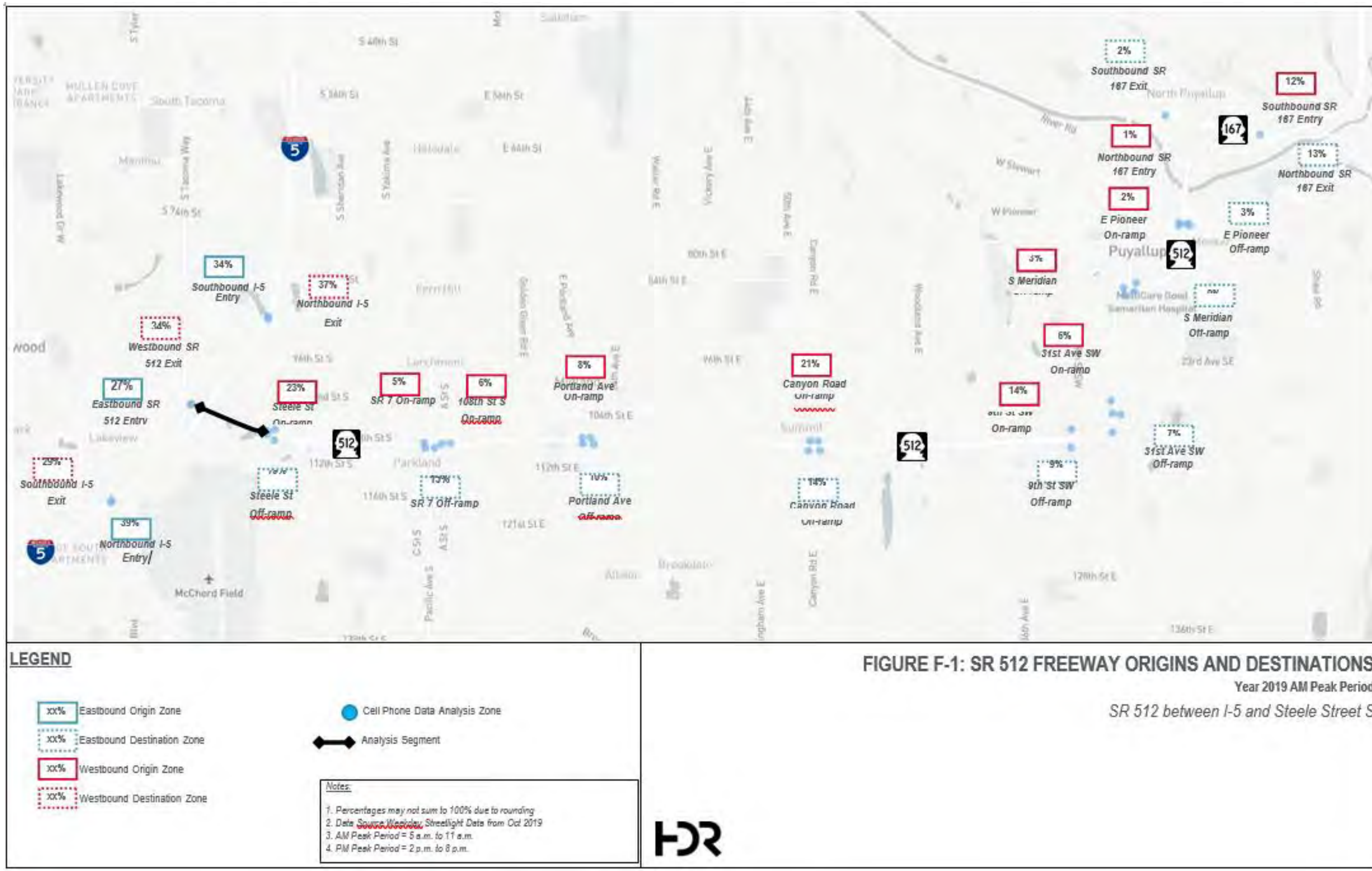


Figure F-2. SR 512 Between I-5 and Steele Street S, PM Peak Period

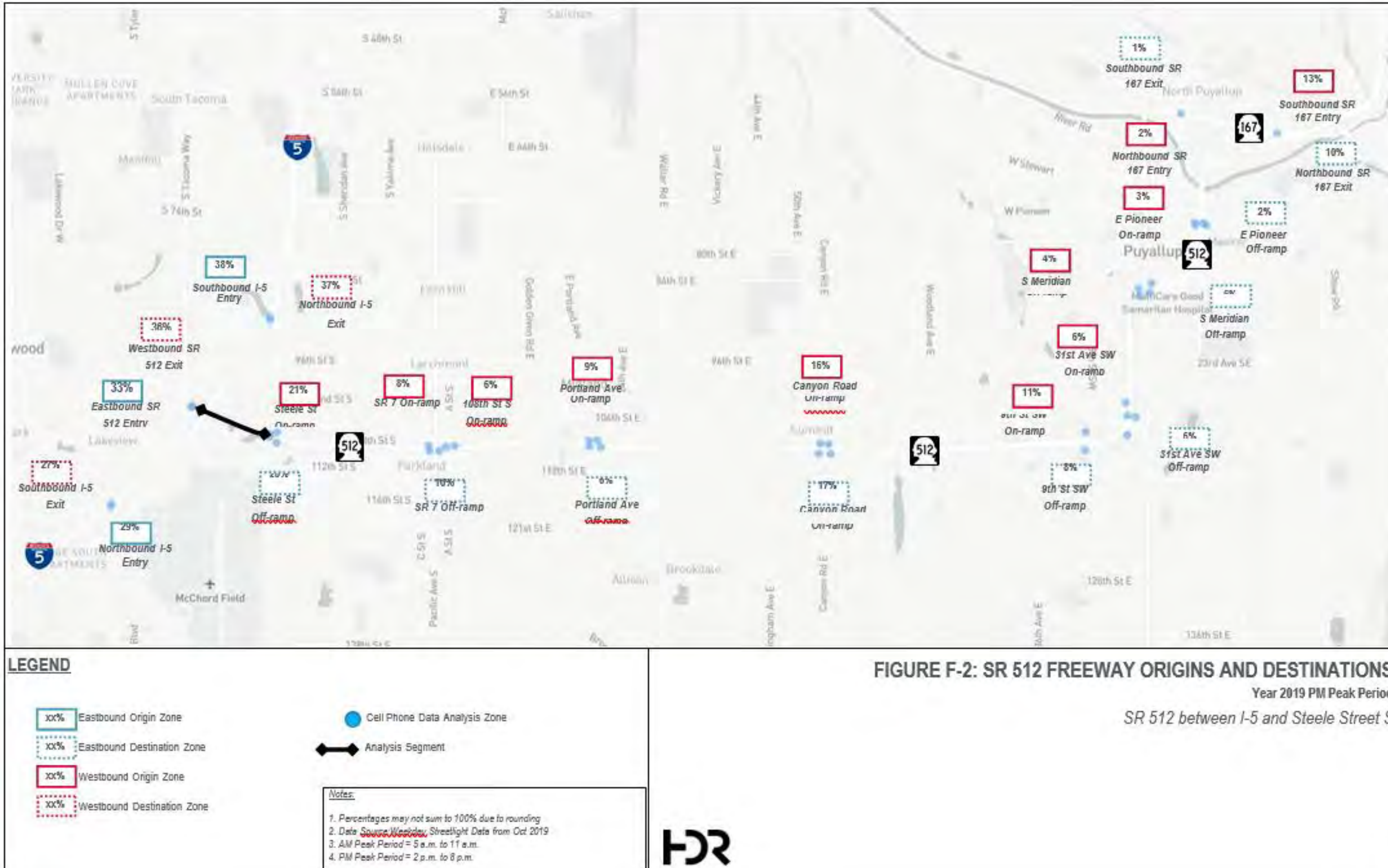


Figure F-3. SR 512 Between I-5 and Steele Street S, Daily

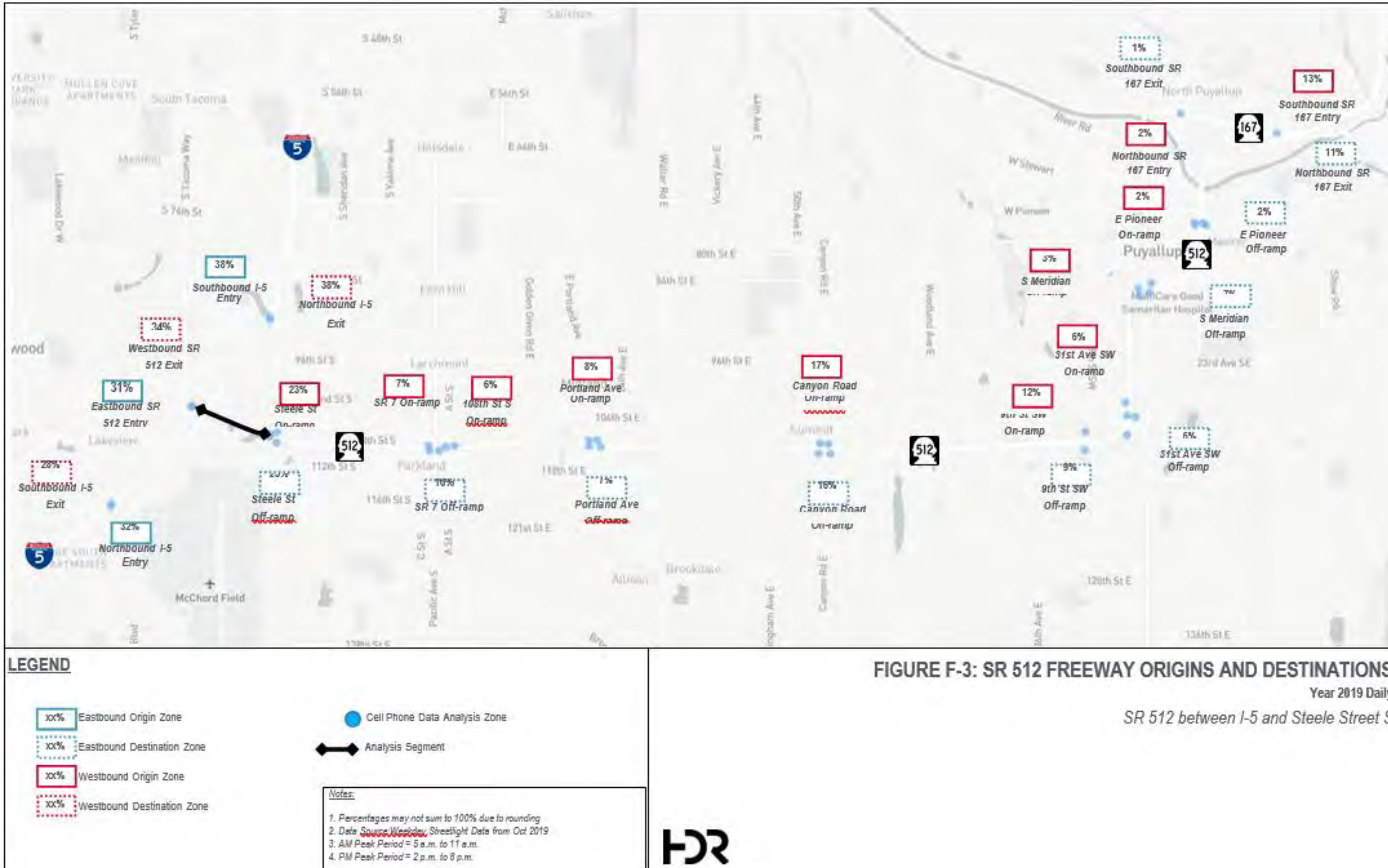


Figure F-4. SR 512 Between Portland Ave E and Canyon Road E, AM Peak Period

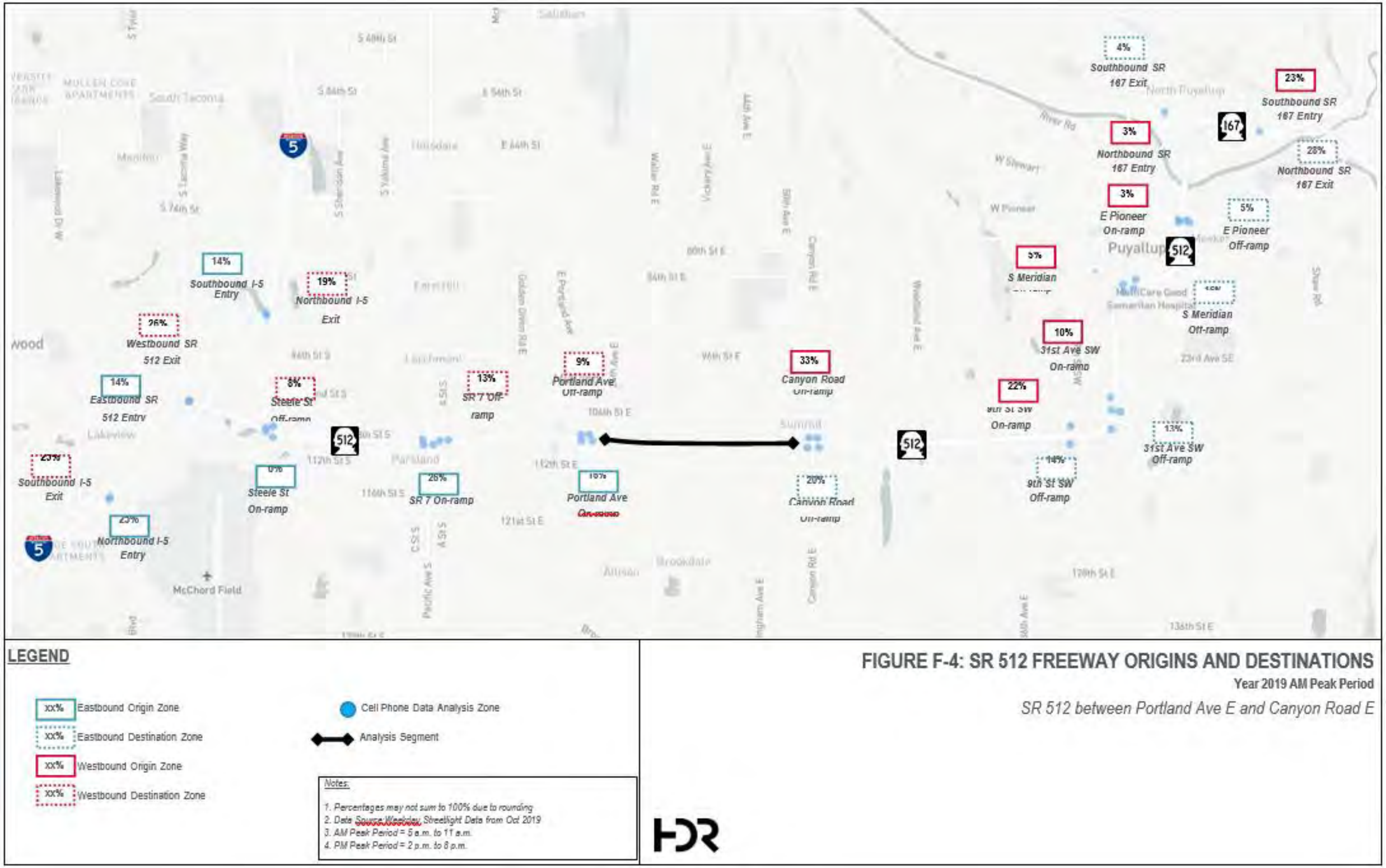


Figure F-5. SR 512 Between Portland Ave E and Canyon Road E, PM Peak Period

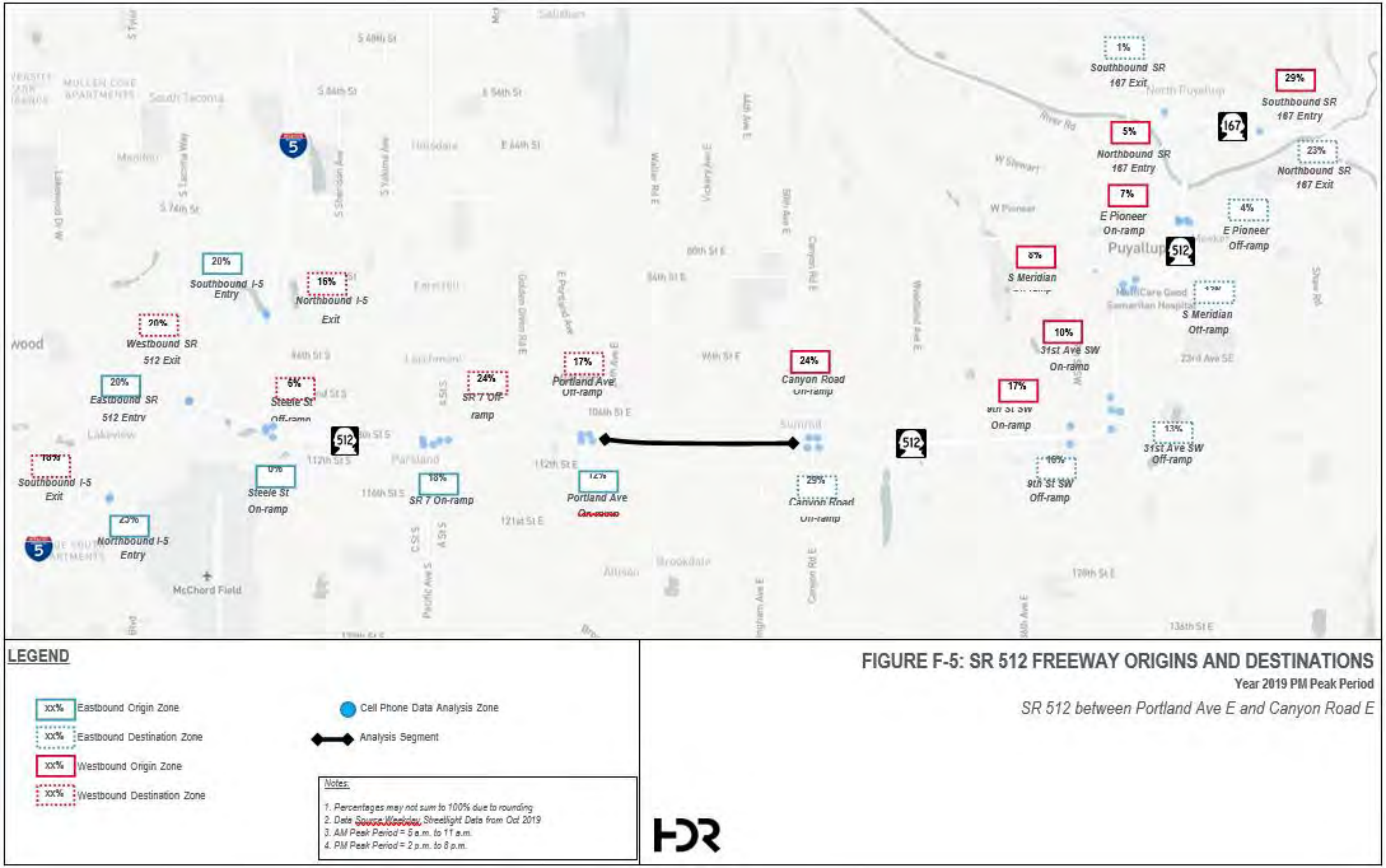


Figure F-6. SR 512 Between Portland Ave E and Canyon Road E, Daily

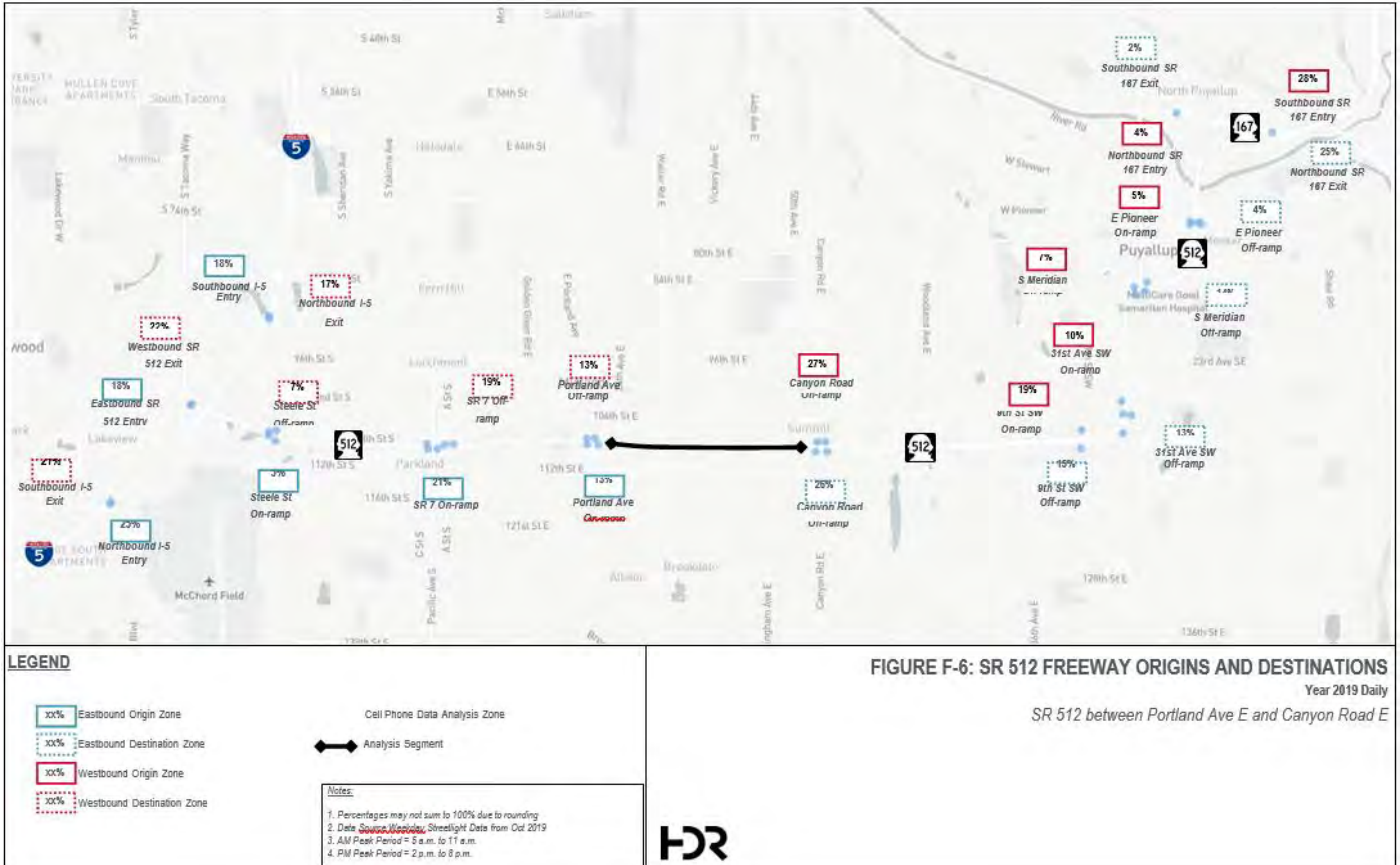


Figure F-7. SR 512 Between SR 167 and E Pioneer, AM Peak Period

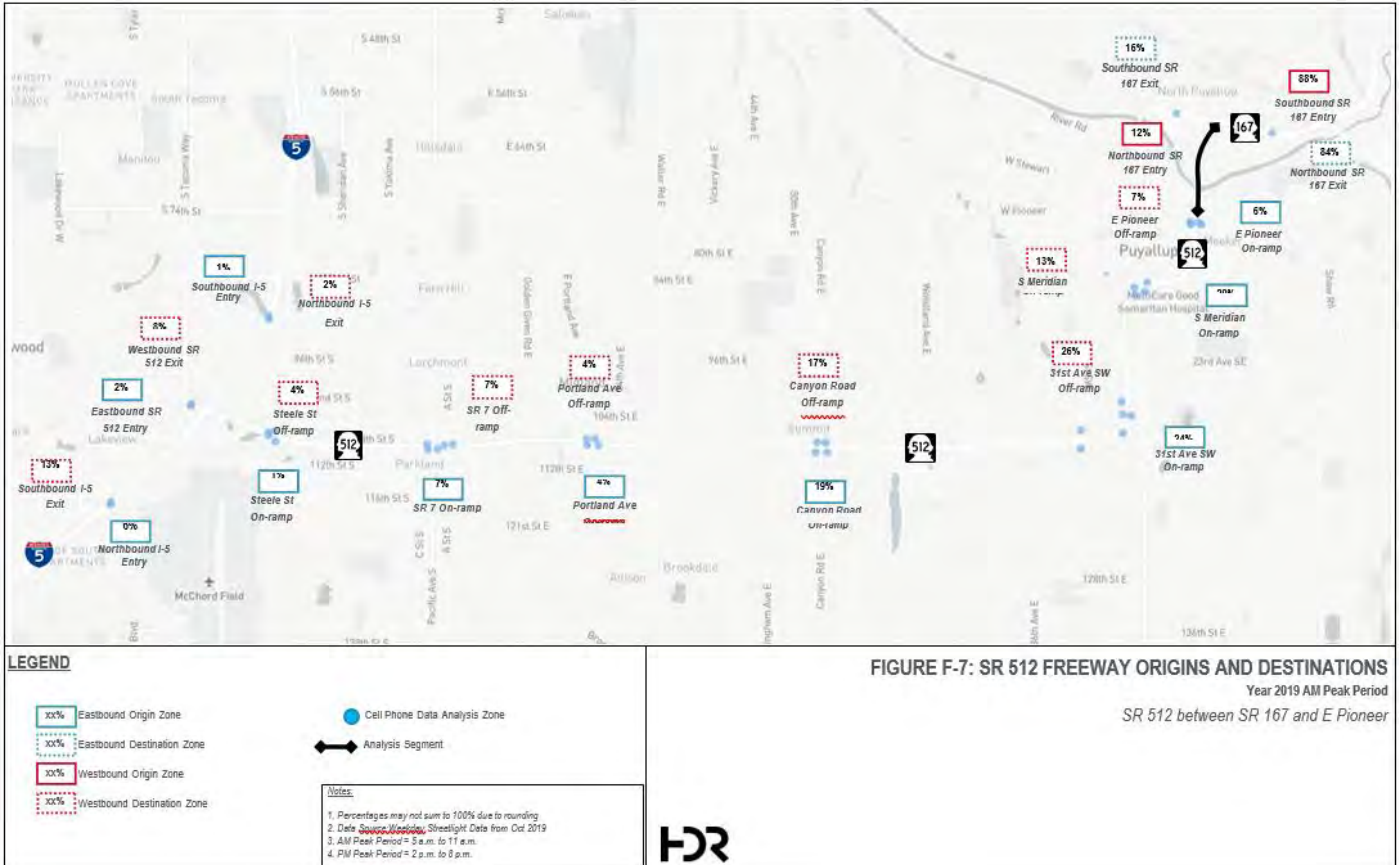


Figure F-8. SR 512 Between SR 167 and E Pioneer, PM Peak Period

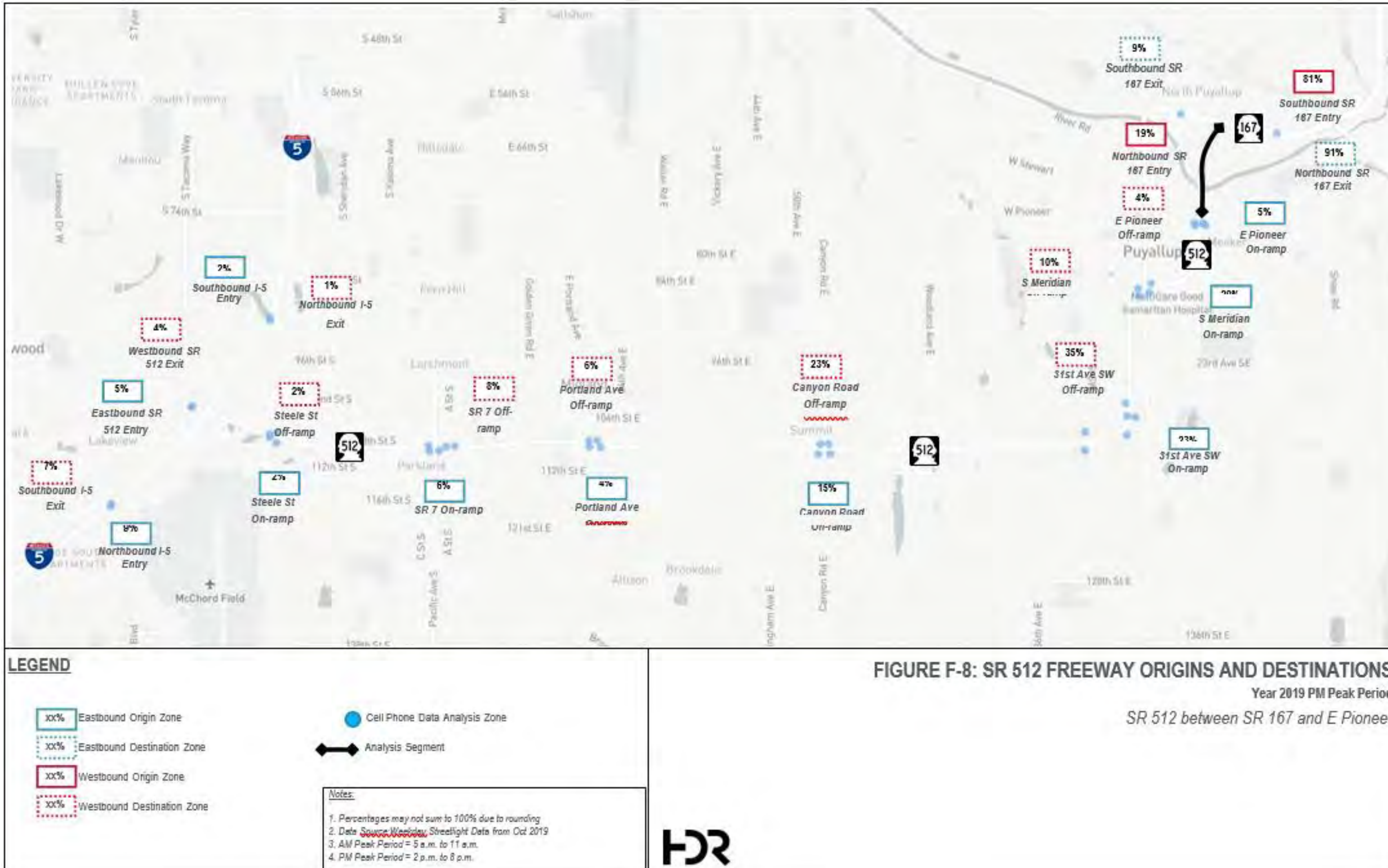
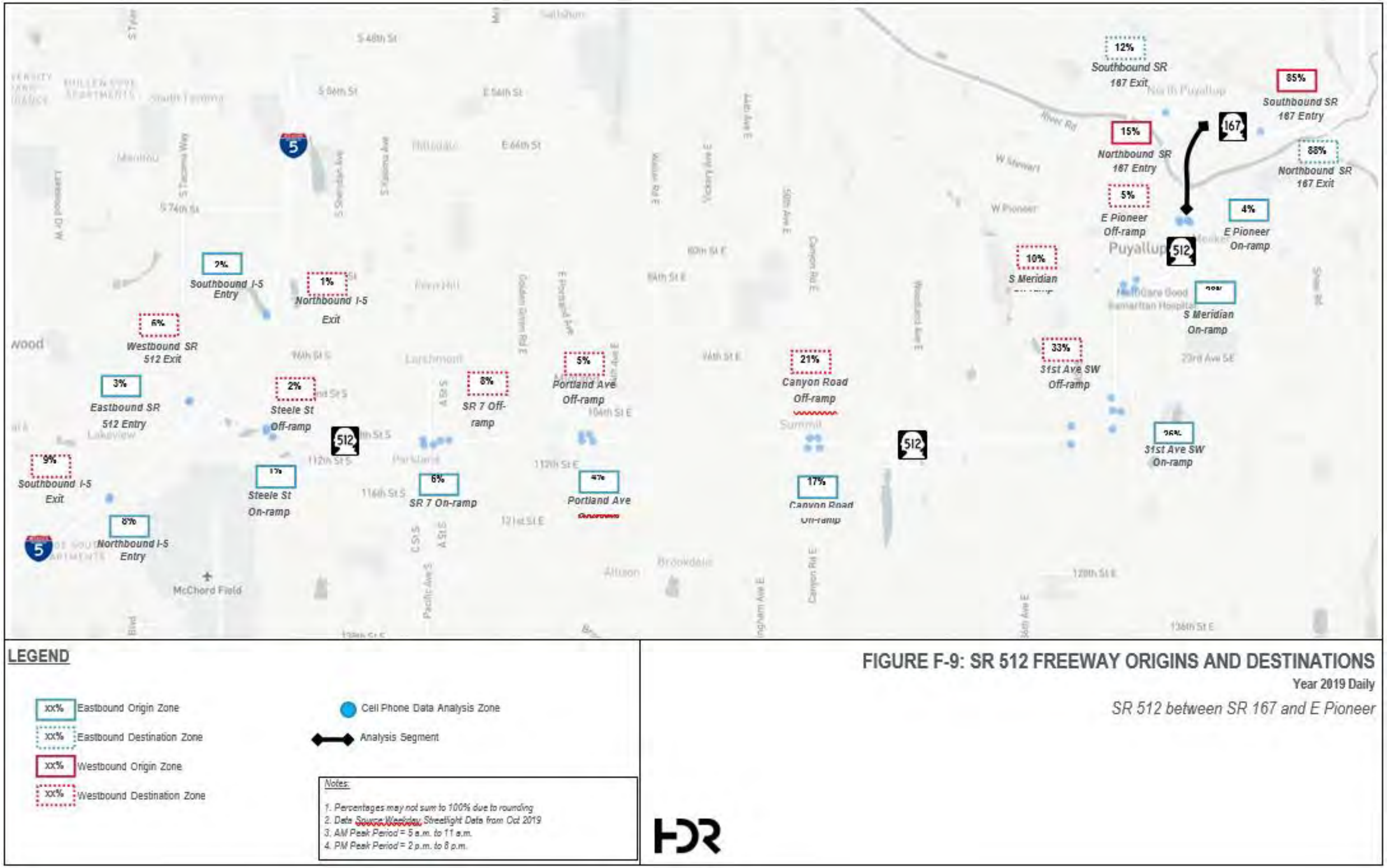


Figure F-9. SR 512 Between SR 167 and E Pioneer, Daily



2.0 Freeway Origins and Destinations - Trucks

Figure F-10. SR 512 Between I-5 and Steele Street S, AM Peak Period (Trucks)

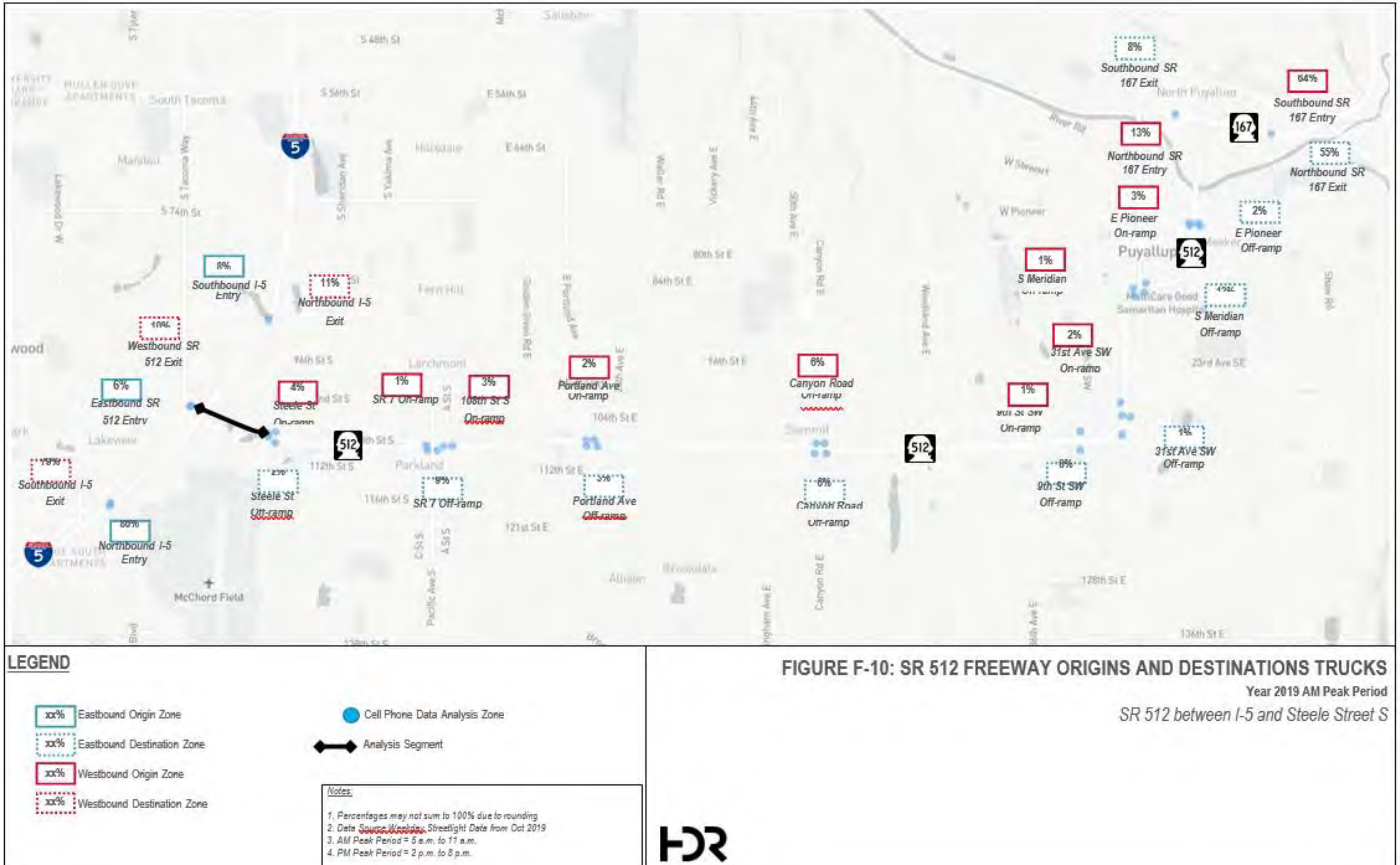


Figure F-11. SR 512 Between I-5 and Steele Street S, PM Peak Period (Trucks)

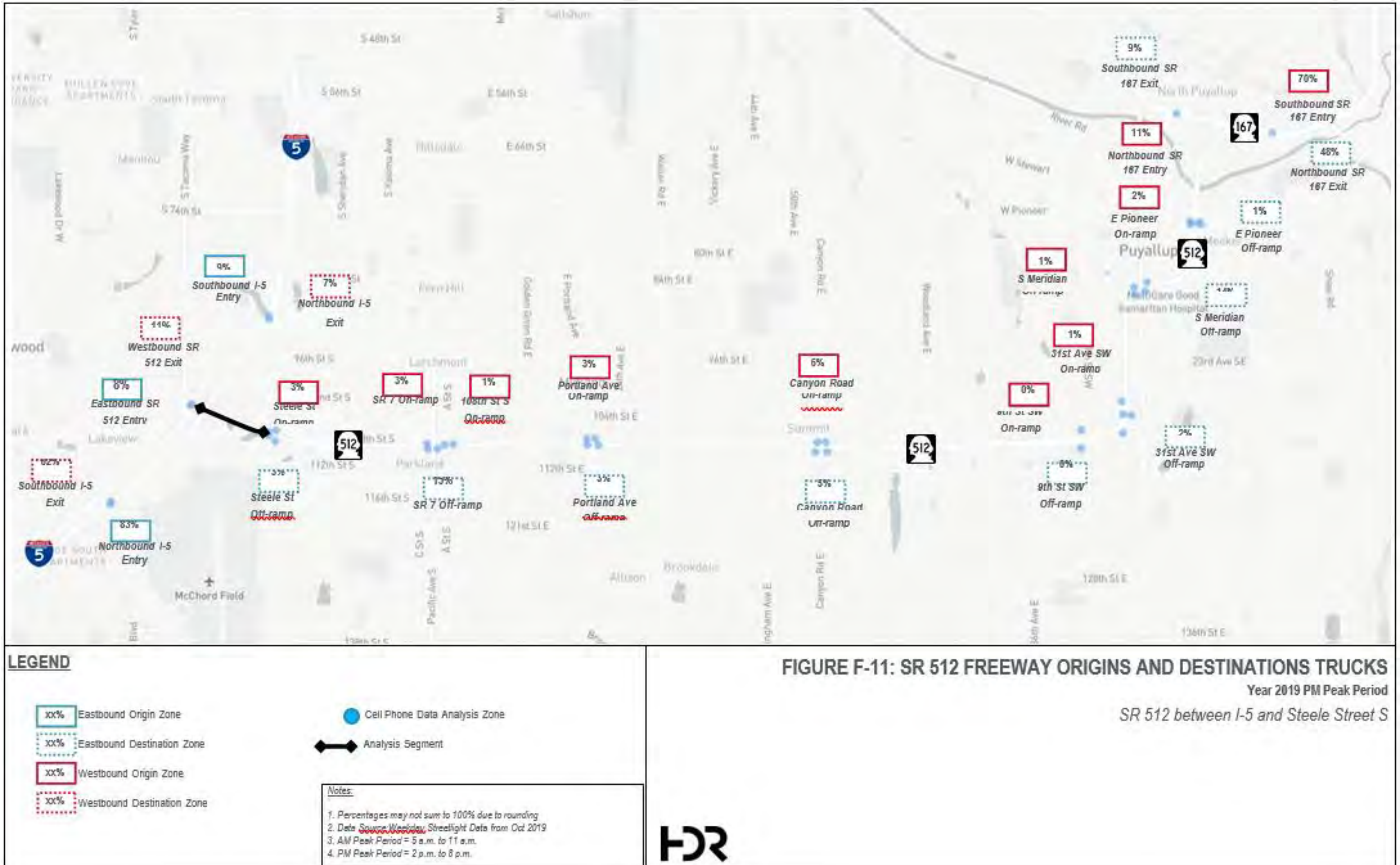


Figure F-12. SR 512 Between I-5 and Steele Street S, Daily (Trucks)

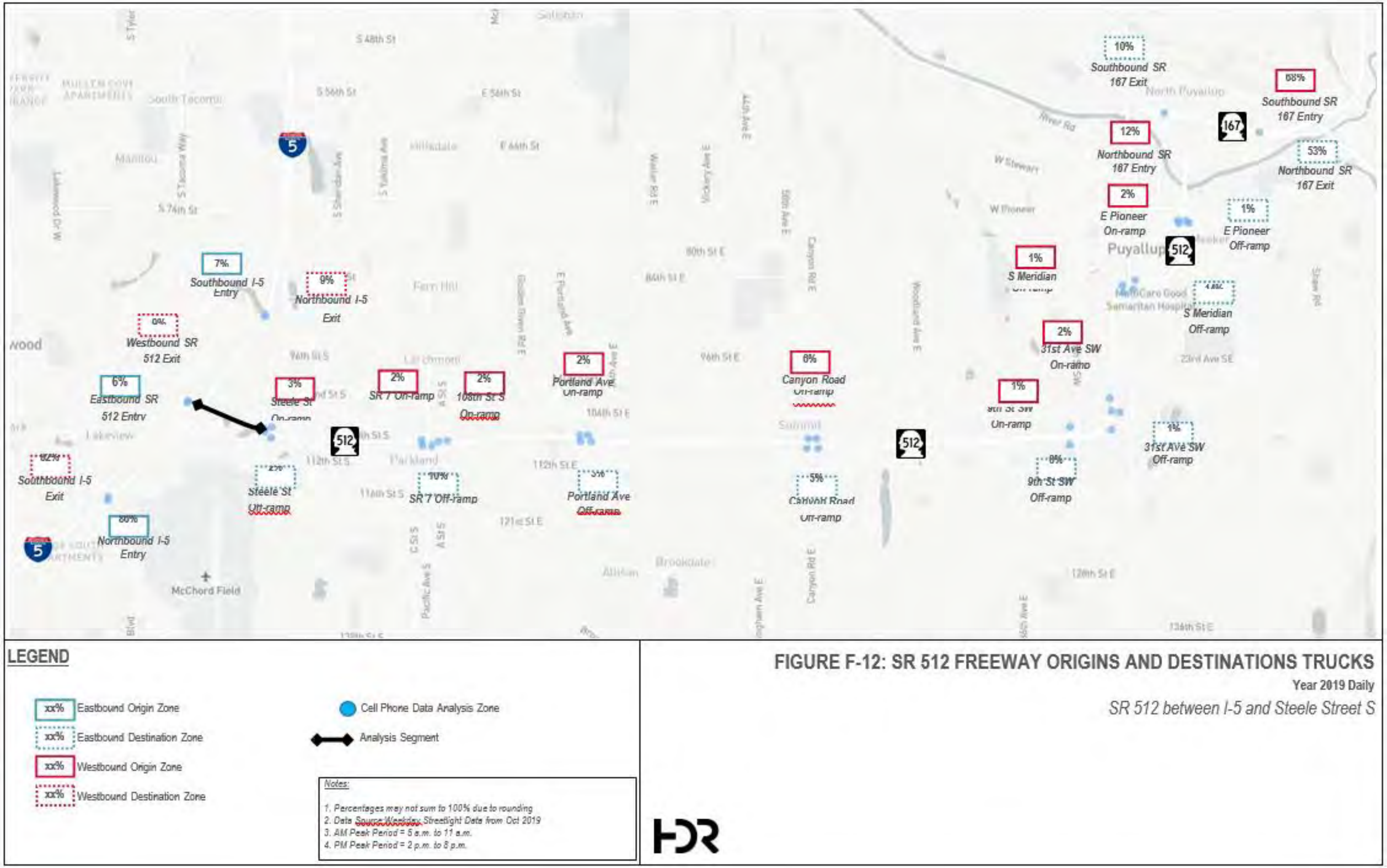


Figure F-13. SR 512 Between Portland Ave E and Canyon Road E, AM Peak Period (Trucks)

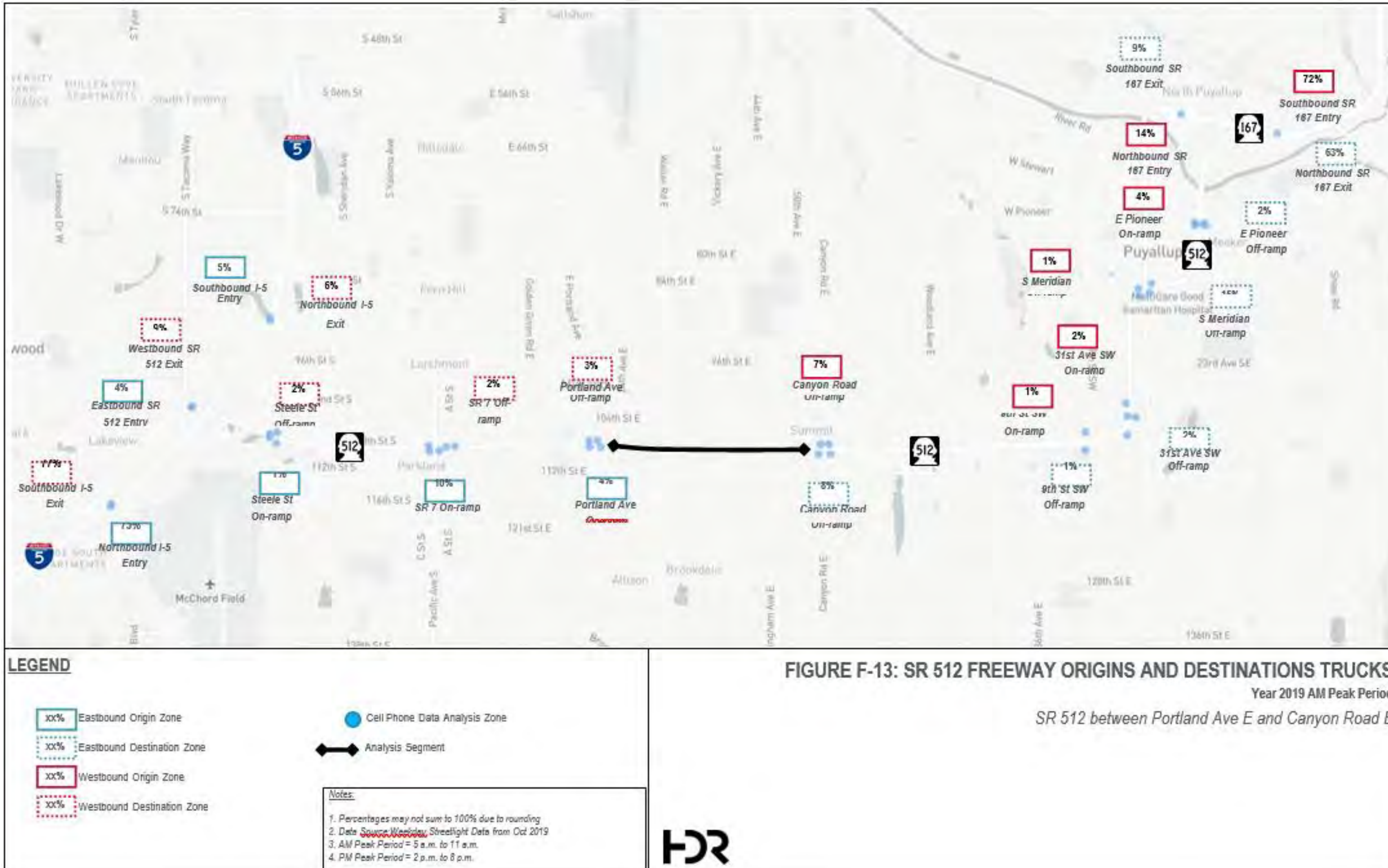


Figure F-14. SR 512 Between Portland Ave E and Canyon Road E, PM Peak Period (Trucks)

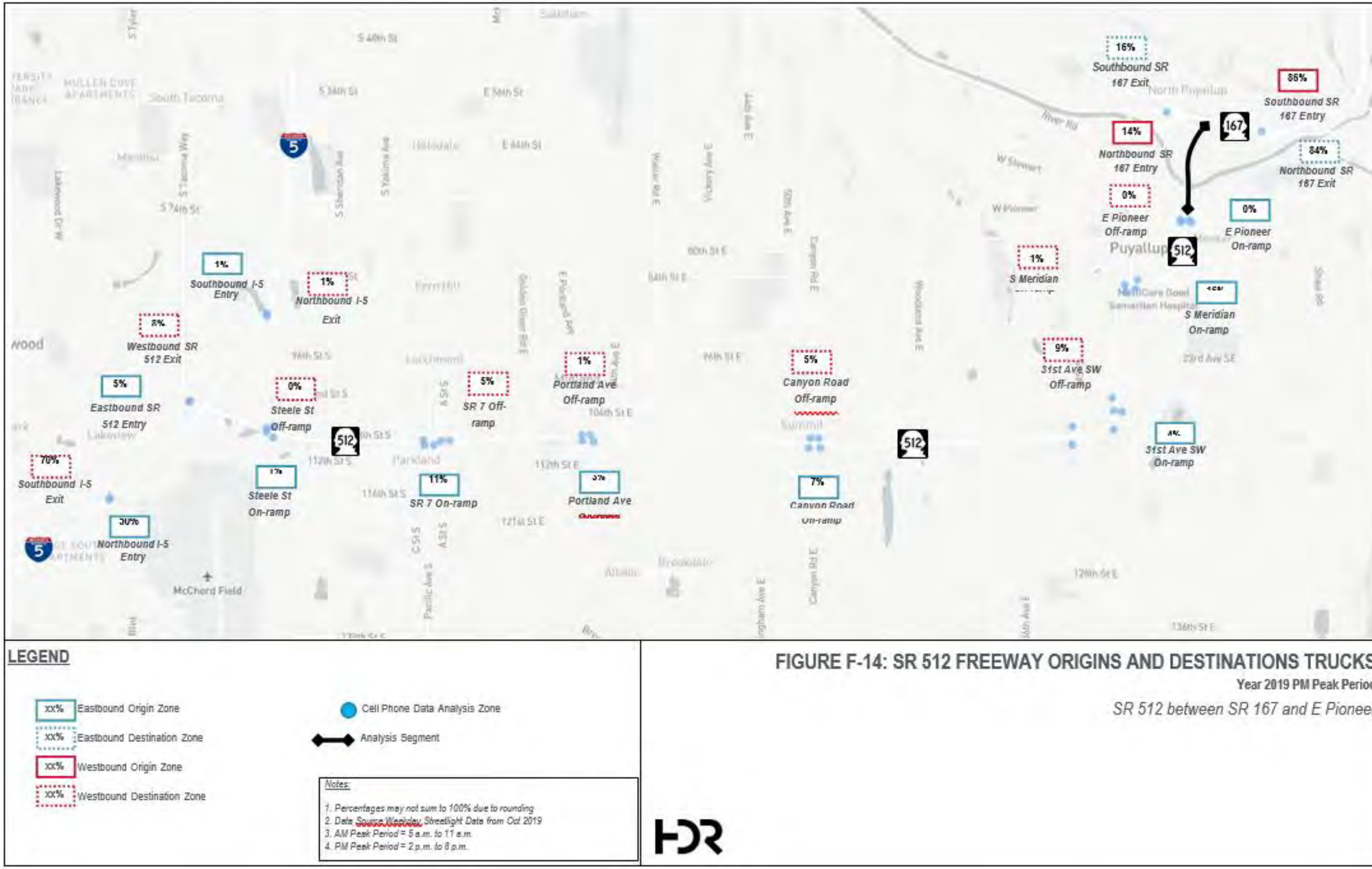


Figure F-15. SR 512 Between Portland Ave E and Canyon Road E, Daily (Trucks)

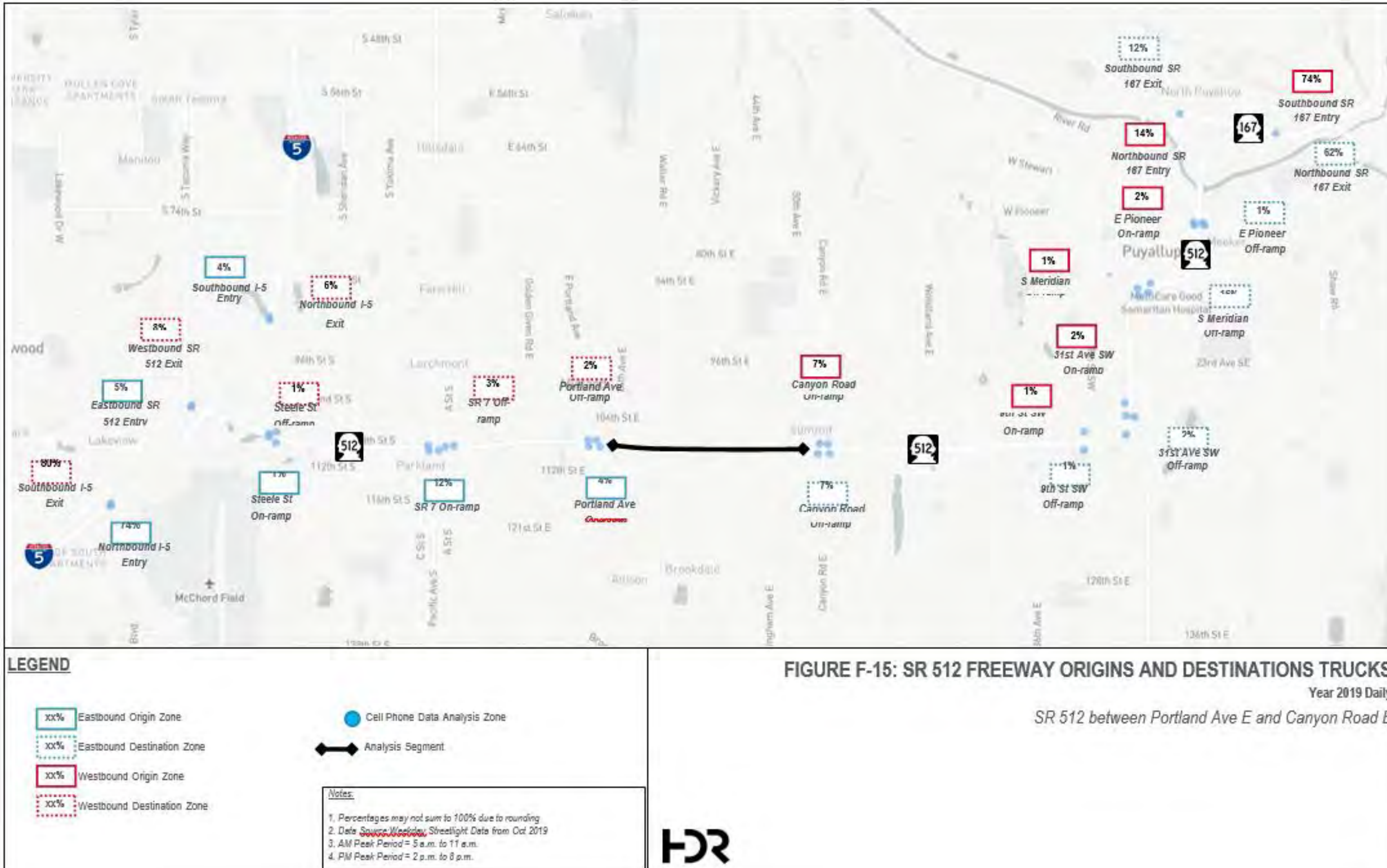


Figure F-16. SR 512 Between SR 167 and E Pioneer, AM Peak Period (Trucks)

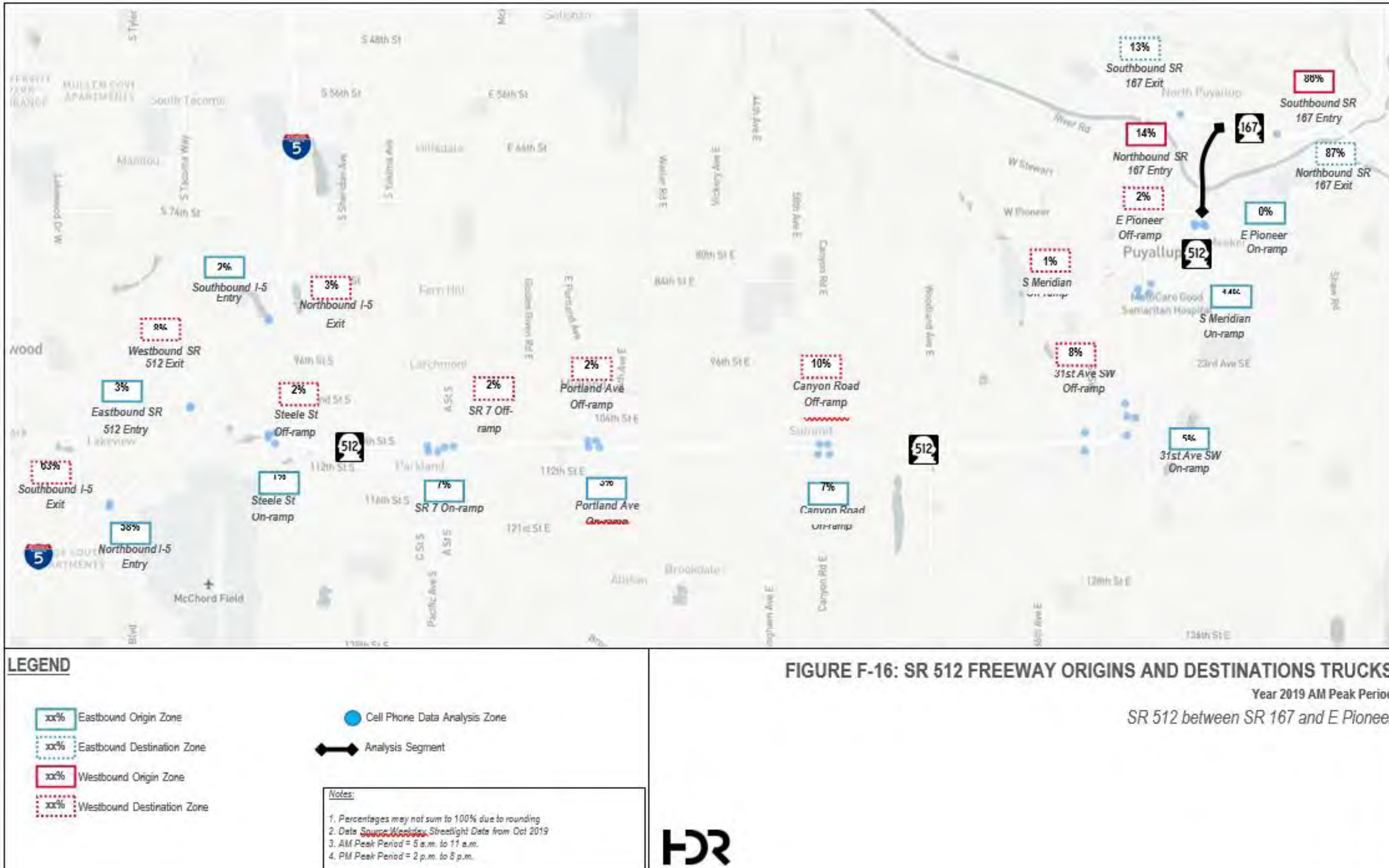


Figure F- 17. SR 512 Between SR 167 and E Pioneer, PM Peak Period (Trucks)

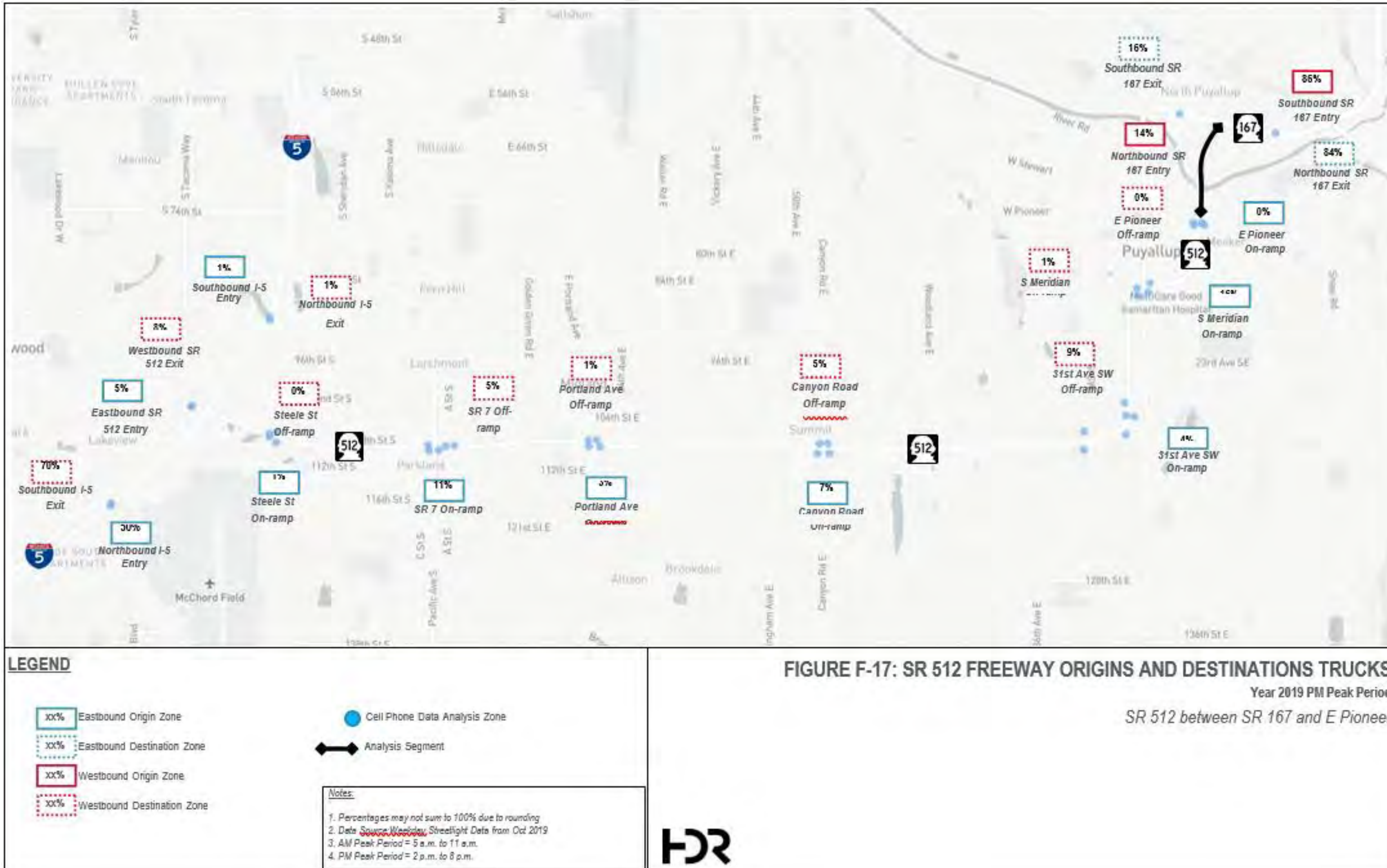
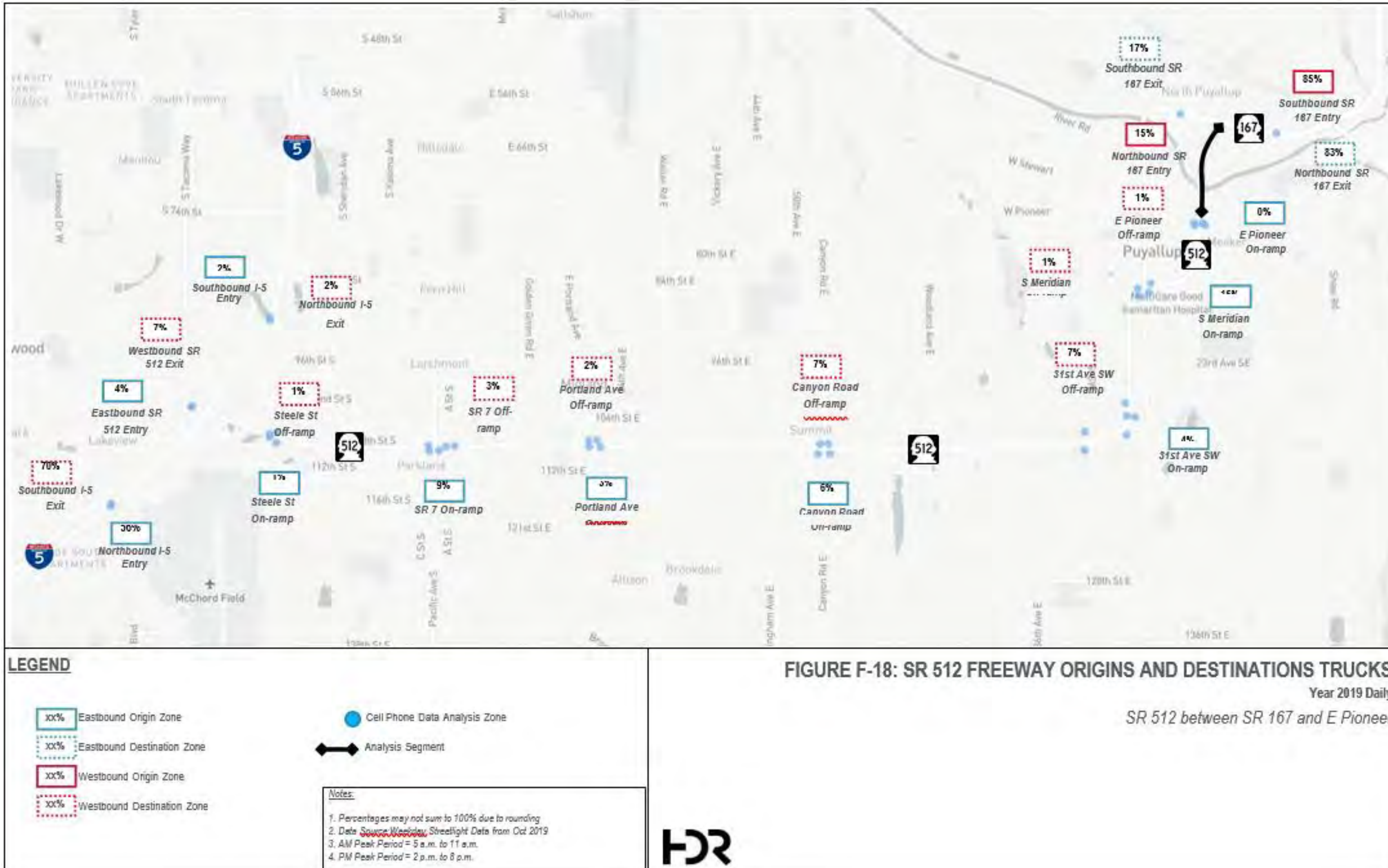


Figure F- 18. SR 512 Between SR 167 and E Pioneer, Daily (Trucks)



3.0 October 2019 Regional Travel Patterns

All Vehicles

Table F-1. Percent of Total - SR 512 as Origin

	Weekday Daily	Weekday AM Peak (5 a.m. to 11 a.m.)	Weekday Mid Peak (11 a.m. to 2 p.m.)	Weekday PM Peak (2 p.m. to 8 p.m.)
SR 512 to SR 512	53%	48%	54%	59%
SR 512 to I-5	16%	18%	16%	14%
SR 512 to SR 167	27%	30%	26%	24%
SR 512 to RTB	3%	3%	3%	2%
SR 512 to BTL	1%	1%	1%	1%

Table F-2. Percent of Total - SR 512 as Destination

	Weekday Daily	Weekday AM Peak (5 a.m. to 11 a.m.)	Weekday Mid Peak (11 a.m. to 2 p.m.)	Weekday PM Peak (2 p.m. to 8 p.m.)
SR 512 to SR 512	53%	59%	52%	50%
SR 512 to I-5	20%	18%	20%	21%
SR 512 to SR 167	24%	20%	23%	26%
SR 512 to RTB	3%	2%	3%	3%
SR 512 to BTL	1%	1%	1%	1%

Table F-3. Trip Type - Total Trips

Trip Type	Weekday Daily	Weekday AM Peak (5 a.m. to 11 a.m.)	Weekday Mid Peak (11 a.m. to 2 p.m.)	Weekday PM Peak (2 p.m. to 8 p.m.)
Internal-Internal	175,888	52,953	30,015	67,435
External-Internal	158,236	37,394	27,605	68,005
Internal-External	156,856	57,095	25,182	47,168
External-External	99,082	34,547	17,915	29,681

Table F-4. Trip Type - Percent of Total

Trip Type	Weekday Daily	Weekday AM Peak (5 a.m. to 11 a.m.)	Weekday Mid Peak (11 a.m. to 2 p.m.)	Weekday PM Peak (2 p.m. to 8 p.m.)
Internal-Internal	30%	29%	30%	32%
External-Internal	27%	21%	27%	32%
Internal-External	27%	31%	25%	22%
External-External	17%	19%	18%	14%

Trucks

Table F-5. Percent of Total - SR 512 as Origin (Trucks)

	Weekday Daily	Weekday AM Peak (5 a.m. to 11 a.m.)	Weekday Mid Peak (11 a.m. to 2 p.m.)	Weekday PM Peak (2 p.m. to 8 p.m.)
SR 512 to SR 512	35%	34%	35%	41%
SR 512 to I-5	18%	19%	20%	18%
SR 512 to SR 167	40%	40%	41%	37%
SR 512 to RTB	4%	3%	2%	3%
SR 512 to BTL	3%	3%	2%	2%

Table F-6. Percent of Total - SR 512 as Destination (Trucks)

	Weekday Daily	Weekday AM Peak (5 a.m. to 11 a.m.)	Weekday Mid Peak (11 a.m. to 2 p.m.)	Weekday PM Peak (2 p.m. to 8 p.m.)
SR 512 to SR 512	36%	39%	33%	33%
SR 512 to I-5	35%	34%	33%	33%
SR 512 to SR 167	23%	22%	24%	26%
SR 512 to RTB	4%	3%	5%	5%
SR 512 to BTL	3%	2%	4%	3%

Table F-7. Trip Type - Total Trips (Trucks)

Trip Type	Weekday Daily	Weekday AM Peak (5 a.m. to 11 a.m.)	Weekday Mid Peak (11 a.m. to 2 p.m.)	Weekday PM Peak (2 p.m. to 8 p.m.)
Internal-Internal	159,539	64,139	29,887	39,746
External-Internal	287,900	99,772	60,675	79,982
Internal-External	297,114	125,780	54,391	58,075
External-External	877,646	310,195	157,838	128,334

Table F-8. Percent of Total (Trucks)

Trip Type	Weekday Daily	Weekday AM Peak (5 a.m. to 11 a.m.)	Weekday Mid Peak (11 a.m. to 2 p.m.)	Weekday PM Peak (2 p.m. to 8 p.m.)
Internal-Internal	10%	11%	10%	13%
External-Internal	18%	17%	20%	26%
Internal-External	18%	21%	18%	19%
External-External	54%	52%	52%	42%

Appendix G Crash Analysis

Under 23 U.S. Code § 148 and 23 U.S. Code § 407, safety data, reports, surveys, schedules, and lists compiled or collected for the purpose of identifying, evaluating, or planning the safety enhancement of potential crash sites, hazardous roadway conditions, or railway-highway crossings are not subject to discovery or admitted into evidence in a Federal or State court proceeding or considered for other purposes in any action for damages arising from any occurrence at a location mentioned or addressed in such reports, surveys, schedules, lists, or data.

2.0 2015-2019

Table G-1. Crash Type by Location (2015-2019)

Crash Type	Mainline	Ramp	Local/Cross	Intersection	Total
Rear-end	1,201	177	210	724	2,312
Sideswipe	313	60	67	102	542
Fixed-object	412	137	27	68	644
Angled/Sideswipe	65	20	14	658	757
Other	129	94	13	62	298
N/A	1	1	0	0	2
Grand Total					4555

Table G-2. Crash Severity by Location (2015-2019)

Severity	Mainline	Ramp	Local/Cross	Intersection	Total
Fatal	6	0	0	2	8
Serious Injury	25	5	2	17	49
Evident Injury	84	19	15	85	203
Possible Injury	426	68	65	352	911
PDO	1,564	385	247	1,142	3,338
Unknown	16	12	2	16	46
Grand Total					4,555

Table G-3. Crash Location by Year

Year	Mainline	Ramp	Local/Cross	Intersection	Average	Total
2015	392	87	51	344	218.5	874
2016	426	107	63	346	235.5	942
2017	456	103	71	332	240.5	962
2018	447	99	76	303	231.25	925
2019	400	93	70	289	213	852
Average	424.2	97.8	66.2	322.8		
Total	2121	489	331	1614		

Mainline

Table G-4. Mainline Crash Type by Severity, Peak (2015-2019)

Crash Type	Fatal	Serious Injury	Evident Injury	Possible Injury	PDO	Unknown
Rear-end	1	0	27	176	558	0
Sideswipe	0	0	1	16	127	0
Fixed-object	0	1	2	18	77	3
Angled/Sideswipe	0	0	1	7	12	0
Other	0	1	4	3	18	0
N/A	0	0	0	0	1	0

Table G-5. Mainline Crash Type by Severity, Off-Peak (2015-2019)

Crash Type	Fatal	Serious Injury	Evident Injury	Possible Injury	PDO	Unknown
Rear-end	1	6	15	126	291	0
Sideswipe	0	2	5	14	148	0
Fixed-object	0	7	20	39	235	10
Angled/Sideswipe	1	2	2	10	30	0
Other	3	6	7	17	67	3
N/A	0	0	0	0	0	0

Table G-6. Mainline Crash Type by Direction, Peak, Off-Peak (2015-2019)

Crash Type	Eastbound Peak	Eastbound Off-Peak	Westbound Peak	Westbound Off-Peak
Rear-end	379	149	383	290
Sideswipe	66	71	78	98
Fixed-object	53	157	48	154
Angled/Sideswipe	8	24	12	21
Other	17	47	9	56
N/A	0	0	1	0
Total	523	448	531	619

Ramp

Table G-7. Ramp Crash Type by Severity, Peak (2015-2019)

Crash Type	Fatal	Serious Injury	Evident Injury	Possible Injury	PDO	Unknown
Rear-end	0	0	2	15	78	0
Sideswipe	0	0	0	2	23	0
Fixed-object	0	0	1	1	12	2
Angled/Sideswipe	0	0	0	2	7	0
Other	0	0	1	0	11	1
N/A	0	0	0	0	1	0

Table G-8. Ramp Crash Type by Severity, Off-Peak (2015-2019)

Crash Type	Fatal	Serious Injury	Evident Injury	Possible Injury	PDO	Unknown
Rear-end	0	1	1	24	56	0
Sideswipe	0	0	0	1	34	0
Fixed-object	0	1	6	7	100	5
Angled/Sideswipe	0	0	0	2	9	0
Other	0	3	8	12	54	4
N/A	0	0	0	0	0	0

Table G-9. Ramp Crash Type, Peak, Off-Peak (2015-2019)

Crash Type	Peak	Off-Peak
Rear-end	95	82
Sideswipe	25	35
Fixed-object	16	121
Angled/Sideswipe	9	11
Other	13	81
N/A	1	0

Cross

Table G-10. Cross Crash Type by Severity, Peak (2015-2019)

Crash Type	Fatal	Serious Injury	Evident Injury	Possible Injury	PDO	Unknown
Rear-end	0	0	3	32	86	0
Sideswipe	0	0	2	1	26	0
Fixed-object	0	0	0	1	4	0
Angled/Sideswipe	0	0	2	0	3	0
Other	0	0	0	0	3	1
N/A	0	0	0	0	0	0

Table G-11. Cross Crash Type by Severity, Off-Peak (2015-2019)

Crash Type	Fatal	Serious Injury	Evident Injury	Possible Injury	PDO	Unknown
Rear-end	0	1	5	22	61	0
Sideswipe	0	0	0	4	34	0
Fixed-object	0	1	1	4	15	1
Angled/Sideswipe	0	0	2	0	7	0
Other	0	0	0	1	8	0
N/A	0	0	0	0	0	0

Table G-12. Cross Crash Type, Peak, Off-Peak (2015-2019)

Crash Type	Peak	Off-Peak
Rear-end	121	89
Sideswipe	29	38
Fixed-object	5	22
Angled/Sideswipe	5	9
Other	4	9
N/A	0	0

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Intersection

Table G-13. Intersection Crash Type by Severity, Peak (2015-2019)

Crash Type	Fatal	Serious Injury	Evident Injury	Possible Injury	PDO	Unknown
Rear-end	0	0	11	58	197	1
Sideswipe	0	0	2	3	46	0
Fixed-object	0	0	0	1	12	0
Angled/Sideswipe	0	1	12	43	128	2
Other	0	0	2	7	6	0
N/A	0	0	0	0	0	0

Table G-14. Intersection Crash Type by Severity, Off-Peak (2015-2019)

Crash Type	Fatal	Serious Injury	Evident Injury	Possible Injury	PDO	Unknown
Rear-end	1	4	16	127	307	2
Sideswipe	0	0	0	5	44	2
Fixed-object	0	1	5	8	39	2
Angled/Sideswipe	1	9	23	87	346	6
Other	0	2	14	13	17	1
N/A	0	0	0	0	0	0

Table G-15. Intersection Crash Type, Peak, Off-Peak (2015-2019)

Crash Type	Peak	Off-Peak
Rear-end	267	457
Sideswipe	51	51
Fixed-object	12	55
Angled/Sideswipe	186	472
Other	15	47
N/A	0	0

Peak Totals

Table G-16. Peak Totals Crash Type by Severity, Peak (2015-2019)

Crash Type	Fatal	Serious Injury	Evident Injury	Possible Injury	PDO	Unknown
Rear-end	1	0	43	281	919	1
Sideswipe	0	0	5	22	222	0
Fixed-object	0	1	3	21	105	5
Angled/Sideswipe	0	1	15	52	150	2
Other	0	1	7	10	38	2
N/A	0	0	0	0	2	0

Table G-17. Peak Totals Crash Type by Severity, Off-Peak (2015-2019)

Crash Type	Fatal	Serious Injury	Evident Injury	Possible Injury	PDO	Unknown
Rear-end	2	12	37	299	715	2
Sideswipe	0	2	5	24	260	2
Fixed-object	0	10	32	60	389	18
Angled/Sideswipe	2	11	27	99	392	6
Other	3	11	29	43	146	8
N/A	0	0	0	0	0	0

Table G-18. Peak Totals Crash Type, Peak, Off-Peak (2015-2019)

Crash Type	Peak	Off-Peak
Rear-end	1,245	1,067
Sideswipe	249	293
Fixed-object	135	509
Angled/Sideswipe	220	537
Other	58	240
N/A	2	0

Contributing Factors

Table G-19. Contributing Factors Crash Type by Severity, Peak (2015-2019)

Factor	Fatal	Serious Injury	Evident Injury	Possible Injury	PDO	Unknown
Driver Distraction/Inattention	1	0	35	243	1,340	0
Disregard Traffic Controls	0	3	35	118	0	0
Under Influence of Alcohol/Drugs	0	0	3	24	89	10
Other/Unknown	0	0	0	1	7	0
Did Not Grant RW to Vehicle	0	0	0	0	0	0

Table G-20. Contributing Factors Crash Type by Severity, Off-Peak (2015-2019)

Factor	Fatal	Serious Injury	Evident Injury	Possible Injury	PDO	Unknown
Driver Distraction/Inattention	1	18	47	298	1,748	0
Disregard Traffic Controls	0	24	79	200	0	0
Under Influence of Alcohol/Drugs	0	3	4	25	141	36
Other/Unknown	5	1	0	2	13	0
Did Not Grant RW to Vehicle	1	0	0	0	0	0

Table G-21. Contributing Factors Crash Type, Peak, Off-Peak (2015-2019)

Factor	Peak	Off-Peak
Driver Distraction/Inattention	1,619	2,112
Disregard Traffic Controls	156	303
Under Influence of Alcohol/Drugs	126	209
Other/Unknown	8	21
Did Not Grant RW to Vehicle	0	1

Ped/Bike

Table G-22. Ped/Bike Crash Type by Severity, Peak (2015-2019)

Crash Type	Fatal	Serious Injury	Evident Injury	Possible Injury	PDO	Unknown
Pedestrian Crashes	0	0	2	5	0	0
Bicycle Crashes	0	0	0	2	0	0

Table G-23. Ped/Bike Crash Type by Severity, Off-Peak (2015-2019)

Crash Type	Fatal	Serious Injury	Evident Injury	Possible Injury	PDO	Unknown
Pedestrian Crashes	1	3	9	5	0	0
Bicycle Crashes	0	0	3	1	0	0

Table G- 24. Ped/Bike Crash Type by Severity, Total, Peak and Off-Peak (2015-2019)

Crash Type	Fatal	Serious Injury	Evident Injury	Possible Injury	PDO	Unknow n	Total
Pedestrian Crashes	1	3	11	10	0	0	25
Bicycle Crashes	0	0	3	3	0	0	6

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3.0 2020-2021

Table G-25. Crash Type by Location (2020-2021)

Crash Type	Mainline	Ramp	Local/Cross	Intersection
Rear-end	376	63	85	260
Sideswipe	160	20	25	37
Fixed-object	183	50	9	24
Angled/Sideswipe	31	6	6	247
Other	37	36	4	15
N/A	0	0	0	0
Grand Total				1,674

Table G-26. Crash Severity by Location (2020-2021)

Severity	Mainline	Ramp	Local/Cross	Intersection
Fatal	3	0	0	2
Serious Injury	11	1	1	8
Evident Injury	40	12	6	25
Possible Injury	100	19	20	91
PDO	628	139	100	451
Unknown	5	4	2	6
Grand Total				1,674

Mainline

Table G-27. Mainline Crash Type by Severity, Peak (2020-2021)

Crash Type	Fatal	Serious Injury	Evident Injury	Possible Injury	PDO	Unknown
Rear-end	0	1	10	43	188	0
Sideswipe	0	1	0	7	47	1
Fixed-object	0	0	4	2	25	0
Angled/Sideswipe	0	0	0	1	11	0
Other	0	0	1	0	7	0
N/A	0	0	0	0	0	0

Table G-28. Mainline Crash Type by Severity, Off-Peak (2020-2021)

Crash Type	Fatal	Serious Injury	Evident Injury	Possible Injury	PDO	Unknown
Rear-end	1	1	7	29	96	0
Sideswipe	0	2	2	7	93	0
Fixed-object	1	4	12	4	127	4
Angled/Sideswipe	0	2	2	5	10	0
Other	1	0	2	2	24	0
N/A	0	0	0	0	0	0

Table G-29. Mainline Crash Type by Direction, Peak, Off-Peak (2020-2021)

Crash Type	Eastbound Peak	Eastbound Off-Peak	Westbound Peak	Westbound Off-Peak
Rear-end	126	45	116	89
Sideswipe	24	54	32	50
Fixed-object	13	74	18	78
Angled/Sideswipe	5	9	7	10
Other	2	10	6	0
N/A	0	0	0	0
Total	44	147	63	157

Ramp

Table G-30. Ramp Crash Type by Severity, Peak (2020-2021)

Crash Type	Fatal	Serious Injury	Evident Injury	Possible Injury	PDO	Unknown
Rear-end	0	0	0	7	24	0
Sideswipe	0	0	0	0	9	0
Fixed-object	0	0	0	2	10	0
Angled/Sideswipe	0	0	1	0	1	0
Other	0	0	1	1	9	0
N/A	0	0	0	0	0	0

Table G-31. Ramp Crash Type by Severity, Off-Peak (2020-2021)

Crash Type	Fatal	Serious Injury	Evident Injury	Possible Injury	PDO	Unknown
Rear-end	0	1	2	2	27	0
Sideswipe	0	0	0	0	11	0
Fixed-object	0	0	6	0	29	3
Angled/Sideswipe	0	0	0	2	2	0
Other	0	0	2	5	17	1
N/A	0	0	0	0	0	0

Table G-32. Ramp Crash Type, Peak, Off-Peak (2020-2021)

Crash Type	Peak	Off-Peak
Rear End	31	32
Sideswipe	9	11
Fixed-object	12	38
Angled/Sideswipe	2	4
Other	11	25
N/A	0	0

Cross

Table G-33. Cross Crash Type by Severity, Peak (2020-2021)

Crash Type	Fatal	Serious Injury	Evident Injury	Possible Injury	PDO	Unknown
Rear-end	0	0	2	8	40	0
Sideswipe	0	1	0	0	11	0
Fixed-object	0	0	0	0	1	0
Angled/Sideswipe	0	0	0	0	3	0
Other	0	0	0	0	0	0
N/A	0	0	0	0	0	0

Table G-34. Cross Crash Type by Severity, Off-Peak (2020-2021)

Crash Type	Fatal	Serious Injury	Evident Injury	Possible Injury	PDO	Unknown
Rear-end	0	0	2	8	24	1
Sideswipe	0	0	1	3	9	0
Fixed-object	0	0	0	0	8	0
Angled/Sideswipe	0	0	0	1	2	0
Other	0	0	1	0	2	1
N/A	0	0	0	0	0	0

Table G-35. Cross Crash Type, Peak, Off-Peak (2020-2021)

Crash Type	Peak	Off-Peak
Rear End	50	35
Sideswipe	12	13
Fixed-object	1	8
Angled/Sideswipe	3	3
Other	0	4
N/A	0	0

Intersection

Table G-36. Intersection Crash Type by Severity, Peak (2020-2021)

Crash Type	Fatal	Serious Injury	Evident Injury	Possible Injury	PDO	Unknown
Rear-end	0	0	4	12	68	1
Sideswipe	0	0	0	1	13	1
Fixed-object	0	0	0	0	1	0
Angled/Sideswipe	1	1	2	8	75	2
Other	0	0	3	3	0	0
N/A	0	0	0	0	0	0

Table G-37. Intersection Crash Type by Severity, Off-Peak (2020-2021)

Crash Type	Fatal	Serious Injury	Evident Injury	Possible Injury	PDO	Unknown
Rear-end	0	1	8	35	131	0
Sideswipe	0	0	1	2	19	0
Fixed-object	0	0	1	3	18	1
Angled/Sideswipe	0	5	4	26	122	1
Other	1	1	2	1	4	0
N/A	0	0	0	0	0	0

Table G-38. Intersection Crash Type, Peak, Off-Peak (2020-2021)

Crash Type	Peak	Off-Peak
Rear End	85	175
Sideswipe	15	22
Fixed-object	1	23
Angled/Sideswipe	89	158
Other	6	9
N/A	0	0

Peak Totals

Table G-39. Peak Totals Crash Type by Severity, Peak (2020-2021)

Crash Type	Fatal	Serious Injury	Evident Injury	Possible Injury	PDO	Unknown
Rear-end	0	1	16	70	320	1
Sideswipe	0	2	0	8	80	2
Fixed-object	0	0	4	4	37	0
Angled/Sideswipe	1	1	3	9	90	2
Other	0	0	5	4	16	0
N/A	0	0	0	0	0	0

Table G-40. Peak Totals Crash Type by Severity, Off-Peak (2020-2021)

Crash Type	Fatal	Serious Injury	Evident Injury	Possible Injury	PDO	Unknown
Rear-end	1	3	19	74	278	1
Sideswipe	0	2	4	12	132	0
Fixed-object	1	4	19	7	182	8
Angled/Sideswipe	0	7	6	34	136	1
Other	2	1	7	8	47	2
N/A	0	0	0	0	0	0

Table G-41. Peak Totals Crash Type, Peak, Off-Peak (2020-2021)

Crash Type	Peak	Off-Peak
Rear End	408	376
Sideswipe	92	150
Fixed-object	45	221
Angled/Sideswipe	106	184
Other	25	67
N/A	0	0

Combination Factors

Table G-42. Contributing Factors Crash Type by Severity, Peak (2020-2021)

Factor	Fatal	Serious Injury	Evident Injury	Possible Injury	PDO	Unknown
Driver Distraction/Inattention	1	0	16	63	496	0
Disregard Traffic Controls	0	4	11	26	0	0
Under Influence of Alcohol/Drugs	0	0	0	6	41	5
Other/Unknown	0	0	1	0	6	0
Did Not Grant RW to Vehicle	0	0	0	0	0	0

Table G-43. Contributing Factors Crash Type by Severity, Off-Peak (2020-2021)

Factor	Fatal	Serious Injury	Evident Injury	Possible Injury	PDO	Unknown
Driver Distraction/Inattention	3	4	15	91	678	0
Disregard Traffic Controls	1	12	35	37	0	0
Under Influence of Alcohol/Drugs	0	0	5	7	75	12
Other/Unknown	0	1	0	0	13	0
Did Not Grant RW to Vehicle	0	0	0	0	0	0

Table G-44. Contributing Factors Crash Type, Peak, Off-Peak (2020-2021)

Factor	Peak	Off-Peak
Driver Distraction/Inattention	576	800
Disregard Traffic Controls	41	85
Under Influence of Alcohol/Drugs	52	99
Other/Unknown	7	14
Did Not Grant RW to Vehicle	0	0

4.0 Intersection Crashes

2015-2019

Table G-45. Intersection Crashes, Crash Severity (2015-2019)

ID	Intersection	Total Crashes	Fatal	Serious Injury	Evident Injury	Possible Injury	PDO	Unknown
1	Southbound I-5 Off-ramp/SR 512	118	0	3	4	26	85	0
2	SR 512/S Tacoma Way	121	0	0	6	18	95	2
3	100th Street SW/S Tacoma Way	0	0	0	0	0	0	0
4	Pacific Hwy SW/S Tacoma Way	0	0	0	0	0	0	0
5	Eastbound SR 512/Steele Street S	29	0	0	1	7	19	2
6	Westbound SR 512/Steele Street S	20	0	1	2	1	16	0
7	Sales Road South/Steele Street S	22	0	0	4	2	15	1
8	109th Street South/Steele Street S	11	0	0	1	2	8	0
9	112th Street South/Steele Street S	56	0	0	2	11	43	0
10	112th Street S/SR 7	116	0	1	6	22	87	0
11	Eastbound SR 512 Ramps/SR 7	106	1	0	4	29	72	0
12	108th Street S/SR 7	87	0	0	7	21	59	0
13	108th Street E/Westbound SR 512 Off-ramp	19	0	0	2	4	12	1
14	112th Street E/A Street S	27	0	0	3	5	19	0
15	112th Street E/C Street S	30	0	1	1	7	20	1
16	112th Street E/Portland Avenue E	28	0	1	3	9	14	1
17	Eastbound SR 512 Ramps/Portland Avenue E	32	0	1	2	9	20	0
18	Westbound SR 512 Ramps/Portland Avenue E	22	0	0	2	4	16	0
19	104th Street E/Portland Avenue E	13	0	1	3	1	8	0
20	112th Street E/Canyon Road E	74	0	1	4	15	52	2
21	Eastbound SR 512 Ramps/Canyon Road	52	0	1	5	9	36	1
22	Westbound SR 512 Ramps/Canyon Road E	46	0	0	3	6	37	0
23	104th Street E/Canyon Road E	17	0	0	2	2	13	0
24	39th Avenue SW/94th Avenue E	74	0	1	2	19	52	0
25	SR 512 Eastbound Off-ramp/94th Avenue	45	0	2	0	9	33	1
26	SR 512 Westbound On-ramp/94th Avenue E	126	1	2	8	36	78	1

Under 23 U.S. Code § 148 and 23 U.S. Code § 407, safety data, reports, surveys, schedules, and lists compiled or collected for the purpose of identifying, evaluating, or planning the safety enhancement of potential crash sites, hazardous roadway conditions, or railway-highway crossings are not subject to discovery or admitted into evidence in a Federal or State court proceeding or considered for other purposes in any action for damages arising from any occurrence at a location mentioned or addressed in such reports, surveys, schedules, lists, or data.

ID	Intersection	Total Crashes	Fatal	Serious Injury	Evident Injury	Possible Injury	PDO	Unknown
27	31st Avenue SW/9th Street SW/94th Avenue E	43	0	0	1	12	29	1
28	31st Avenue SW/Westbound SR 512 Ramps	52	0	0	1	11	40	0
29	31st Avenue SW/Eastbound SR 512 Ramps	90	0	0	2	25	63	0
30	31st Avenue SW/South Meridian	54	0	1	1	11	40	1
31	Eastbound SR 512 Ramps/South Meridian	24	0	0	2	5	17	0
32	Westbound SR 512 Ramps/South Meridian	25	0	0	0	8	17	0
33	Summit Country Center/Canyon Road E	12	0	0	1	2	9	0
34	South Hill Park and Ride/94th Avenue E	5	0	0	0	2	3	0
35	31st Avenue SW/ South Hill Park and Ride	2	0	0	0	1	1	0
36	31st Avenue SW/South Hill Park Drive	0	0	0	0	0	0	0
37	15th Avenue SW/South Meridian	0	0	0	0	0	0	0
38	SR 512 Eastbound Ramps / Pioneer Ave	11	0	0	0	1	9	1
39	SR 512 Westbound Ramps / Pioneer Ave	5	0	0	0	0	5	0

Table G-46. Intersection Crashes, Crash Type (2015-2019)

ID	Intersection	Total Crashes	Rear-end	Sideswipe	Fixed-object	Angled/ Sideswipe	Other
1	Southbound I-5 Off-ramp/SR 512	118	49	10	9	48	2
2	SR 512/S Tacoma Way	121	57	12	11	40	1
3	100th Street SW/S Tacoma Way	0	0	0	0	0	0
4	Pacific Hwy SW/S Tacoma Way	0	0	0	0	0	0
5	Eastbound SR 512/Steele Street S	29	11	1	3	13	1
6	Westbound SR 512/Steele Street S	20	7	1	1	10	1
7	Sales Road South/Steele Street S	22	4	0	1	16	1
8	109th Street South/Steele Street S	11	3	1	0	7	0
9	112th Street South/Steele Street S	56	24	5	1	23	3
10	112th Street S/SR 7	116	75	8	1	22	10
11	Eastbound SR 512 Ramps/SR 7	106	64	6	1	30	5
12	108th Street S/SR 7	87	31	10	2	38	6
13	108th Street E/Westbound SR 512 Off-ramp	19	2	0	9	3	5

Under 23 U.S. Code § 148 and 23 U.S. Code § 407, safety data, reports, surveys, schedules, and lists compiled or collected for the purpose of identifying, evaluating, or planning the safety enhancement of potential crash sites, hazardous roadway conditions, or railway-highway crossings are not subject to discovery or admitted into evidence in a Federal or State court proceeding or considered for other purposes in any action for damages arising from any occurrence at a location mentioned or addressed in such reports, surveys, schedules, lists, or data.

ID	Intersection	Total Crashes	Rear-end	Sideswipe	Fixed-object	Angled/ Sideswipe	Other
14	112th Street E/A Street S	27	4	1	0	22	0
15	112th Street E/C Street S	30	5	1	1	21	2
16	112th Street E/Portland Avenue E	28	7	2	3	12	4
17	Eastbound SR 512 Ramps/Portland Avenue E	32	9	0	1	21	1
18	Westbound SR 512 Ramps/Portland Avenue E	22	9	0	2	11	0
19	104th Street E/Portland Avenue E	13	3	0	3	5	2
20	112th Street E/Canyon Road E	74	43	5	0	26	0
21	Eastbound SR 512 Ramps/Canyon Road	52	29	1	0	19	3
22	Westbound SR 512 Ramps/Canyon Road E	46	20	3	3	18	2
23	104th Street E/Canyon Road E	17	7	3	2	5	0
24	39th Avenue SW/94th Avenue E	74	31	3	0	39	1
25	SR 512 Eastbound Off-ramp/94th Avenue	45	20	2	0	23	0
26	SR 512 Westbound On-ramp/94th Avenue E	126	41	3	3	78	1
27	31st Avenue SW/9th Street SW/94th Avenue E	43	18	6	0	19	0
28	31st Avenue SW/Westbound SR 512 Ramps	52	39	1	0	12	0
29	31st Avenue SW/Eastbound SR 512 Ramps	90	55	4	6	18	7
30	31st Avenue SW/South Meridian	54	21	10	0	22	1
31	Eastbound SR 512 Ramps/South Meridian	24	5	1	2	15	1
32	Westbound SR 512 Ramps/South Meridian	25	11	1	0	13	0
33	Summit Country Center/Canyon Road E	12	6	0	0	5	1
34	South Hill Park and Ride/94th Avenue E	5	5	0	0	0	0
35	31st Avenue SW/ South Hill Park and Ride	2	2	0	0	0	0
36	31st Avenue SW/South Hill Park Drive	0	0	0	0	0	0
37	15th Avenue SW/South Meridian	0	0	0	0	0	0
38	SR 512 Eastbound Ramps / Pioneer Ave	11	4	1	2	3	1
39	SR 512 Westbound Ramps / Pioneer Ave	5	3	0	1	1	0

Under 23 U.S. Code § 148 and 23 U.S. Code § 407, safety data, reports, surveys, schedules, and lists compiled or collected for the purpose of identifying, evaluating, or planning the safety enhancement of potential crash sites, hazardous roadway conditions, or railway-highway crossings are not subject to discovery or admitted into evidence in a Federal or State court proceeding or considered for other purposes in any action for damages arising from any occurrence at a location mentioned or addressed in such reports, surveys, schedules, lists, or data.

2020-2021

Table G-47. Intersection Crashes, Crash Severity (2020-2021)

ID	Intersection	Total Crashes	Fatal	Serious Injury	Evident Injury	Possible Injury	PDO	Unknown
1	Southbound I-5 Off-ramp/SR 512	36	0	0	0	5	31	0
2	SR 512/S Tacoma Way	47	0	0	2	4	40	1
3	100th Street SW/S Tacoma Way	0	0	0	0	0	0	0
4	Pacific Hwy SW/S Tacoma Way	0	0	0	0	0	0	0
5	Eastbound SR 512/Steele Street S	15	0	0	1	1	13	0
6	Westbound SR 512/Steele Street S	9	0	0	0	0	9	0
7	Sales Road South/Steele Street S	9	1	0	0	3	5	0
8	109th Street South/Steele Street S	6	0	0	2	1	2	1
9	112th Street South/Steele Street S	15	0	1	0	2	12	0
10	112th Street S/SR 7	45	0	2	2	7	34	0
11	Eastbound SR 512 Ramps/SR 7	60	0	1	0	7	52	0
12	108th Street S/SR 7	49	1	1	2	10	35	0
13	108th Street E/Westbound SR 512 Off-ramp	4	0	0	1	1	2	0
14	112th Street E/A Street S	5	0	0	1	0	4	0
15	112th Street E/C Street S	5	0	0	0	0	3	2
16	112th Street E/Portland Avenue E	12	0	0	3	2	7	0
17	Eastbound SR 512 Ramps/Portland Avenue E	7	0	0	0	1	6	0
18	Westbound SR 512 Ramps/Portland Avenue E	7	0	0	0	0	7	0
19	104th Street E/Portland Avenue E	7	0	0	0	1	6	0
20	112th Street E/Canyon Road E	17	0	0	0	2	15	0
21	Eastbound SR 512 Ramps/Canyon Road	22	0	0	0	3	19	0
22	Westbound SR 512 Ramps/Canyon Road E	19	0	0	2	1	16	0
23	104th Street E/Canyon Road E	8	0	0	0	0	8	0
24	39th Avenue SW/94th Avenue E	26	0	1	1	7	17	0
25	SR 512 Eastbound Off-ramp/94th Avenue	15	0	0	2	7	6	0
26	SR 512 Westbound On-ramp/94th Avenue E	16	0	0	0	2	14	0
27	31st Avenue SW/9th Street SW/94th Avenue E	18	0	0	1	4	13	0
28	31st Avenue SW/Westbound SR 512 Ramps	28	0	0	2	7	19	0

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ID	Intersection	Total Crashes	Fatal	Serious Injury	Evident Injury	Possible Injury	PDO	Unknown
29	31st Avenue SW/Eastbound SR 512 Ramps	22	0	0	1	4	17	0
30	31st Avenue SW/South Meridian	23	0	0	1	4	18	0
31	Eastbound SR 512 Ramps/South Meridian	6	0	1	0	0	5	0
32	Westbound SR 512 Ramps/South Meridian	14	0	0	0	4	9	1
33	Summit Country Center/Canyon Road E	3	0	1	0	0	1	1
34	South Hill Park and Ride/94th Avenue E	2	0	0	0	0	2	0
35	31st Avenue SW/ South Hill Park and Ride	0	0	0	0	0	0	0
36	31st Avenue SW/South Hill Park Drive	0	0	0	0	0	0	0
37	15th Avenue SW/South Meridian	0	0	0	0	0	0	0
38	SR 512 Eastbound Ramps / Pioneer Ave	5	0	0	1	1	3	0
39	SR 512 Westbound Ramps / Pioneer Ave	1	0	0	0	0	1	0

Table G-48. Intersection Crashes, Crash Type (2020-2021)

ID	Intersection	Total Crashes	Rear-end	Sideswipe	Fixed-object	Angled/ Sideswipe	Other
1	Southbound I-5 Off-ramp/SR 512	36	13	3	3	17	0
2	SR 512/S Tacoma Way	47	20	2	3	22	0
3	100th Street SW/S Tacoma Way	0	0	0	0	0	0
4	Pacific Hwy SW/S Tacoma Way	0	0	0	0	0	0
5	Eastbound SR 512/Steele Street S	15	4	0	1	9	1
6	Westbound SR 512/Steele Street S	9	4	2	0	3	0
7	Sales Road South/Steele Street S	9	1	0	0	8	0
8	109th Street South/Steele Street S	6	3	0	0	3	0
9	112th Street South/Steele Street S	15	3	1	1	10	0
10	112th Street S/SR 7	45	23	5	0	15	2
11	Eastbound SR 512 Ramps/SR 7	60	35	3	1	16	5
12	108th Street S/SR 7	49	24	3	5	16	1
13	108th Street E/Westbound SR 512 Off-ramp	4	1	0	2	0	1
14	112th Street E/A Street S	5	0	0	0	5	0
15	112th Street E/C Street S	5	0	0	1	4	0

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ID	Intersection	Total Crashes	Rear-end	Sideswipe	Fixed-object	Angled/ Sideswipe	Other
16	112th Street E/Portland Avenue E	12	2	0	1	7	2
17	Eastbound SR 512 Ramps/Portland Avenue E	7	3	1	1	2	0
18	Westbound SR 512 Ramps/Portland Avenue E	7	3	0	0	4	0
19	104th Street E/Portland Avenue E	7	1	0	0	6	0
20	112th Street E/Canyon Road E	17	9	0	0	8	0
21	Eastbound SR 512 Ramps/Canyon Road	22	8	1	0	13	0
22	Westbound SR 512 Ramps/Canyon Road E	19	5	4	0	10	0
23	104th Street E/Canyon Road E	8	1	0	0	7	0
24	39th Avenue SW/94th Avenue E	26	10	1	1	13	1
25	SR 512 Eastbound Off-ramp/94th Avenue	15	9	2	0	3	1
26	SR 512 Westbound On-ramp/94th Avenue E	16	6	1	0	9	0
27	31st Avenue SW/9th Street SW/94th Avenue E	18	11	2	0	5	0
28	31st Avenue SW/Westbound SR 512 Ramps	28	21	2	0	5	0
29	31st Avenue SW/Eastbound SR 512 Ramps	22	16	1	1	4	0
30	31st Avenue SW/South Meridian	23	10	1	0	12	0
31	Eastbound SR 512 Ramps/South Meridian	6	1	1	1	3	0
32	Westbound SR 512 Ramps/South Meridian	14	8	0	1	5	0
33	Summit Country Center/Canyon Road E	3	0	1	0	2	0
34	South Hill Park and Ride/94th Avenue E	2	2	0	0	0	0
35	31st Avenue SW/ South Hill Park and Ride	0	0	0	0	0	0
36	31st Avenue SW/South Hill Park Drive	0	0	0	0	0	0
37	15th Avenue SW/South Meridian	0	0	0	0	0	0
38	SR 512 Eastbound Ramps / Pioneer Ave	5	3	0	0	1	1
39	SR 512 Westbound Ramps / Pioneer Ave	1	0	0	1	0	0

5.0 Mainline Crashes

2015-2019

Table G-49. Mainline Crashes, Eastbound, Crash Severity (2015-2019)

ID	Intersection	Total Crashes	Fatal	Serious Injury	Evident Injury	Possible Injury	PDO	Unknown
1	Inside I-5	27	0	0	0	6	21	0
2	I-5 NB Ramps to S Steele St	90	1	0	1	19	69	0
3	S Steele St to S Steele St Ramps	25	0	1	0	5	19	0
4	S Steele St Ramps to SR 7 Interchange	64	0	3	5	9	47	0
5	SR 7 Interchange to SR 7 Interchange	37	1	1	3	7	25	0
6	SR 7 Interchange to Portland Ave Interchange	50	0	2	5	8	35	0
7	Portland Ave Interchange to Portland Ave Interchange	54	0	2	2	7	43	0
8	Portland Ave Interchange to Canyon Rd Interchange	53	1	1	3	7	40	1
9	Canyon Rd Interchange to Canyon Rd Interchange	78	0	1	2	14	59	2
10	Canyon Rd Interchange to 9th St SW Ramps	56	1	3	1	12	39	0
11	9th St SW Ramps to 31st Ave Ramps	190	1	2	4	38	142	3
12	31st Ave Ramps to Meridian Interchange	59	0	0	2	16	41	0
13	Meridian Interchange to Meridian Interchange	75	0	2	4	18	50	1
14	Meridian Interchange to Pioneer Ave Interchange	18	0	0	1	5	12	0
15	Pioneer Ave Interchange to Pioneer Ave Interchange	30	0	0	2	8	20	0
16	Pioneer Ave Interchange to SR 167 Interchange	55	0	0	3	9	43	0
17	SR 167 Interchange to SR 167 Interchange	9	0	0	0	1	8	0

Table G-50. Mainline Crashes, Westbound, Crash Severity (2015-2019)

ID	Intersection	Total Crashes	Fatal	Serious Injury	Evident Injury	Possible Injury	PDO	Unknown
17	SR 167 Interchange	14	0	0	0	2	12	0
16	SR 167 Interchange to Pioneer Ave Interchange	35	0	0	0	7	28	0
15	Inside Pioneer Ave	27	0	0	1	6	19	1
14	Pioneer Ave Interchange to Meridian Interchange	19	0	0	3	4	12	0
13	Inside Meridian	26	0	0	1	4	21	0
12	Meridian Interchange to 31st Ave Ramps	51	0	0	1	14	36	0
11	Inside 9th & 31st St	185	1	3	11	33	136	1
10	9th St SW Ramps to Canyon Rd Interchange	74	0	0	5	15	53	1
9	Inside Canyon Rd	74	0	1	5	14	53	1
8	Canyon Rd Interchange to Portland Ave Interchange	72	0	0	4	13	54	1
7	Inside Portland Ave	48	0	0	1	12	32	3
6	Portland Ave Interchange to SR 7 Interchange	36	0	1	5	5	24	1
5	Inside SR 7	60	0	1	1	9	49	0
4	SR 7 Interchange to S Steele St Ramps	108	0	1	1	21	85	0
3	Inside S Steele St	48	0	0	3	6	39	0
2	S Steele St to I-5 NB Ramps	183	0	0	2	44	137	0
1	Inside I-5	90	0	0	2	28	60	0

Table G-51. Mainline Crashes, Eastbound, Crash Type (2015-2019)

ID	Intersection	Total Crashes	Rear-end	Sideswipe	Fixed-object	Angled/ Sideswipe	Other
1	Inside I-5	27	11	6	4	4	2
2	I-5 NB Ramps to S Steele St	90	63	17	6	1	3
3	S Steele St to S Steele St Ramps	25	18	5	1	0	1
4	S Steele St Ramps to SR 7 Interchange	64	38	7	13	4	2
5	SR 7 Interchange to SR 7 Interchange	37	19	3	8	2	5
6	SR 7 Interchange to Portland Ave Interchange	50	19	10	17	0	4
7	Portland Ave Interchange to Portland Ave Interchange	54	26	7	16	3	2
8	Portland Ave Interchange to Canyon Rd Interchange	53	14	9	20	6	4
9	Canyon Rd Interchange to Canyon Rd Interchange	78	31	16	21	2	8
10	Canyon Rd Interchange to 9th St SW Ramps	56	22	7	16	1	10
11	9th St SW Ramps to 31st Ave Ramps	190	110	25	36	5	14
12	31st Ave Ramps to Meridian Interchange	59	37	6	14	1	1
13	Meridian Interchange to Meridian Interchange	75	50	4	16	0	5
14	Meridian Interchange to Pioneer Ave Interchange	18	8	3	5	1	1
15	Pioneer Ave Interchange to Pioneer Ave Interchange	30	19	6	4	1	0
16	Pioneer Ave Interchange to SR 167 Interchange	55	36	4	12	1	2
17	SR 167 Interchange to SR 167 Interchange	9	6	2	1	0	0

Table G-52. Mainline Crashes, Westbound, Crash Type (2015-2019)

ID	Intersection	Total Crashes	Rear-end	Sideswipe	Fixed-object	Angled/ Sideswipe	Other	#N/A
1	Inside I-5	14	7	0	4	3	0	0
2	I-5 NB Ramps to S Steele St	35	17	6	7	2	2	1
3	S Steele St to S Steele St Ramps	27	15	3	7	1	1	0
4	S Steele St Ramps to SR 7 Interchange	19	4	1	12	0	2	0
5	SR 7 Interchange to SR 7 Interchange	26	8	6	10	1	1	0
6	SR 7 Interchange to Portland Ave Interchange	51	36	6	5	2	2	0
7	Portland Ave Interchange to Portland Ave Interchange	185	101	27	34	6	17	0
8	Portland Ave Interchange to Canyon Rd Interchange	74	40	6	16	0	12	0
9	Canyon Rd Interchange to Canyon Rd Interchange	74	50	10	9	0	5	0
10	Canyon Rd Interchange to 9th St SW Ramps	72	33	12	14	3	10	0
11	9th St SW Ramps to 31st Ave Ramps	48	15	3	24	0	6	0
12	31st Ave Ramps to Meridian Interchange	36	11	5	17	1	2	0
13	Meridian Interchange to Meridian Interchange	60	32	4	19	3	2	0
14	Meridian Interchange to Pioneer Ave Interchange	108	70	20	13	3	2	0
15	Pioneer Ave Interchange to Pioneer Ave Interchange	48	27	18	2	1	0	0
16	Pioneer Ave Interchange to SR 167 Interchange	183	138	34	5	5	1	0
17	SR 167 Interchange to SR 167 Interchange	90	69	15	4	2	0	0

Under 23 U.S. Code § 148 and 23 U.S. Code § 407, safety data, reports, surveys, schedules, and lists compiled or collected for the purpose of identifying, evaluating, or planning the safety enhancement of potential crash sites, hazardous roadway conditions, or railway-highway crossings are not subject to discovery or admitted into evidence in a Federal or State court proceeding or considered for other purposes in any action for damages arising from any occurrence at a location mentioned or addressed in such reports, surveys, schedules, lists, or data.

2020-2021

Table G-53. Mainline Crashes, Eastbound, Crash Severity (2020-2021)

ID	Intersection	Total Crashes	Fatal	Serious Injury	Evident Injury	Possible Injury	PDO	Unknown
1	Inside I-5	3	0	0	0	0	3	0
2	I-5 NB Ramps to S Steele St	27	0	0	1	4	22	0
3	S Steele St to S Steele St Ramps	11	0	0	0	0	11	0
4	S Steele St Ramps to SR 7 Interchange	26	0	0	1	4	21	0
5	SR 7 Interchange to SR 7 Interchange	18	0	1	0	2	15	0
6	SR 7 Interchange to Portland Ave Interchange	15	0	0	0	1	14	0
7	Portland Ave Interchange to Portland Ave Interchange	20	0	0	1	5	14	0
8	Portland Ave Interchange to Canyon Rd Interchange	22	1	0	4	2	15	0
9	Canyon Rd Interchange to Canyon Rd Interchange	26	0	0	1	3	22	0
10	Canyon Rd Interchange to 9th St SW Ramps	25	0	0	4	1	19	1
11	9th St SW Ramps to 31st Ave Ramps	44	0	0	2	4	38	0
12	31st Ave Ramps to Meridian Interchange	34	0	0	0	4	30	0
13	Meridian Interchange to Meridian Interchange	31	0	0	2	3	26	0
14	Meridian Interchange to Pioneer Ave Interchange	13	0	0	1	1	11	0
15	Pioneer Ave Interchange to Pioneer Ave Interchange	21	0	0	1	3	17	0
16	Pioneer Ave Interchange to SR 167 Interchange	25	0	1	2	4	18	0
17	SR 167 Interchange to SR 167 Interchange	1	0	0	0	0	1	0

Table G-54. Mainline Crashes, Westbound, Crash Severity (2020-2021)

ID	Intersection	Total Crashes	Fatal	Serious Injury	Evident Injury	Possible Injury	PDO	Unknown
17	SR 167 Interchange	8	0	0	1	0	7	0
16	SR 167 Interchange to Pioneer Ave Interchange	18	0	0	2	1	15	0
15	Inside Pioneer Ave	3	0	0	0	1	2	0
14	Pioneer Ave Interchange to Meridian Interchange	22	0	0	0	1	20	1
13	Inside Meridian	11	0	0	0	0	11	0
12	Meridian Interchange to 31st Ave Ramps	20	0	0	1	2	17	0
11	Inside 9th & 31st St	71	0	2	3	8	58	0
10	9th St SW Ramps to Canyon Rd Interchange	35	0	2	1	4	27	1
9	Inside Canyon Rd	23	0	1	1	2	19	0
8	Canyon Rd Interchange to Portland Ave Interchange	23	0	2	2	1	18	0
7	Inside Portland Ave	16	0	1	1	2	12	0
6	Portland Ave Interchange to SR 7 Interchange	17	0	0	1	0	15	1
5	Inside SR 7	26	0	0	0	6	19	1
4	SR 7 Interchange to S Steele St Ramps	33	0	0	2	8	23	0
3	Inside S Steele St	13	0	0	1	2	10	0
2	S Steele St to I-5 NB Ramps	57	2	1	4	14	36	0
1	Inside I-5	29	0	0	0	7	22	0

Table G-55. Mainline Crashes, Eastbound, Crash Type (2020-2021)

ID	Intersection	Total Crashes	Rear-end	Sideswipe	Fixed-object	Angled/ Sideswipe	Other	#N/A
1	Inside I-5	3	1	1	1	0	0	0
2	I-5 NB Ramps to S Steele St	27	15	6	4	1	1	0
3	S Steele St to S Steele St Ramps	11	4	5	1	1	0	0
4	S Steele St Ramps to SR 7 Interchange	26	13	7	6	0	0	0
5	SR 7 Interchange to SR 7 Interchange	18	8	5	2	3	0	0
6	SR 7 Interchange to Portland Ave Interchange	15	8	4	3	0	0	0
7	Portland Ave Interchange to Portland Ave Interchange	20	12	2	5	1	0	0
8	Portland Ave Interchange to Canyon Rd Interchange	22	6	4	11	0	1	0
9	Canyon Rd Interchange to Canyon Rd Interchange	26	9	5	9	0	3	0
10	Canyon Rd Interchange to 9th St SW Ramps	25	9	4	8	3	1	0
11	9th St SW Ramps to 31st Ave Ramps	44	22	9	11	0	2	0
12	31st Ave Ramps to Meridian Interchange	34	15	5	10	2	2	0
13	Meridian Interchange to Meridian Interchange	31	13	6	9	2	1	0
14	Meridian Interchange to Pioneer Ave Interchange	13	7	5	0	1	0	0
15	Pioneer Ave Interchange to Pioneer Ave Interchange	21	13	5	2	0	1	0
16	Pioneer Ave Interchange to SR 167 Interchange	25	16	5	4	0	0	0
17	SR 167 Interchange to SR 167 Interchange	1	0	0	1	0	0	0

Table G- 56. Mainline Crashes, Westbound, Crash Type (2020-2021)

ID	Intersection	Total Crashes	Fatal	Serious Injury	Evident Injury	Possible Injury	PDO	Unknown
17	SR 167 Interchange	8	2	3	3	0	0	0
16	SR 167 Interchange to Pioneer Ave Interchange	18	7	2	8	0	1	0
15	Inside Pioneer Ave	3	2	0	1	0	0	0
14	Pioneer Ave Interchange to Meridian Interchange	22	1	6	14	0	1	0
13	Inside Meridian	11	2	2	5	1	1	0
12	Meridian Interchange to 31st Ave Ramps	20	11	3	5	1	0	0
11	Inside 9th & 31st St	71	35	13	14	5	4	0
10	9th St SW Ramps to Canyon Rd Interchange	35	18	7	6	1	3	0
9	Inside Canyon Rd	23	8	8	3	1	3	0
8	Canyon Rd Interchange to Portland Ave Interchange	23	9	3	6	0	5	0
7	Inside Portland Ave	16	5	3	7	0	1	0
6	Portland Ave Interchange to SR 7 Interchange	17	3	3	10	0	1	0
5	Inside SR 7	26	9	5	7	2	3	0
4	SR 7 Interchange to S Steele St Ramps	33	19	6	5	3	0	0
3	Inside S Steele St	13	9	2	1	1	0	0
2	S Steele St to I-5 NB Ramps	57	46	7	0	2	2	0
1	Inside I-5	29	19	9	1	0	0	0

Appendix H Operations Analysis Supplemental Express Toll Lane

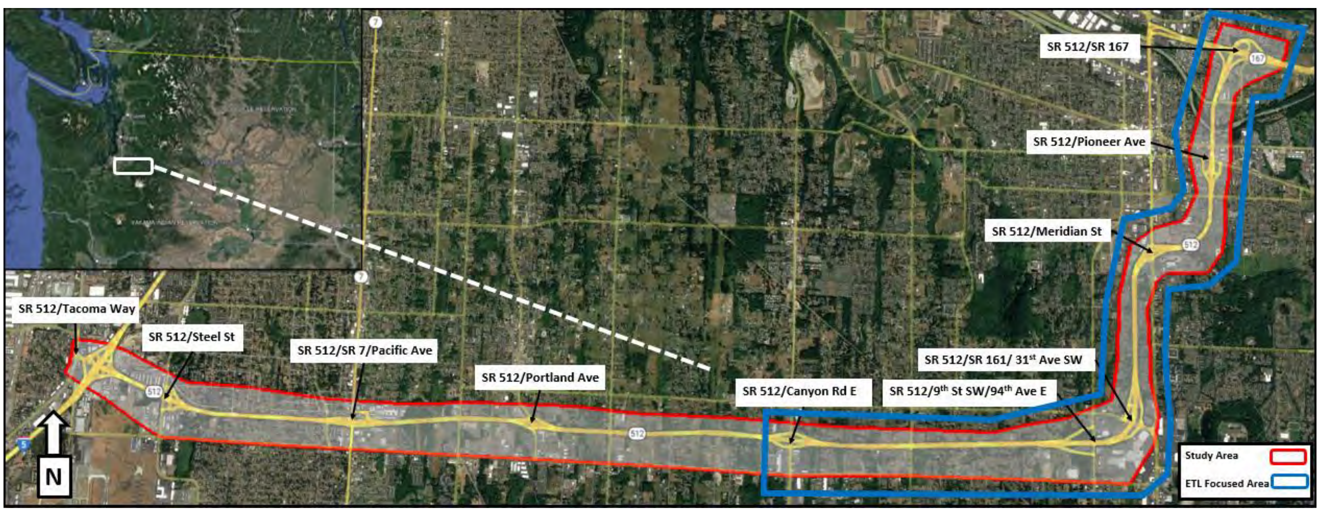
Technical Memorandum

Date:	June 23, 2023
Project:	SR 512 Corridor Study
To:	WSDOT Olympic Region
From:	Shaun Bready; Nate Larson, PE, PTOE; Supplemental Express
Subject:	Toll Lane Operations Analysis

1.0 Introduction and Improvement Scenario

The State Route (SR) 512 Corridor Study was conducted to identify and evaluate strategies on SR 512 between the I-5/SR 512 interchange vicinity in Lakewood, Washington, and the SR 167/SR 512 interchange vicinity in Puyallup, Washington. The SR 512 corridor experiences peak period congestion in both directions and in several locations within the corridor. As part of the Study, WSDOT has focused on the eastern end of this corridor to be evaluated with consideration of express toll lane (ETL) connections to the SR 167 corridor. This analysis is intended to assess ETL configurations, which would improve traffic operations and safety performance along the SR 512 corridor over a near-term and long-term timeframe. The overall Study vicinity and supplemental focused study area are shown in Figure H-1.

Figure H-1. Study Vicinity and ETL Focused Study Area



2.0 Analysis Elements

2.1 Analysis Years

The supplemental ETL focus modeled two scenario years using a variety of analytical tools: a near-term year 2030, and a long-term year 2050.

Freeway, intersection operations, and the Travel Demand Model (TDM) were used to assess projects in both the near- and long-term years.

2.2 Time Periods

The AM and PM periods were analyzed for this assessment study. Considerations to the entire 6-hour AM and PM periods (5:00–11:00 a.m. and 2:00–8:00 p.m.) were analyzed; however, for reporting purposes the peak-hour volume period occurring between 7:00 and 8:00 a.m. and 4:00 through 5:00 p.m. was the primary focus This Study utilized a pre-developed Vissim freeway model based on the SR 512 Corridor Study. The intersection analysis focused only on the peak-hour AM and PM for intersections east of Woodland.

2.3 Future Year Scenarios

For the near-term year 2030 and long-term year 2050 Build models, six scenarios were analyzed using Vissim and Synchro. Each of these scenarios included all the projects from the 2030 and 2050 Baseline model. The modeled scenarios were assessed with respect to multimodal impacts and benefits relative to the Baseline conditions. Model assumptions and descriptions of each scenario are summarized in below in Table H-1.

Table H-1. Future Year Model Assumptions

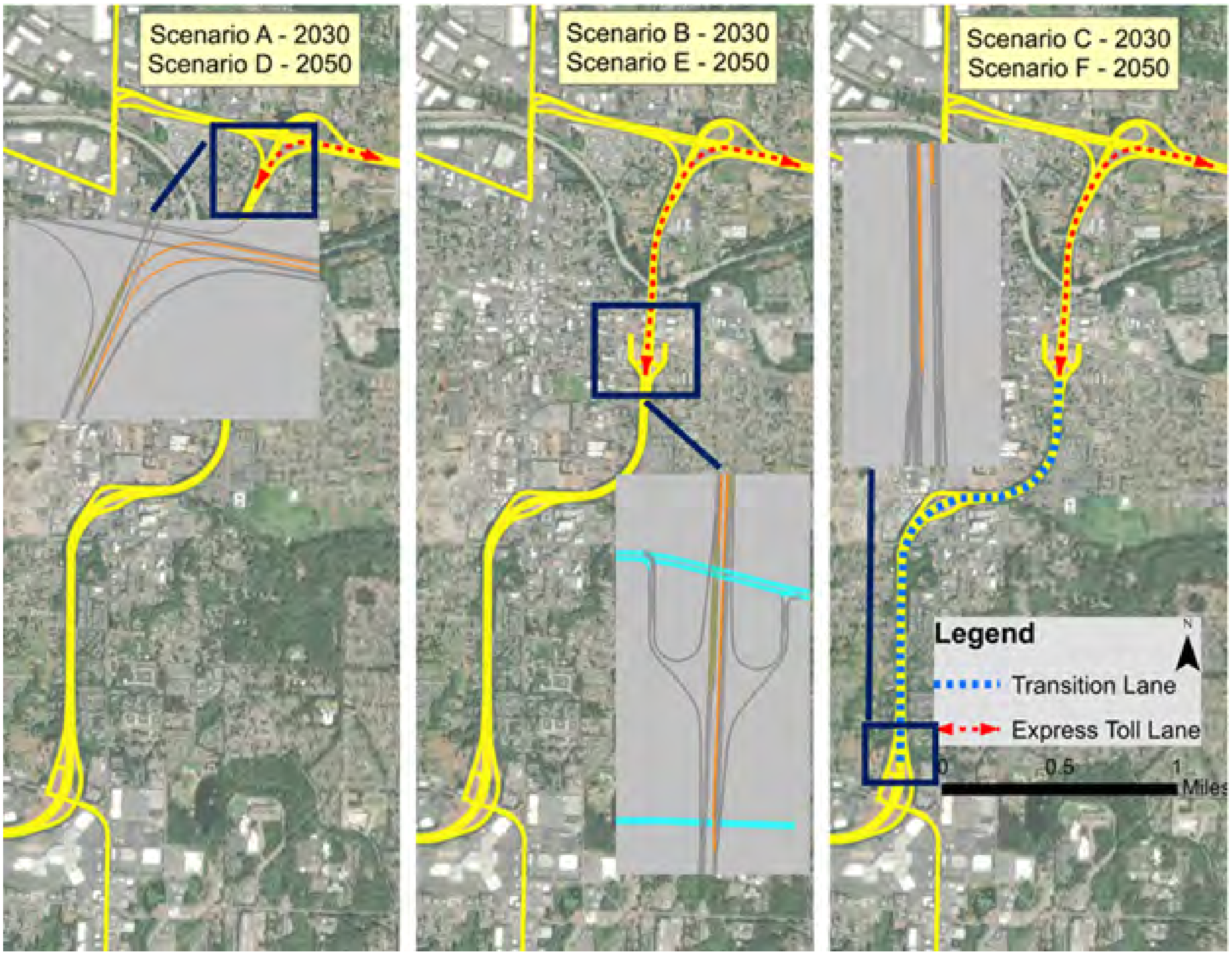
Project/Capacity Elements	Corridor	A (2030)	B (2030)	C (2030)	D (2050)	E (2050)	F (2050)
SR 167 Gateway Extension to I-5	SR 167 Ext.	x	x	x	x	x	x
I-5/SR 512 Interchange Improvement (Alt 1-Drop NB I-5 to 512)	SR 512/I-5	x	x	x			
I-5/SR 512 Interchange Improvement (DDI)	SR 512/I-5				x	x	x
West/Eastbound SR 512 E Pioneer to S Meridian Aux Lane	SR 512	x	x	x	x	x	x
Southbound Single ETL lane between Ellingson and SR 410	SR 167	x	x	x	x	x	x
BRT/Enhanced Transit on SR 167	SR 167	x	x	x	x	x	x
ETL Direct Access Ramp to SR 167 ETL in Kent	SR 167	x	x	x	x	x	x
ETL Direct Access Ramp to SR 167 ETL in Auburn	SR 167	x	x	x	x	x	x
Canyon Road Extension	Off-Corridor	x	x	x	x	x	x
SR 167 ETL Direct Connect touch down north of river: E Pioneer Access, no additional SR 512 capacity across river	SR 512	x			x		
SR 167 ETL DC flyover touch down west of E Pioneer: S Meridian Access	SR 512		x			x	
S Meridian Access, but with capacity extension (such as aux lane) to the west to minimize congestion for PM westbound	SR 512			x			x

Scenarios A and D extend the SR 167 ETL from SR 410 prior to the Puyallup River. An ETL will have a direct connection through the SR 512 interchange. The ETL direct connector allows access to E Pioneer but does not provide any additional lanes of capacity over the Puyallup River.

Scenarios B and E also connect the SR 167 ETL to SR 512. The ETL connection would provide an additional lane of capacity across the Puyallup River and terminate west of the E Pioneer interchange. An ETL direct connection from SR 167 to SR 512 is also assumed. However, it does not provide access to E Pioneer.

Scenarios C and F provide an ETL direct connection from SR 167 to SR 512, which connects to SR 512 at E Pioneer in both directions. The ETL direct connector does not provide access to E Pioneer; however, it does provide access to S Meridian. This ETL connection creates an additional lane of capacity over the Puyallup River. These scenarios add an auxiliary transition lane of capacity at the terminus of the ETL, in both directions, and continues to 31st Avenue SW. Figure H-2 shows how these connections may be configured for each of the scenarios described above.

Figure H-2. ETL Connections to SR 512



3.0 Study Area Unincorporated and Limits

3.1 Freeway Study Area

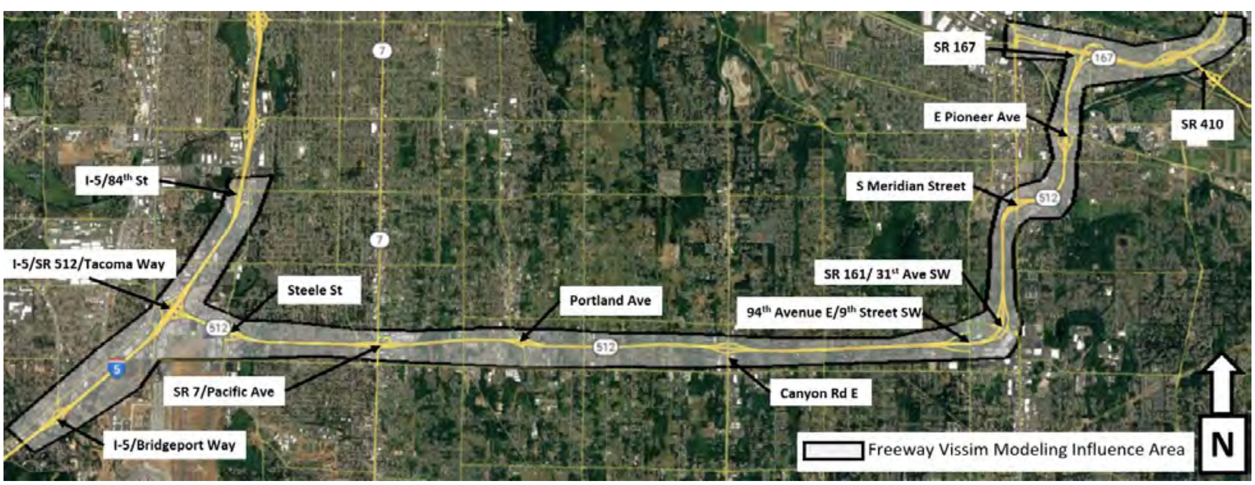
The freeway analysis area is in the northwest region of Pierce County in Washington State and includes parts of Puyallup and Pierce County. The analysis area along SR 512 is bound between the western terminus at Canyon Road interchange to the east. The system interchanges of SR 167/SR 512 and SR 167/SR 410 were included in the modeling limits because the managed lane connections within these facilities are critical components to the overall system operations. Congestion experienced at these locations may have direct impacts to the traffic demands and operations influencing the SR 512 corridor and should be considered.

Within the freeway analysis area, the SR 512 mainline and interchanges listed below will be analyzed and performance metrics were collected using the Vissim microsimulation analysis tool. Figure H-3 outlines the freeway modeling influence area. The freeway analysis area includes only SR 512 from Canyon Road E to E Pioneer. Ramps at the following SR 512 interchanges will be analyzed as part of this study:

1. Canyon Road E
2. SR 161/31st Avenue SW
3. 94th Avenue E/9th Street SW
4. S Meridian
5. E Pioneer
6. SR 167

The Vissim modeling area is the same as the model developed for the overall corridor study. For purposes of volume development, origin-destination (O-D) estimation, and comparisons, the team chose to maintain the same modeled interchanges within the influence area of this model.

Figure H-3. Freeway - Vissim Modeling Influence Area



The Vissim model was used to analyze freeway mainline and ramp operations only for the 6-hour AM and PM peak periods. Ramp terminal intersections on SR 512 anticipated to be affected by the Study were modeled in Synchro/Simtraffic for the both the AM and PM peak hours, as discussed below. Volume throughput measured from the Vissim freeway model was matched in the Synchro/Simtraffic ramp terminal intersection analysis. In addition, if any ramp terminal queues were determined to spill back to the freeway mainline, those queues were replicated in the freeway Vissim model.

3.2 Intersection Study Area

Eighteen ramp terminal and arterial intersections have been identified for this analysis and are listed in Table H-2 and displayed in Figure H-4. These intersections are either ramp terminals at the interchange or are within the interchange vicinity that could experience a difference in operations across scenarios compared in this supplemental analysis. For consistency, these intersections numbers match the intersection numbers displayed in the Final Report of the *SR Corridor Study*.

Table H-2. SR 512 Congestion Study intersections

ID	Intersection
1	112th Street E/Canyon Road E
2	Eastbound SR 512 Ramps/Canyon Road
3	Westbound SR 512 Ramps/Canyon Road E
4	104th Street E/Canyon Road E
5	39th Avenue SW/94th Avenue E
6	SR 512 Eastbound Off-ramp/94th Avenue
7	SR 512 Westbound On-ramp/94th Avenue E
8	31st Avenue SW/9th Street SW/94th Avenue E
9	31st Avenue SW/Westbound SR 512 Ramps
10	31st Avenue SW/Eastbound SR 512 Ramps
11	31st Avenue SW/S Meridian
12	Eastbound SR 512 Ramps/S Meridian
13	Westbound SR 512 Ramps/S Meridian
14	Summit Country Center/Canyon Road E
15	South Hill Park and Ride/94th Avenue E
16	31st Avenue SW/South Hill Park and Ride
17	31st Avenue SW/South Hill Park Drive
18	15th Avenue SW/S Meridian

Figure H-4. Study Intersections – Canyon Road E to SR 167

Study intersections were included in the PM peak hour Synchro/SimTraffic model for all scenarios. Study intersections were included in the AM peak hour Synchro/SimTraffic model for Scenario C and Scenario F. Queues at the off-ramp terminals were modeled with the SimTraffic simulation model. If any queues are observed to spill back to the freeway mainline, those queues were matched in the freeway Vissim model. It should be noted that the E Pioneer interchange ramp terminals are not included as a part of this study. The E Pioneer interchange is being studied and analyzed as a part of WSDOT's Gateway Program.

4.0 Travel Demand Forecasts

4.1 Forecast Development

Travel demand forecasts for this analysis will be based on the Puget Sound Regional Council (PSRC) EMME model output developed by the South Pierce County Connectivity Study. Growth rates for each direction of SR 512, I-5, and SR 167 within the study area were calculated from the South Pierce County Connectivity Study EMME model output between the 2019 Existing year, 2030 near-term year, and 2050 long-term. The travel demand model provided forecasts for the AM and PM peak hours for two horizon years: a 2030 near-term and a 2050 long-term.

4.2 Post Processing

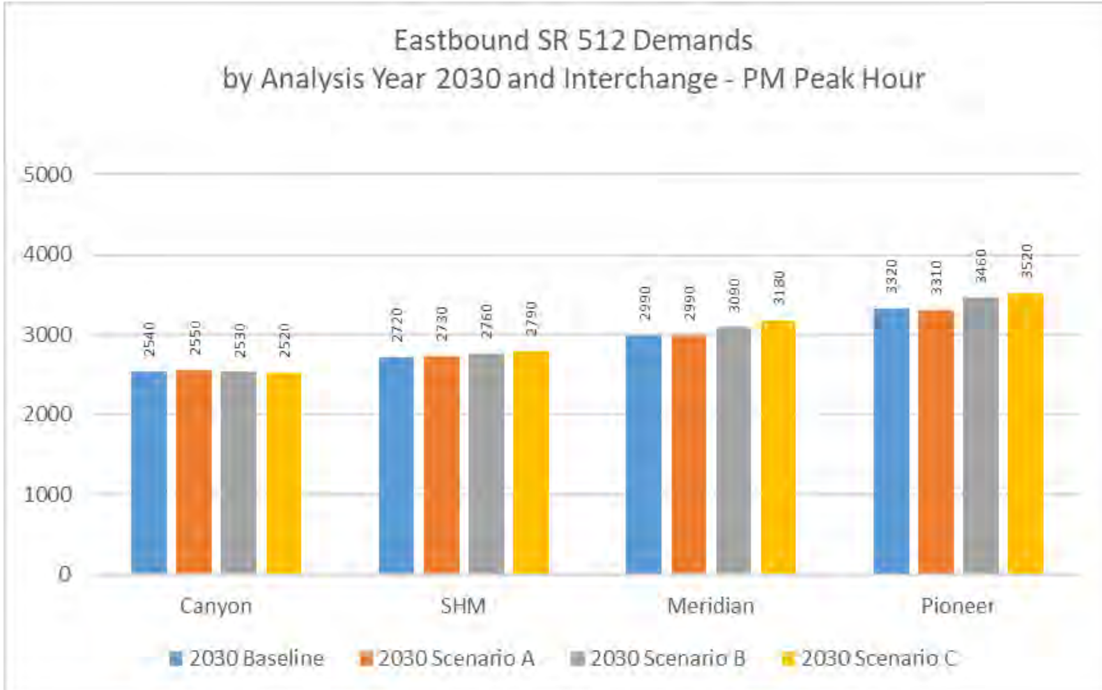
Freeways and Ramps

The growth rates within the study area were applied to existing freeway volumes and balancing adjustments were made per National Cooperative Highway Research Program (NCHRP) Report 765 methodologies. This process can be summarized as:

- Collect existing and future peak period demands from travel demand model and calculate both percent and absolute growth with respect to locations between freeway ramps, ramp terminal, and adjacent intersections for the system peak hour, with a target of matching growth along various segments of the corridor
- Apply growths accordingly over the peak hour to best match the travel demand model as appropriate, while still maintaining overall targets.
- Balance volumes between freeway ramps, ramp terminal, and adjacent intersections for the system peak hour as necessary.
- Apply the same growth across the remainder of the 6-hour peak period, with minor temporal adjustments to different hours.
- Generate 2030 and 2050 AM and PM O-D volumes for the 6-hour period.

Figure H-5 through Figure H-8 shows a comparison of the post-processed vehicle demand at the four major analysis-area arterial crossings during the PM Peak Hour for both the SR 512 eastbound and westbound directions.

Figure H-5. 2030 PM and AM Peak Period Eastbound SR 512 Demands



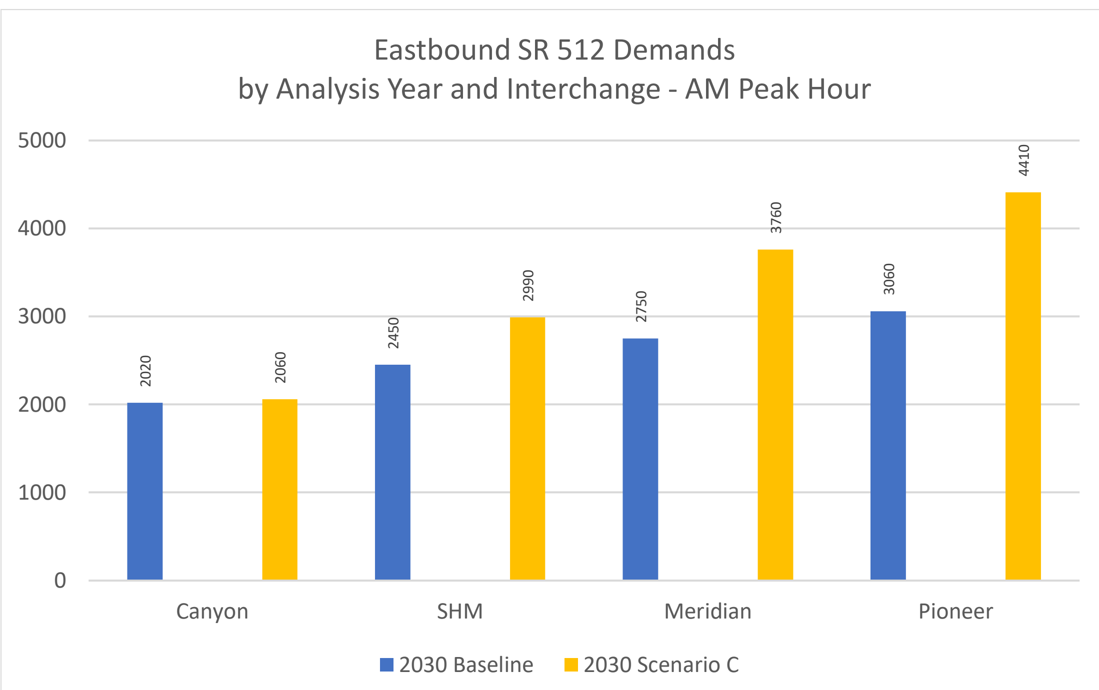
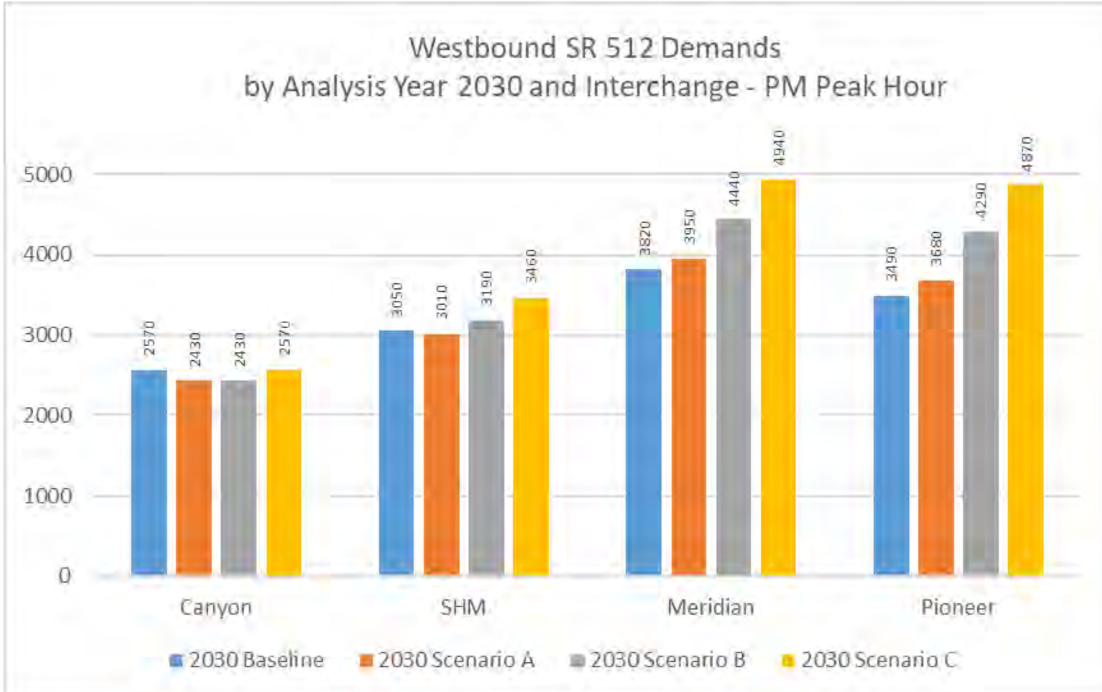


Figure H-6. 2030 PM and AM Peak Period Westbound SR 512 Demands



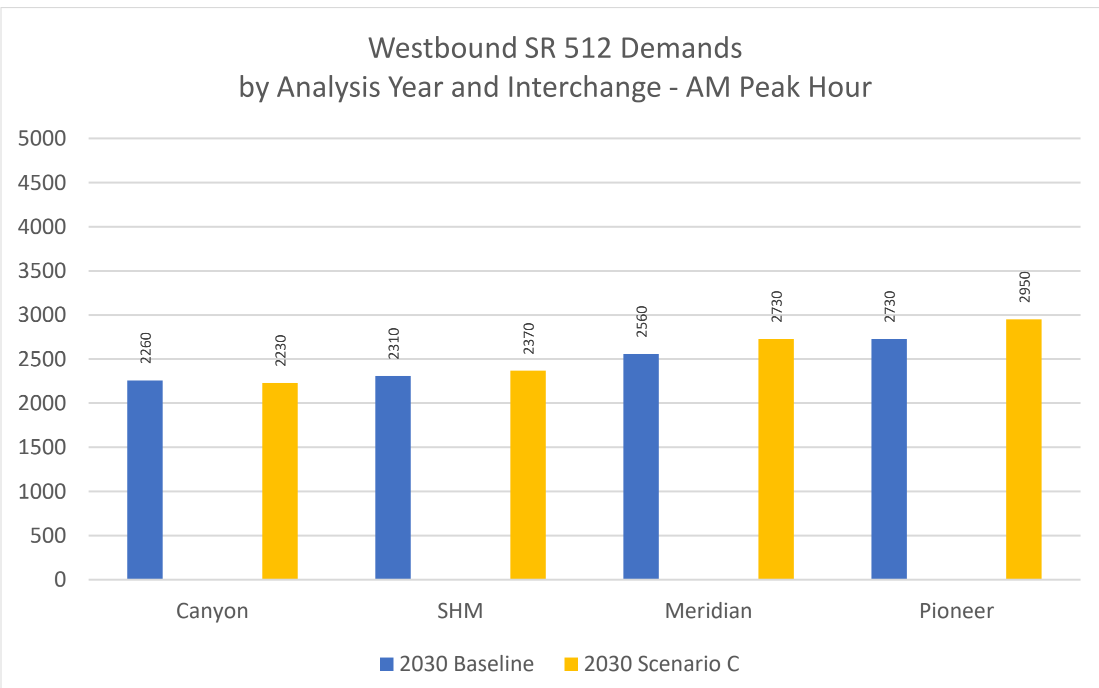
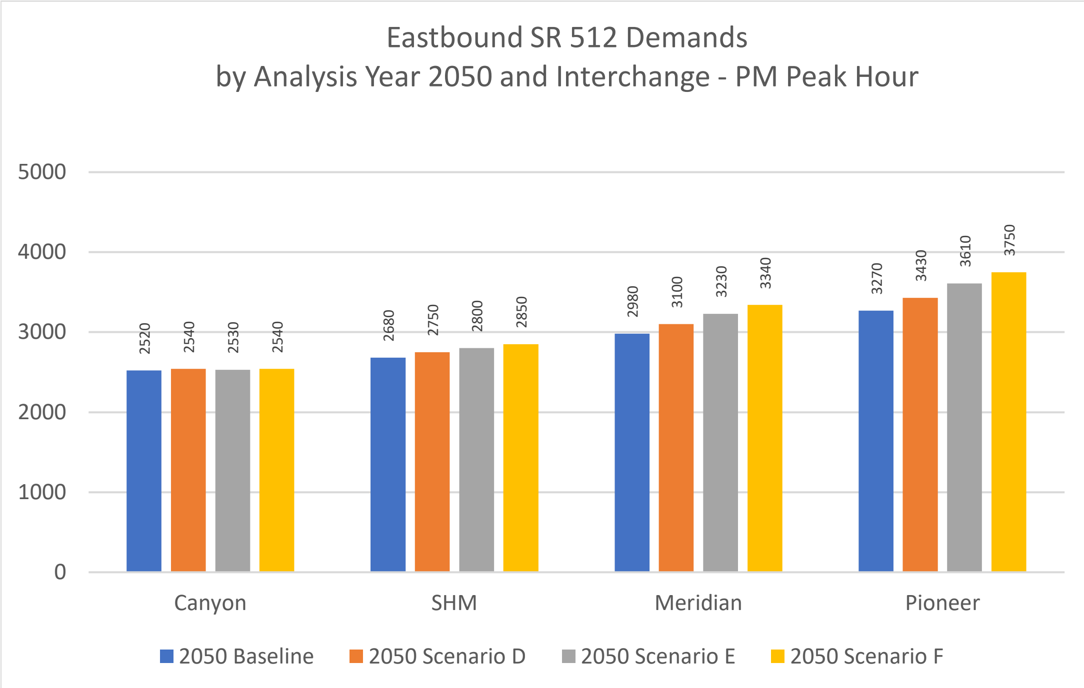


Figure H-7. 2050 PM and AM Peak Period Eastbound SR 512 Demands



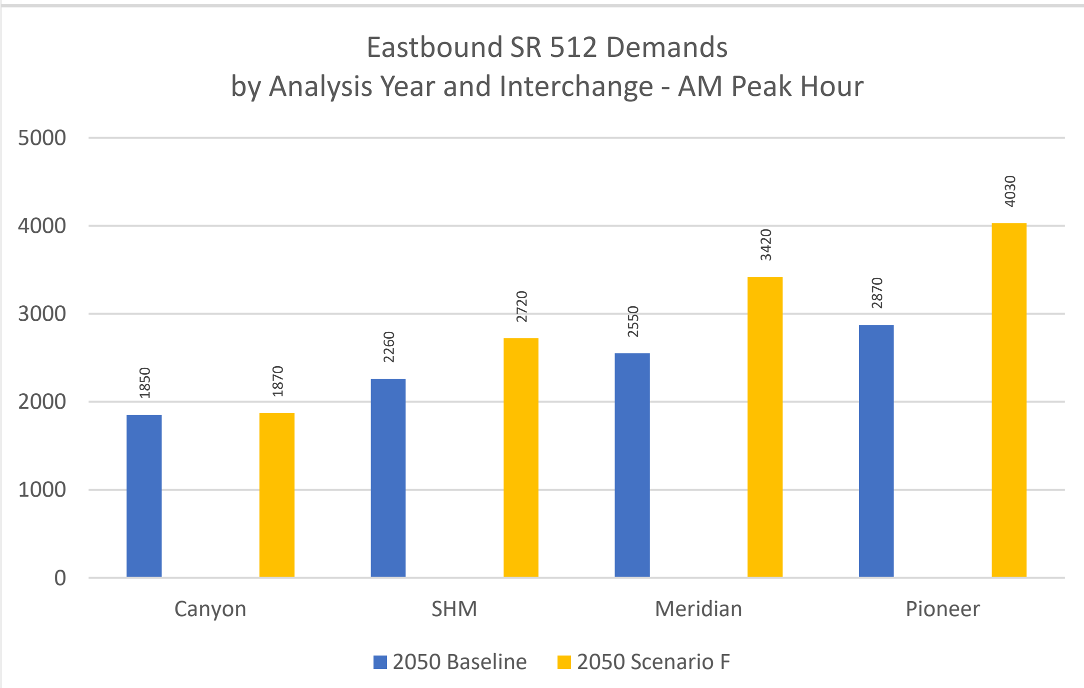
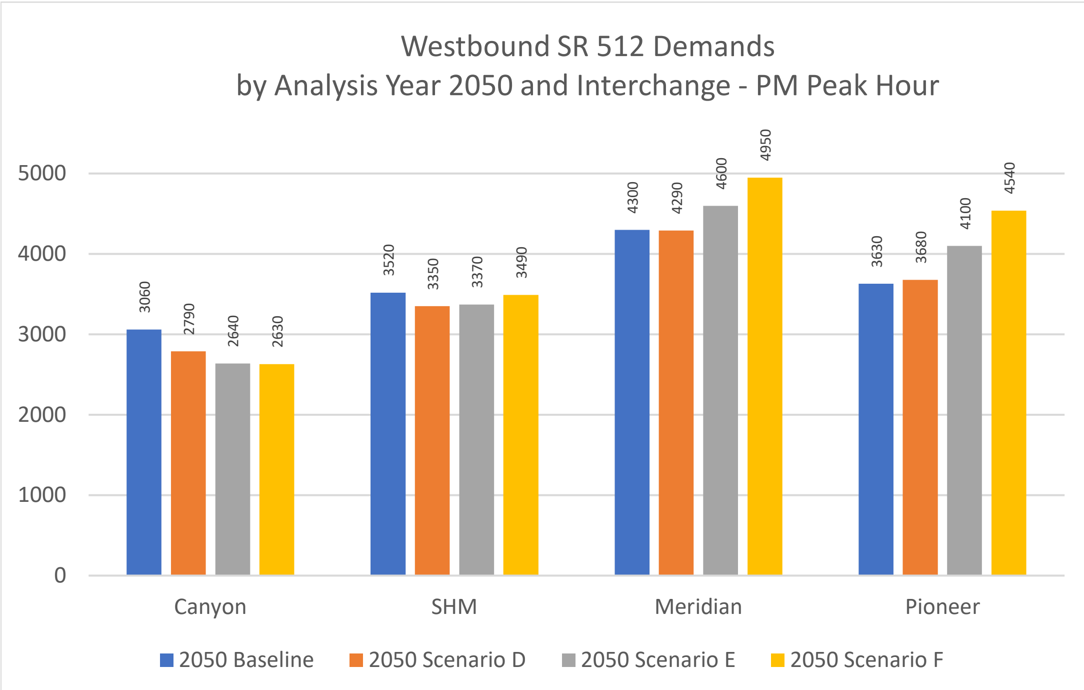
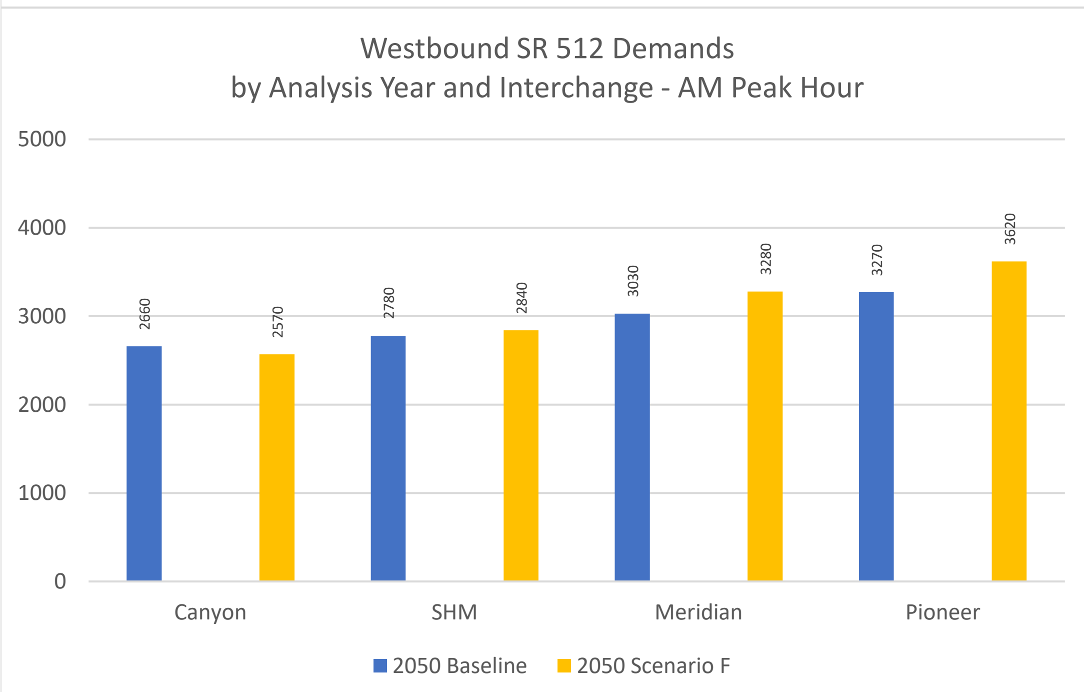


Figure H-8. 2050 PM and AM Peak Period Westbound SR 512 Demands





Intersections

Intersection forecasts also followed NCHRP 765 methodologies. Intersection approach volume growth from the existing and future year TDM models was applied to existing intersection turning movement counts. The turning movement counts were adjusted to generate future year volumes and balanced with adjacent intersections as necessary. As a final post-processing step, ramp volumes were adjusted to match freeway forecasts. The 2030 and 2050 AM and PM peak hour intersection turn movement volumes were generated for the
Synchro/SimTraffic analysis.

5.0 Traffic Operations Analysis

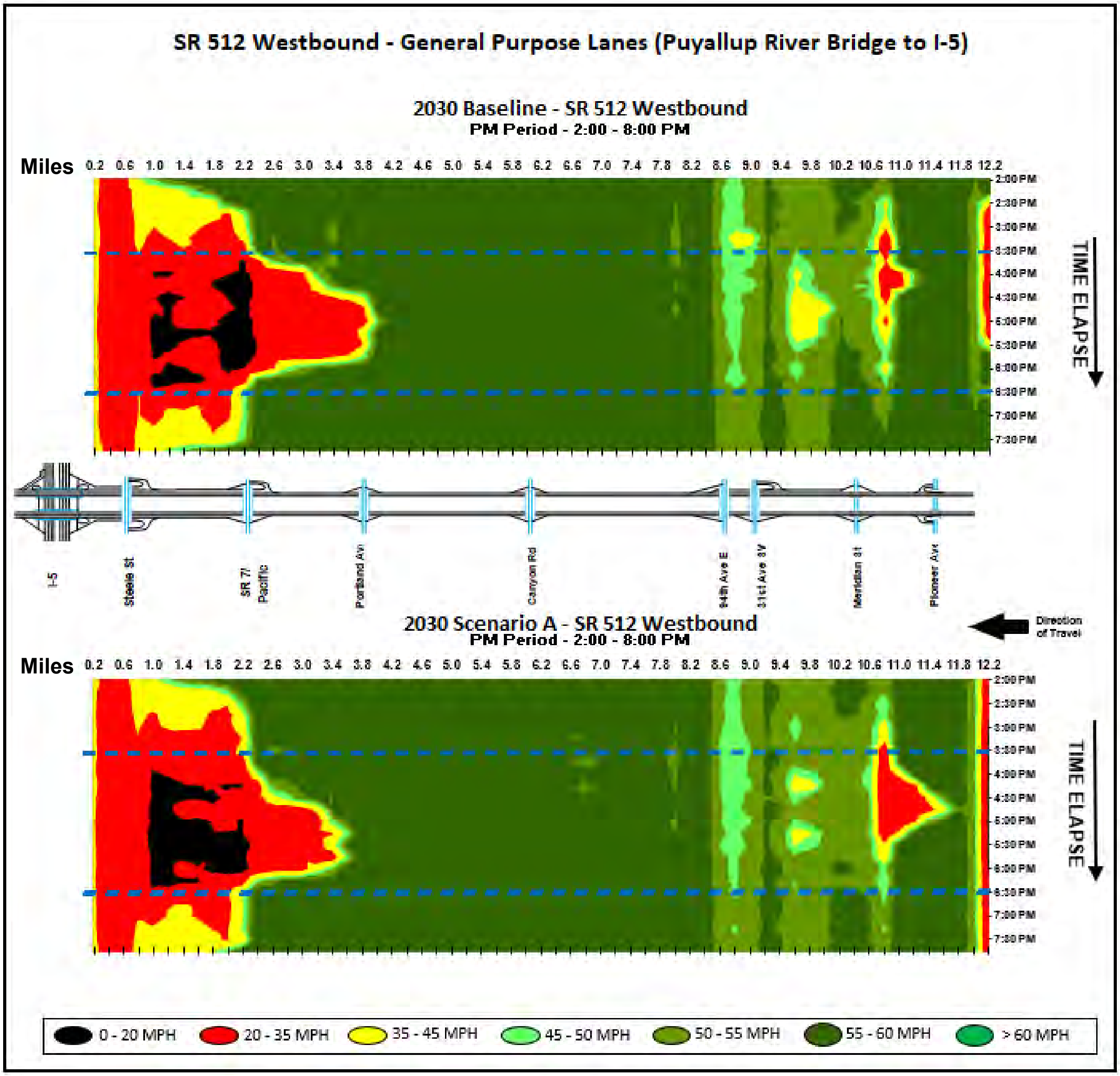
5.1 Future Year 2030 Build Scenarios

Future year 2030 models were developed from the Existing Conditions Vissim model documented in *SR 512: I-5 to SR 167 Corridor Study Existing Condition Technical Memorandum*. For purposes of this analysis, the PM peak period is being analyzed along the SR 512 corridor for all scenarios. Scenario C will also be analyzed for the AM peak period. For comparative purposes, the 2030 Baseline scenarios were analyzed for both AM and PM peak periods.

2030 Scenario A – PM Peak

A heat map comparing 2030 Baseline and 2030 Build Scenario A freeway speeds and congestion in the study area are provided for westbound and eastbound SR 512 in Figure H-9 and Figure H-10 from the Vissim model simulation results.

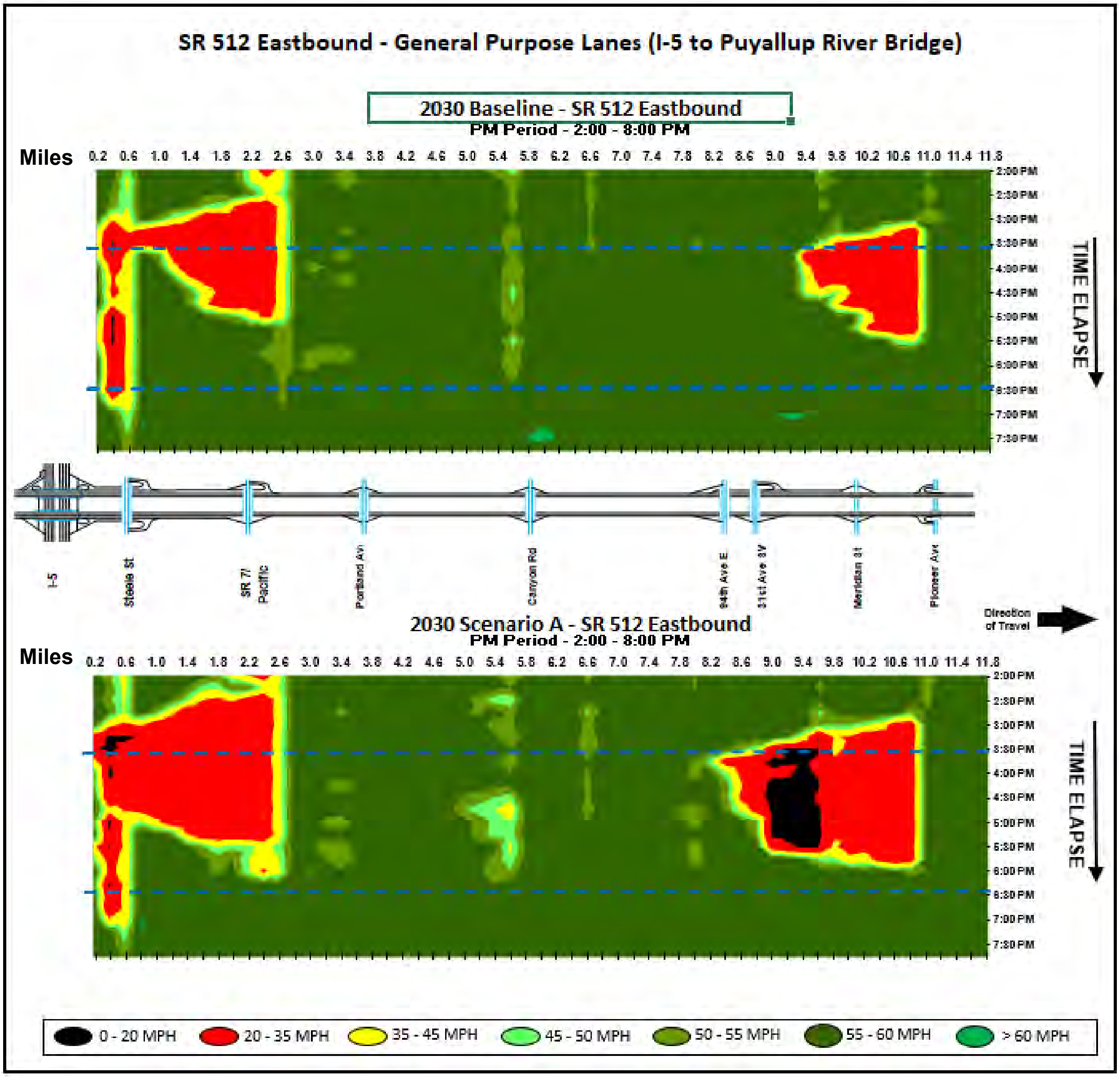
Figure H-9. 2030 PM and AM Peak Period Westbound SR 512 Demands



Westbound SR 512

The congestion between S Meridian and 31st Avenue SW remain similar to the Baseline scenario. The ETL direct connection merging with the general-purpose lanes upstream of the SR 167 westbound to SR 512 westbound merge creates significant operational deficiencies, which directly affects congestion on SR 167 beyond the scope of this study area. The impacts to SR 512 are minimal with this option; however, the impacts are significant to SR 167 operations.

Figure H-10. 2030 PM Period Baseline vs Build Scenario A Eastbound SR 512 Heat Maps



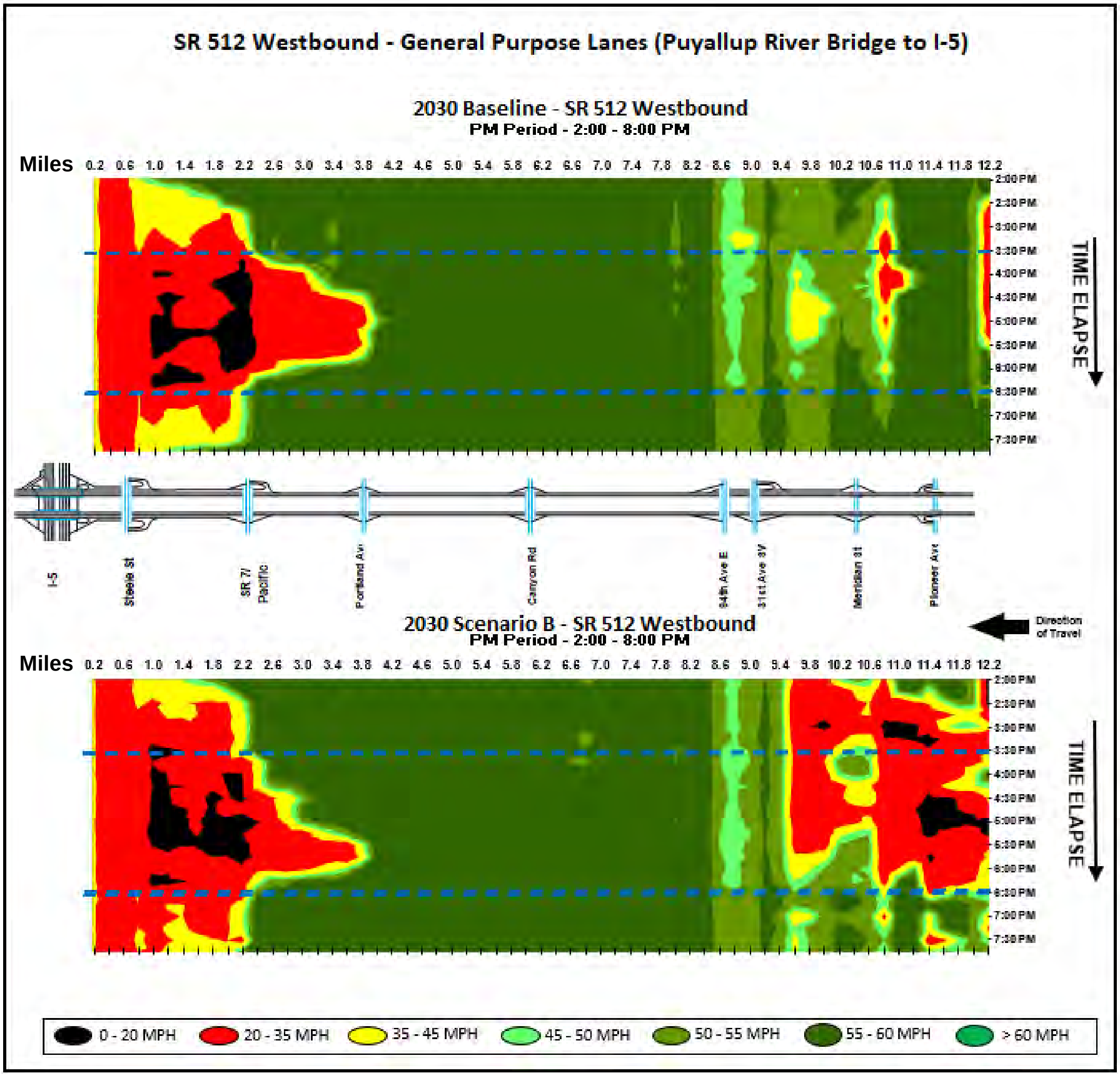
Eastbound SR 512

Eastbound SR 512 has limited to no change in volume between the Baseline scenario and Scenario A. The configuration of the ETL has no relative impact during this peak period. Congestion due to the S Meridian eastbound merge remains consistent or slightly worse in Scenario A due to the reallocated demand to SR 512 corridor from local arterials.

2030 Scenario B – PM Peak

A heat map comparing 2030 Baseline and 2030 Build Scenario B freeway speeds and congestion in the study area are provided for westbound and eastbound SR 512 in Figure H-11 and Figure H-12 from the Vissim model simulation results.

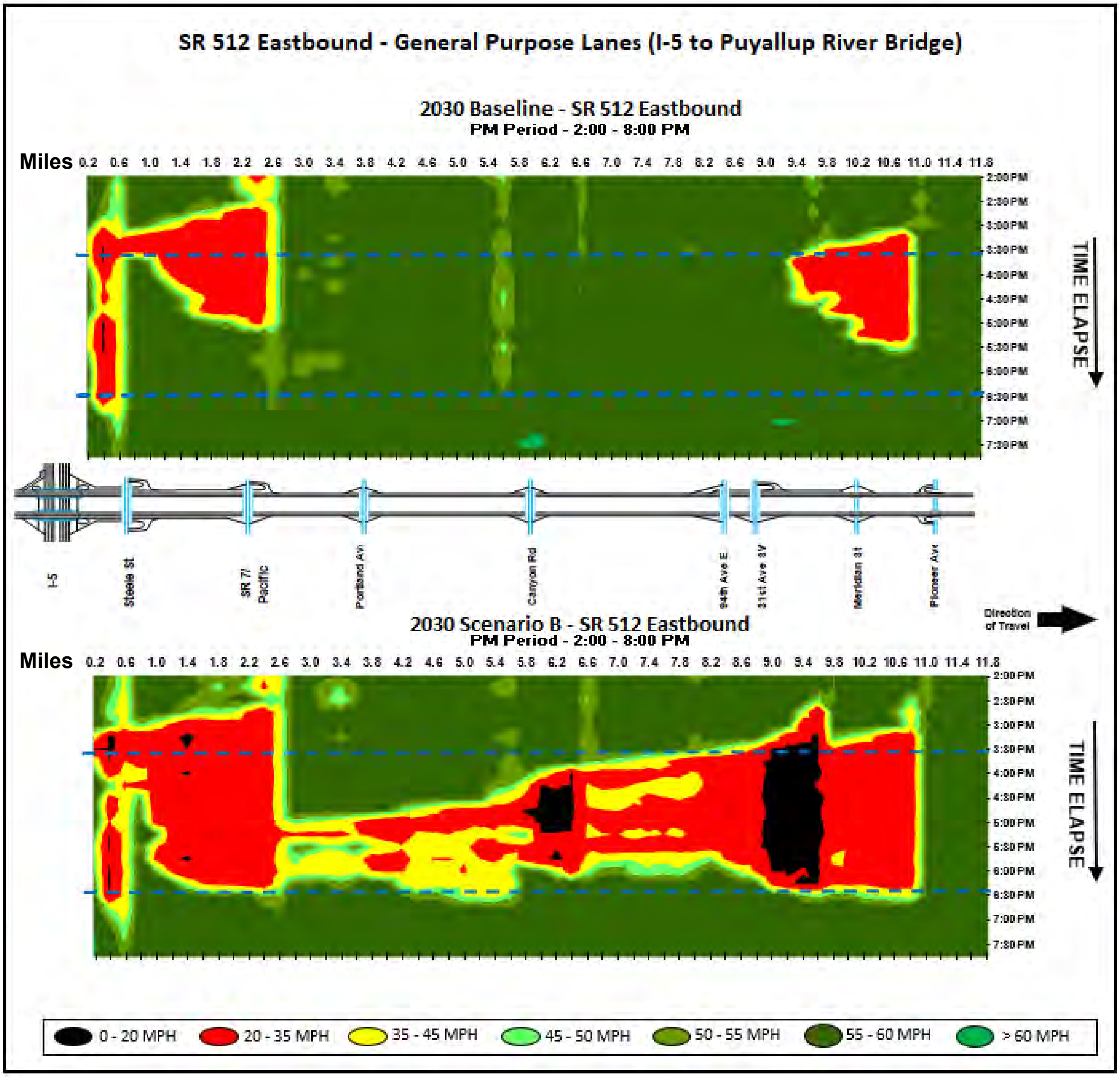
Figure H-11. 2030 PM Period Baseline vs Build Scenario B Westbound SR 512 Heat Maps



Westbound SR 512

Westbound congestion between 31st Avenue SW and S Meridian would increase with Scenario B due the additional the SR 167 ETL direct connection at E Pioneer. The increase encourages more vehicles to get to the weaves, but Scenario B changes would also attract more vehicles to the off-ramps of both 31st Avenue SW and S Meridian. The ETL ending at E Pioneer allows vehicles adequate distance to weave; however, traffic is now aligned in the innermost lanes, which creates more weaving maneuvers that induces congestion over a longer period. The congestion occurring east of E Pioneer is the SR 167 to SR 512 merge which queuing affects SR 167 beyond SR 410 in the Baseline. This congestion is worse in Scenario B due to the ETLs merging to the general-purpose lane at E Pioneer, causing the downstream weaves to operate over capacity.

Figure H-12. 2030 PM Period Baseline vs Build Scenario B Eastbound SR 512 Heat Maps



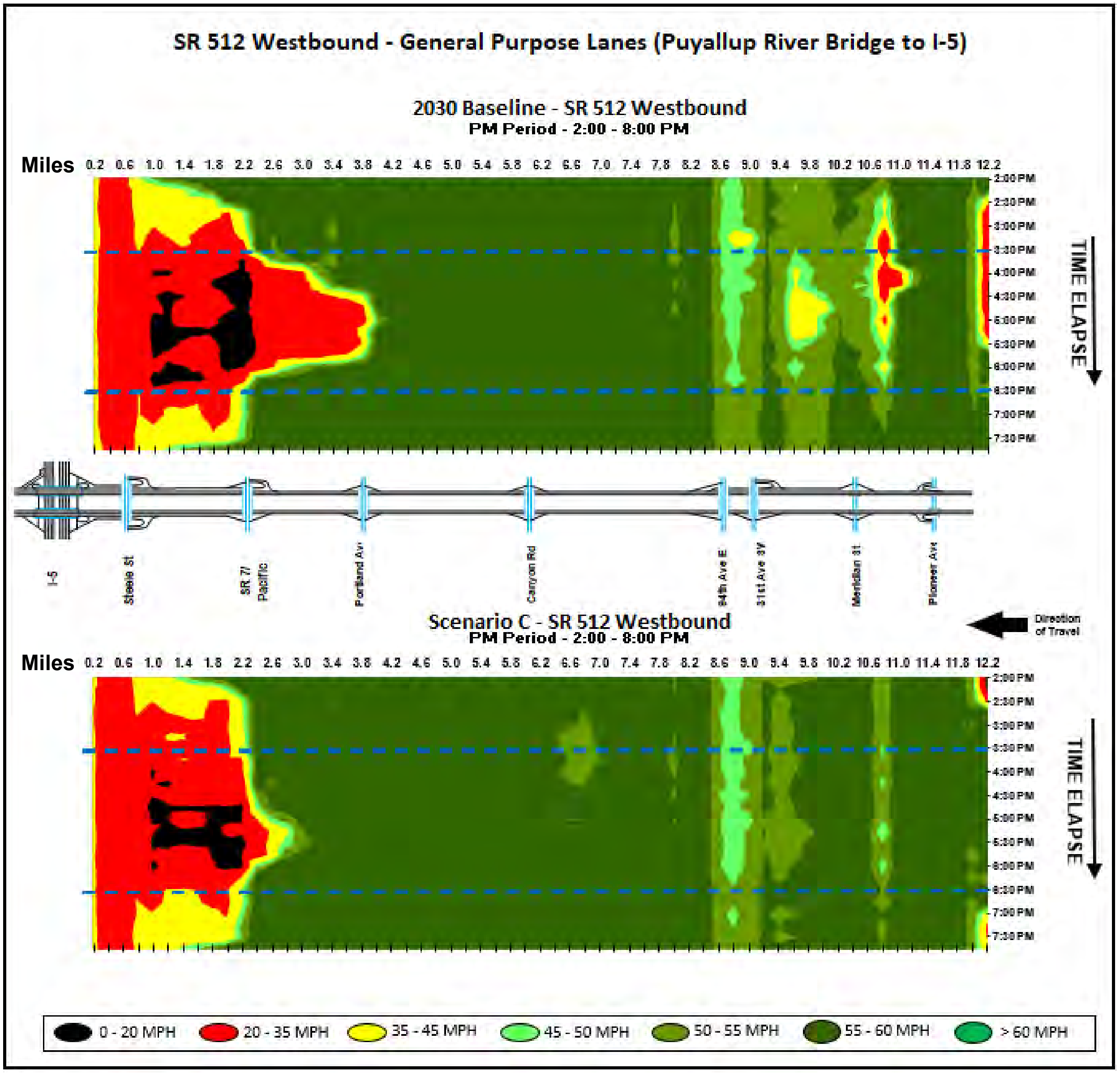
Eastbound SR 512

Eastbound SR 512 has limited to no change in volume between the Baseline scenario and Scenario B. Congestion due to the S Meridian eastbound merge is significantly worsened in Scenario B due to the reallocated demand to SR 512 corridor from local arterials. Traffic destined for the ETL connection must change multiple lanes of traffic to preposition in the innermost lane accessing the ETL.

2030 Scenario C – PM Peak

A heat map comparing 2030 Baseline and 2030 Build Scenario C freeway speeds and congestion in the study area are provided for westbound and eastbound SR 512 in Figure H-13 and Figure H-14 from the Vissim model simulation results.

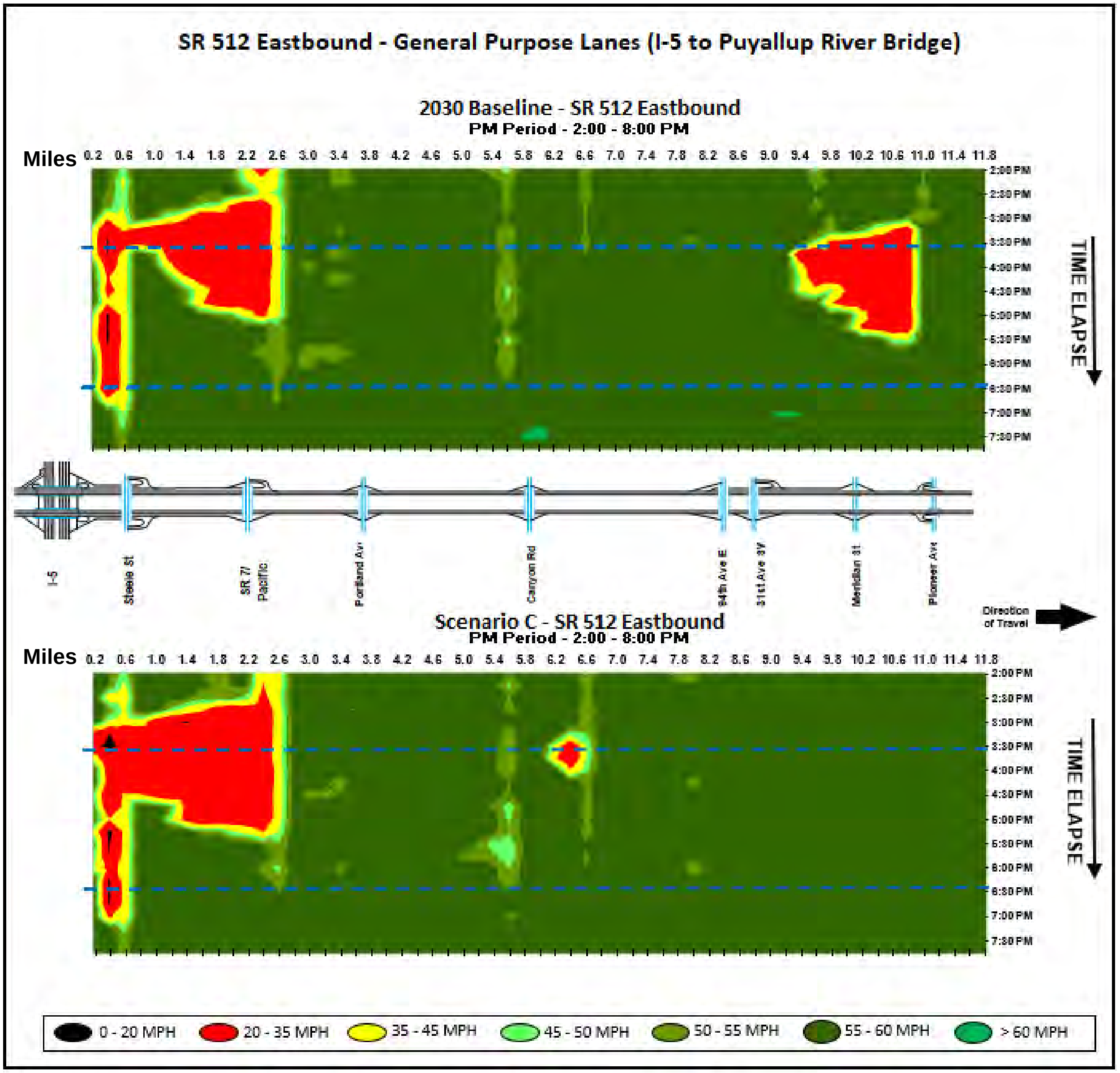
Figure H-13. 2030 PM Period Baseline vs Build Scenario C Westbound SR 512 Heat Maps



Westbound SR 512

The ETL continues westbound on SR 512 as a transition lane, which improves the weaves between E Pioneer and S Meridian, and S Meridian and 31st Avenue SW. The additional diverge lane to 31st Avenue SW helps reduce congestion needing to position early to exit there. The congestion occurring east of E Pioneer is the SR 167 to SR 512 merge, which queuing affects SR 167 beyond SR 410 in the Baseline. This congestion does not occur in Scenario C due to the ETL being separated as its own lane and transitioning back to general purpose and far as 31st Avenue SW.

Figure H-14. 2030 PM and AM Peak Period Westbound SR 512 Demands



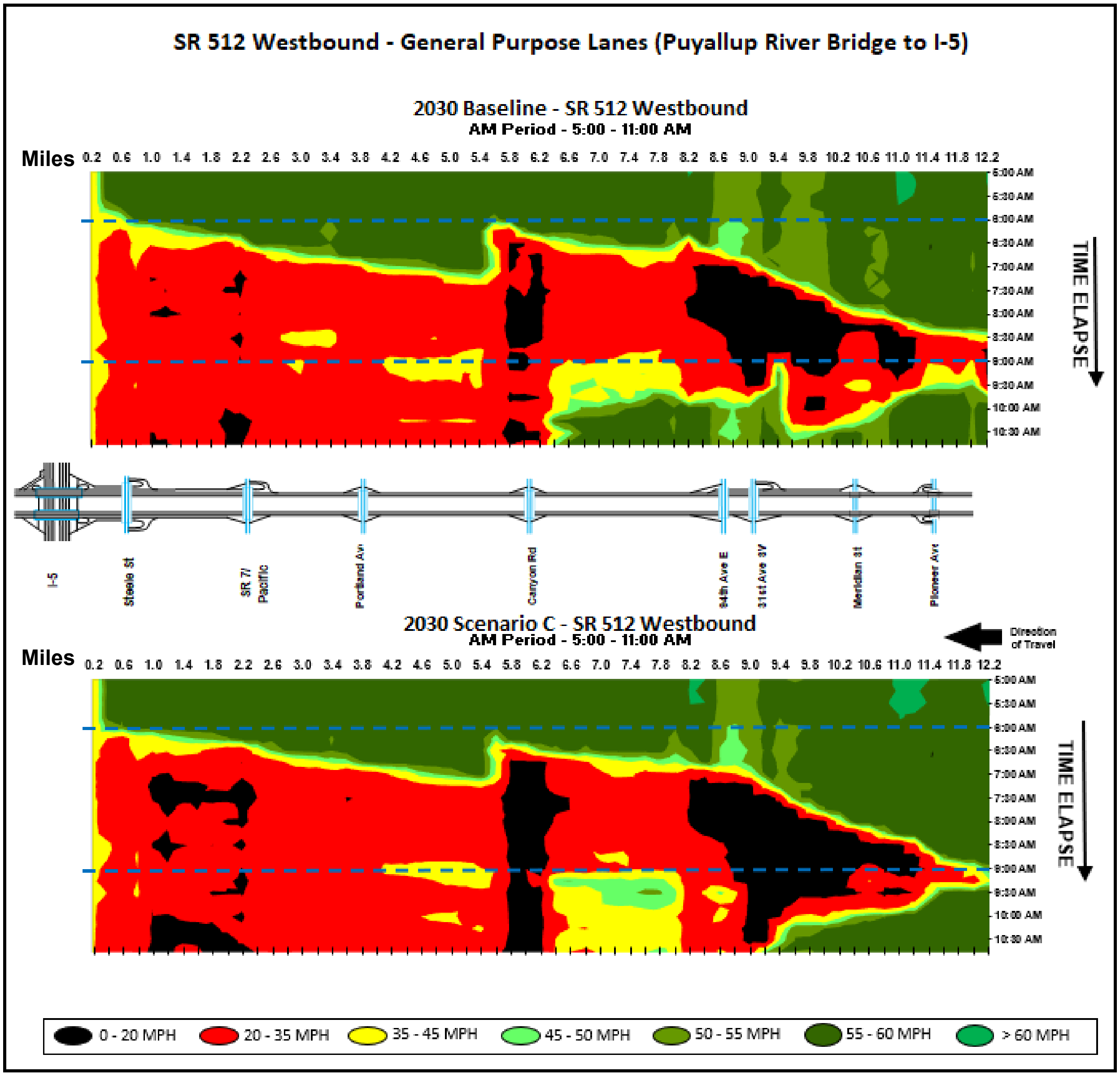
Eastbound SR 512

The ETL increases SR 512 demand, which increases the need for an auxiliary lane from 31st Avenue SW. This allows ETL traffic to travel free flow until the separated ETL diverge at E Pioneer.

2030 Scenario C – AM Peak

A heat map comparing 2030 Baseline and 2030 Build Scenario C freeway speeds and congestion in the study area are provided for westbound and eastbound SR 512 in Figure H-15 and Figure H-16 from the Vissim model simulation results. As noted previously, Scenario C was the only scenario analyzed for the AM Peak Period.

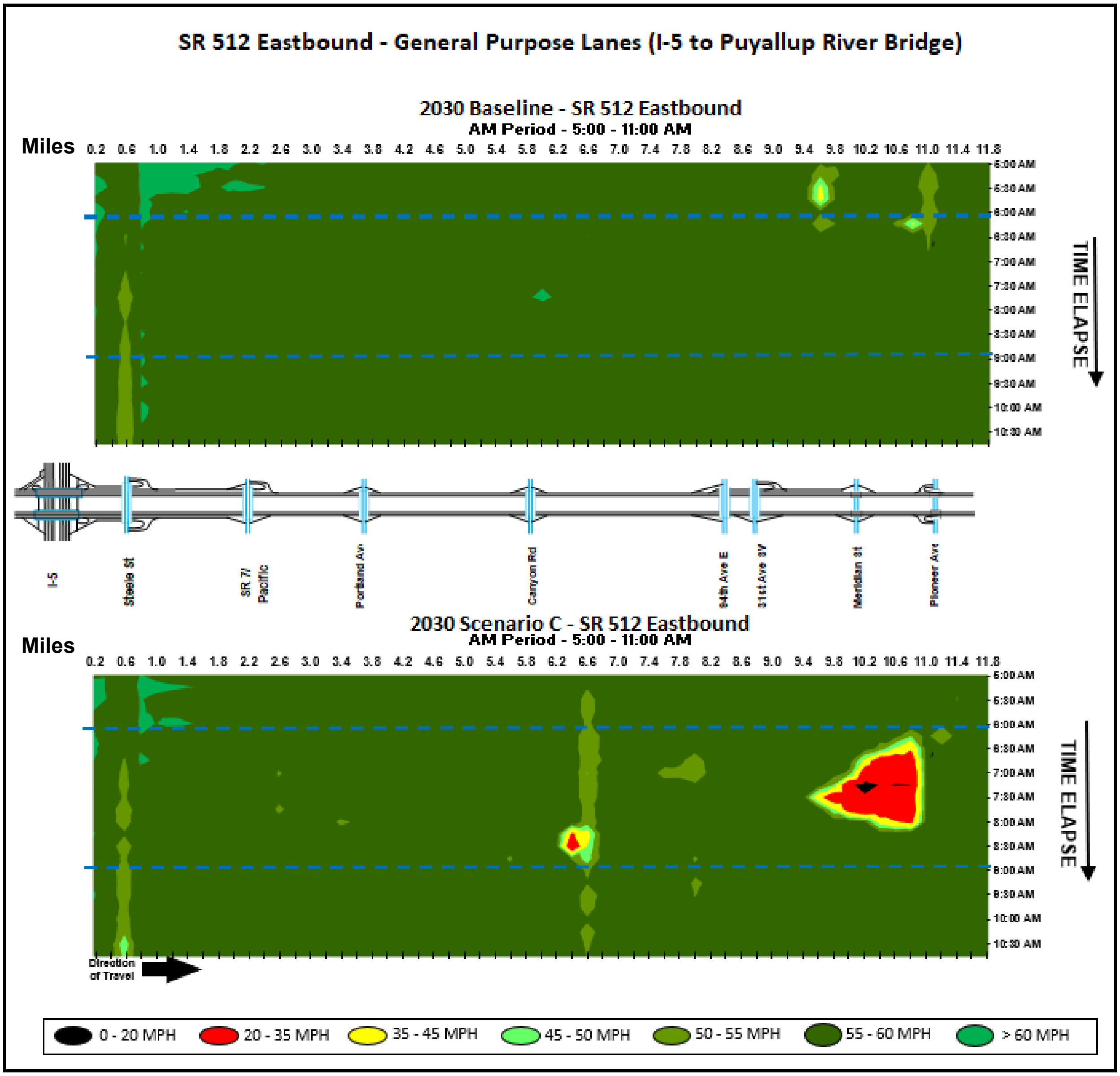
Figure H-15. 2030 AM Period Baseline vs Build Scenario C Westbound SR 512 Heat Maps



Westbound SR 512

The congestion occurring at the I-5 and SR 512 system interchange is severe and queues as far as the 94th Avenue merge in the Baseline. Once the queue extends beyond this point, the effects on the upstream merges and weaves degrade, causing severe congestion as far as the end of the SR 512 corridor. The forecasted SR 512 demand east of the South Hill Mall interchanges is not expected to increase demand west of the South Hill Mall, which should not increase traffic into the end of this congestion. The increased demand along SR 512 is projected to be destined for S Meridian and 31st Avenue SW with minimal new traffic continue to the west of these interchanges.

Figure H-16. 2030 AM Period Baseline vs Build Scenario C Eastbound SR 512 Heat Maps



Eastbound SR 512

In both the Baseline scenario and Scenario C, the congestion downstream on SR 167 does not exist due to the SR 167 ETL addition. The minimal congestion present in Scenario C is due to the increase in traffic demand trying to access the ETL. This added traffic is localized and increases the SR 512 on-ramps from 31st Avenue SW and S Meridian, which causes the S Meridian merge to operate over capacity for a short time during the peak period.

2030 Ramp-Terminal and Arterial Intersection Analysis Results

Figure H-17 shows the percent of intersection meeting Level of Service (LOS) performance thresholds, LOS D or better. This metric is calculated based on the average delay of all movements and approaches. Figure H-17 represents all 2030 Scenarios for the PM Peak hour only. Future traffic demands to/from arterials increase as capacity is added over the Puyallup River are most prevalent in Scenario C. Signal timing optimization was implemented at all intersections for this analysis, but intersections around the South Hill Mall and along S Meridian cannot operate efficiently with the apparent induced traffic demands and increased vehicle throughput due to the ETLs.

Figure H-17. 2030 PM Peak Hour Percent of Intersections meeting LOS Performance Thresholds (Synchro Results)

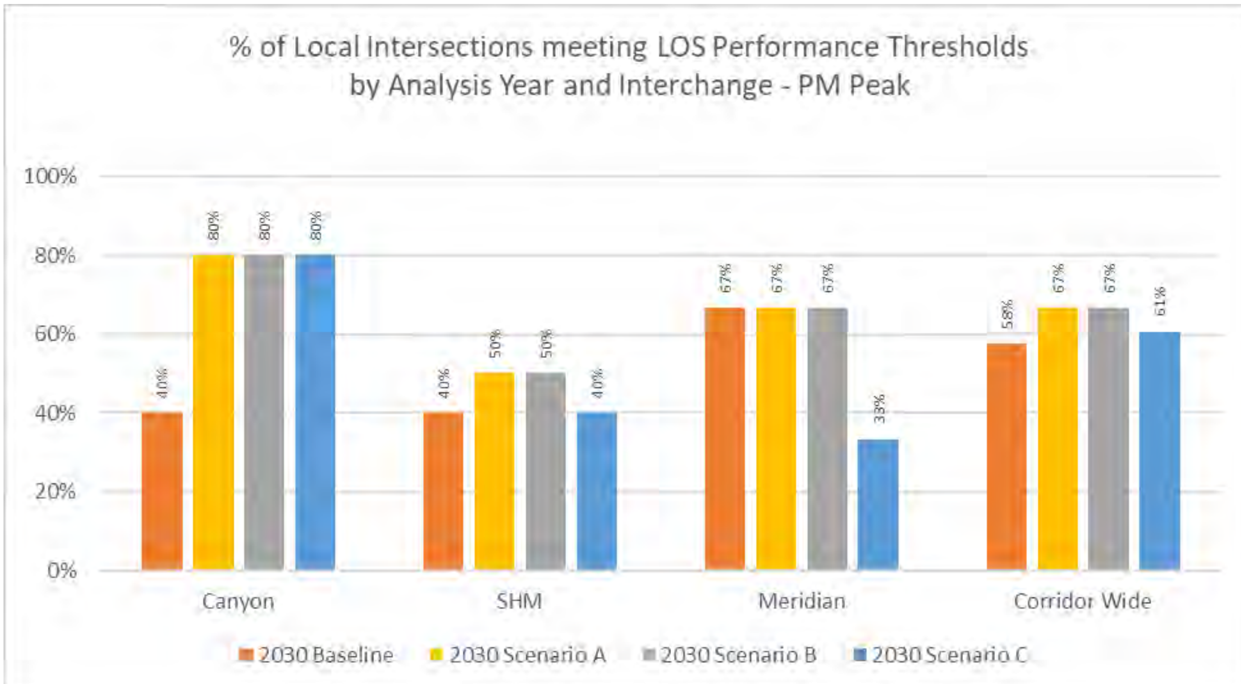
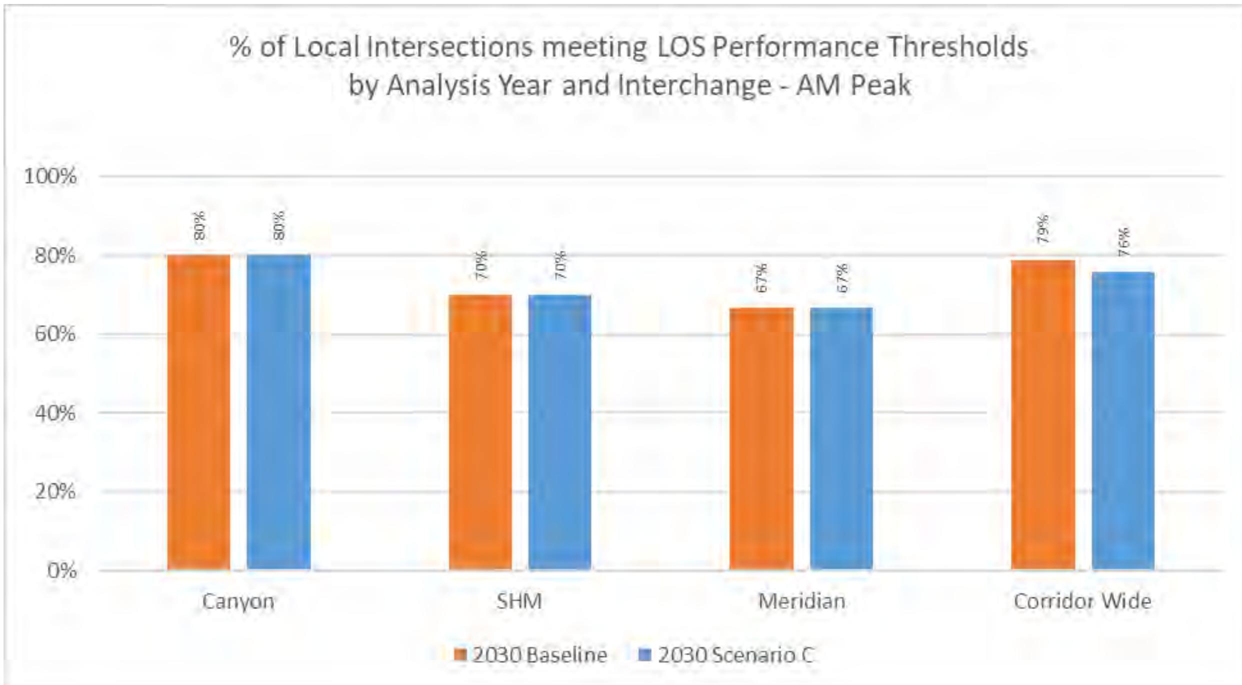


Figure H-18 shows the percent of intersection meeting LOS performance thresholds (LOS D or better). This metric is calculated based on the average delay of all movements and approaches. Figure H-18 represents only 2030 Baseline and Scenario C for the AM Peak hour. The traffic demands in the AM Peak hour had no significant impact to the ramp-terminal and local intersections.

Figure H-18. 2030 AM Peak Hour Percent of Intersections meeting LOS Performance Thresholds (Synchro Results)



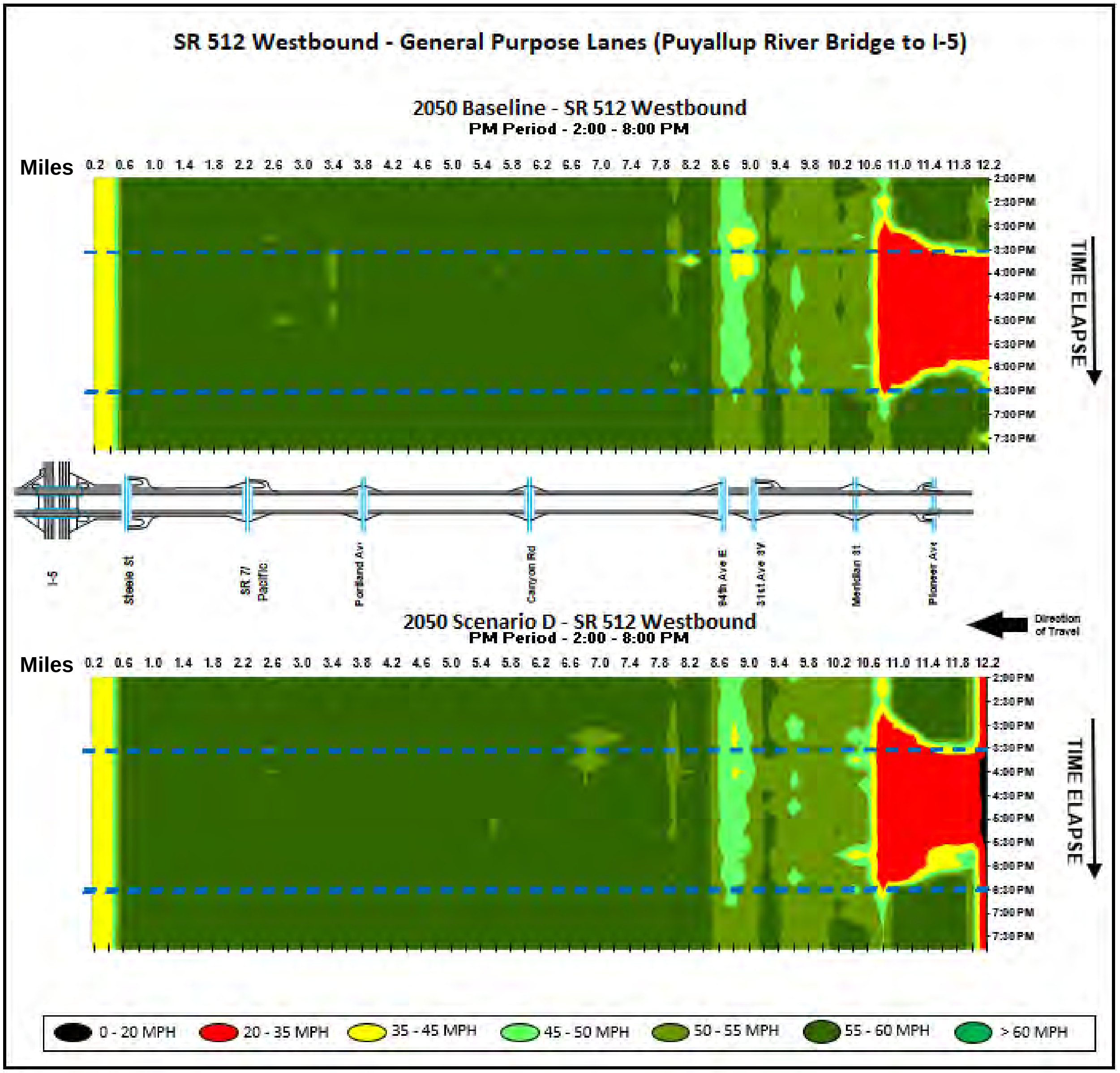
6.0 Future Year 2050 Build Scenarios

Future year 2050 models were developed from the Existing Conditions Vissim model documented in *SR 512: I-5 to SR 167 Corridor Study Existing Conditions Technical Memorandum*. For purposes of this analysis, the PM peak period is being analyzed along the SR 512 corridor for all scenarios. Scenario F will also be analyzed for the AM peak period. For comparative purposes, the 2050 Baseline scenarios were analyzed for both AM and PM peak periods.

2030 Scenario D – PM Peak

A heat map comparing 2050 Baseline and 2050 Build Scenario D freeway speeds and congestion in the study area are provided for westbound and eastbound SR 512 in Figure H-19 and Figure H-20, respectively, from the Vissim model simulation results

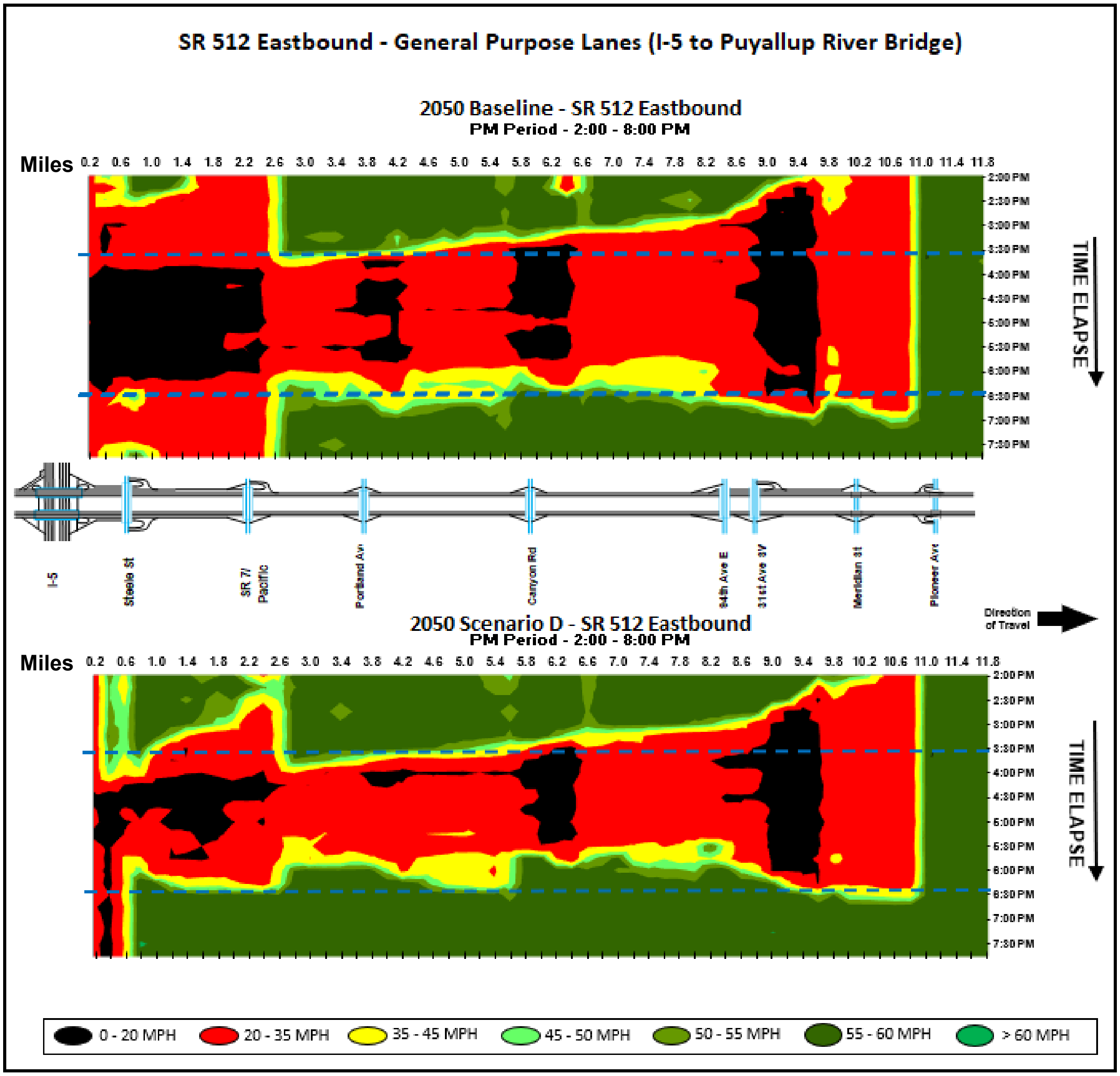
Figure H-19. 2050 PM Period Baseline vs Build Scenario D Westbound SR 512 Heat Maps



Westbound SR 512

Similar to the near-term year 2030 results, the congestion between S Meridian and 31st Avenue SW remain similar to the Baseline scenario. The ETL direct connection merging with the general-purpose lanes upstream of the SR 167 westbound to SR 512 westbound merge creates significant operational deficiencies, which directly affects congestion on SR 167 beyond the scope of this study area. The impacts to SR 512 are minimal with this option; however, the impacts are significant to SR 167 operations. By long-term year 2050, demand projections increase slightly compared to near-term year 2030 which is evident in the increased congestion in the Scenario D heat maps, compared to the Scenario A congestion indicated previously in Figures H-9 and H-10.

Figure H-20. 2050 PM Period Baseline vs Build Scenario D Eastbound SR 512 Heat Maps



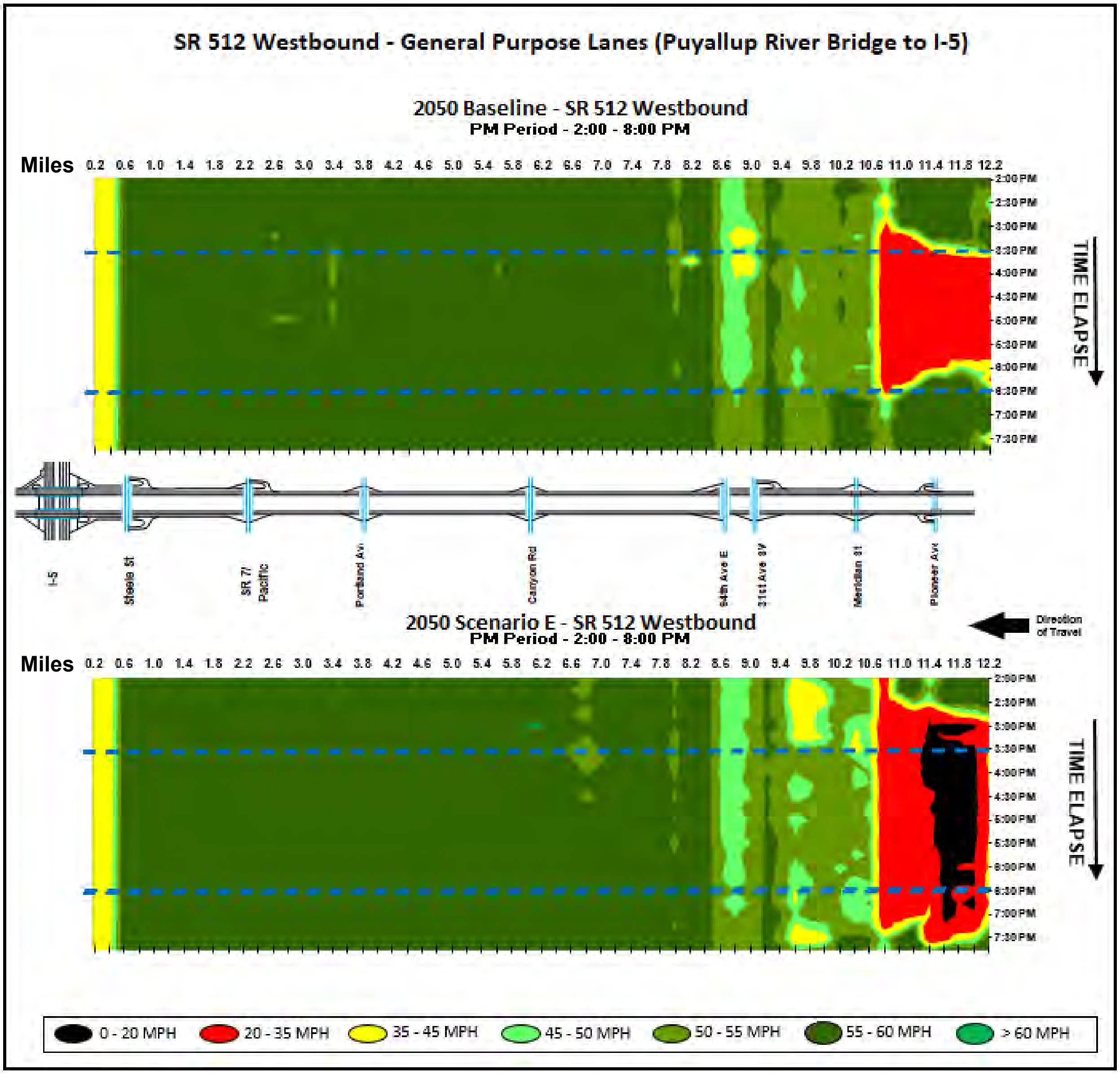
Eastbound SR 512

Unlike near-term year 2030, long-term year 2050 eastbound SR 512 has significant growth in volume in the Baseline scenario. The configuration of the ETL has no relative impact during this peak period. Congestion due to the S Meridian eastbound merge remains consistent or slightly worse in Scenario D as a result of the reallocated demand to SR 512 corridor from local arterials.

2050 Scenario E – PM Peak

A heat map comparing 2050 Baseline and 2050 Build Scenario E freeway speeds and congestion in the study area are provided for westbound and eastbound SR 512 in Figure H-21 and Figure H-22 from the Vissim model simulation results.

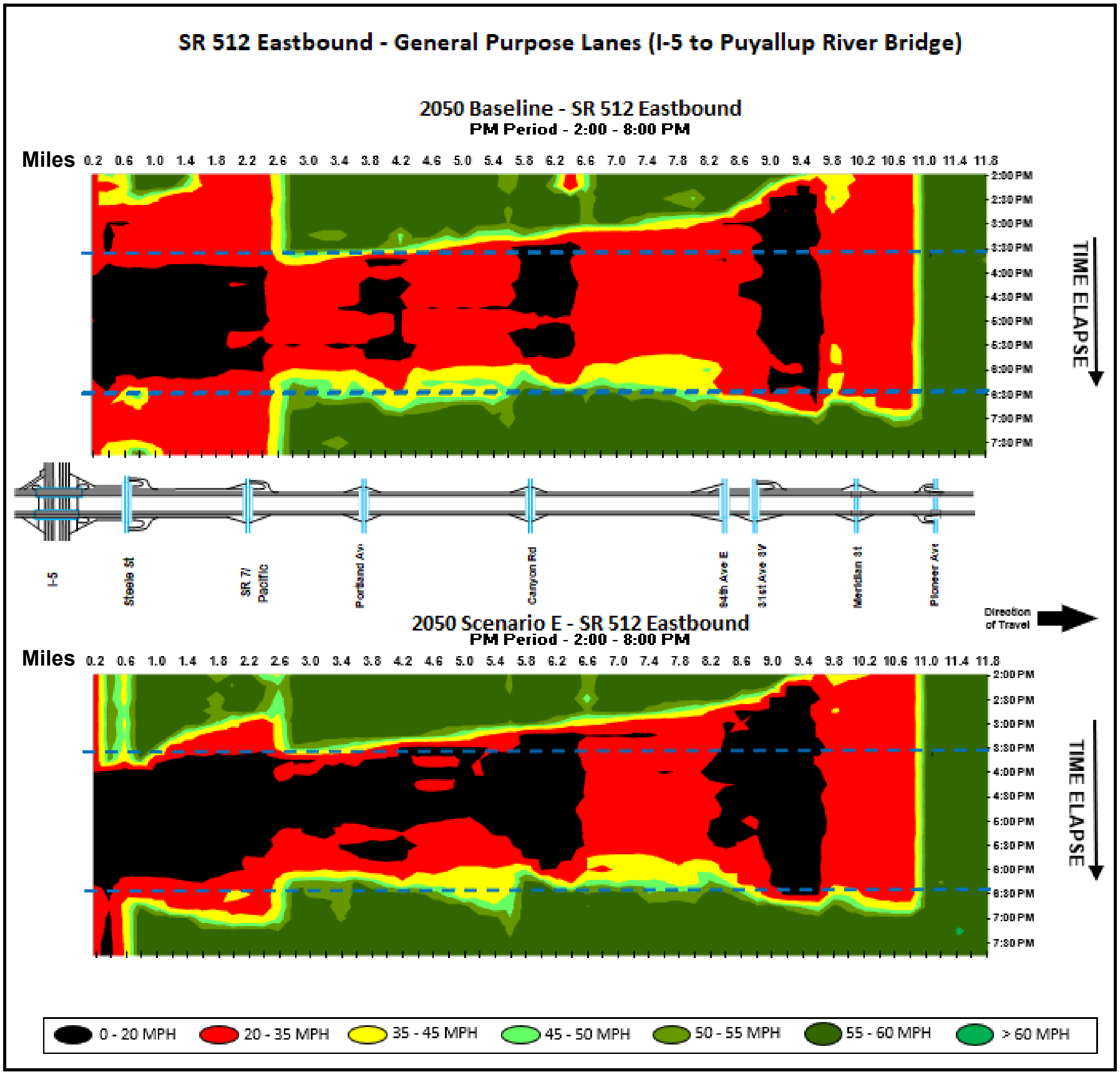
Figure H-21. 2050 PM Period Baseline vs Build Scenario E Westbound SR 512 Heat Maps (Vissim Results)



Westbound SR 512

Westbound congestion between 31st Avenue SW and S Meridian would increase due the additional the SR 167 ETL direct connection at E Pioneer. The latent demand congestion on SR 167 can now bypass the SR 167 to SR 512 merge. This traffic demand allows more vehicles to get to the weaves, but also attracts more vehicles to the off-ramps of both 31st Avenue SW and S Meridian The ETL ending at E Pioneer allows vehicles adequate distance to weave; however, traffic is now aligned in the innermost lanes, which creates more weaving maneuvers that induces congestion over a longer period. The congestion occurring east of E Pioneer is the SR 167 to SR 512 merge, which queuing affects SR 167 beyond SR 410. This congestion is worse in Scenario E due to the ETLs merging to the general-purpose lane at E Pioneer, causing the downstream weaves to operate over capacity.

Figure H-22. 2050 PM Period Baseline vs Build Scenario E Eastbound SR 512 Heat Maps



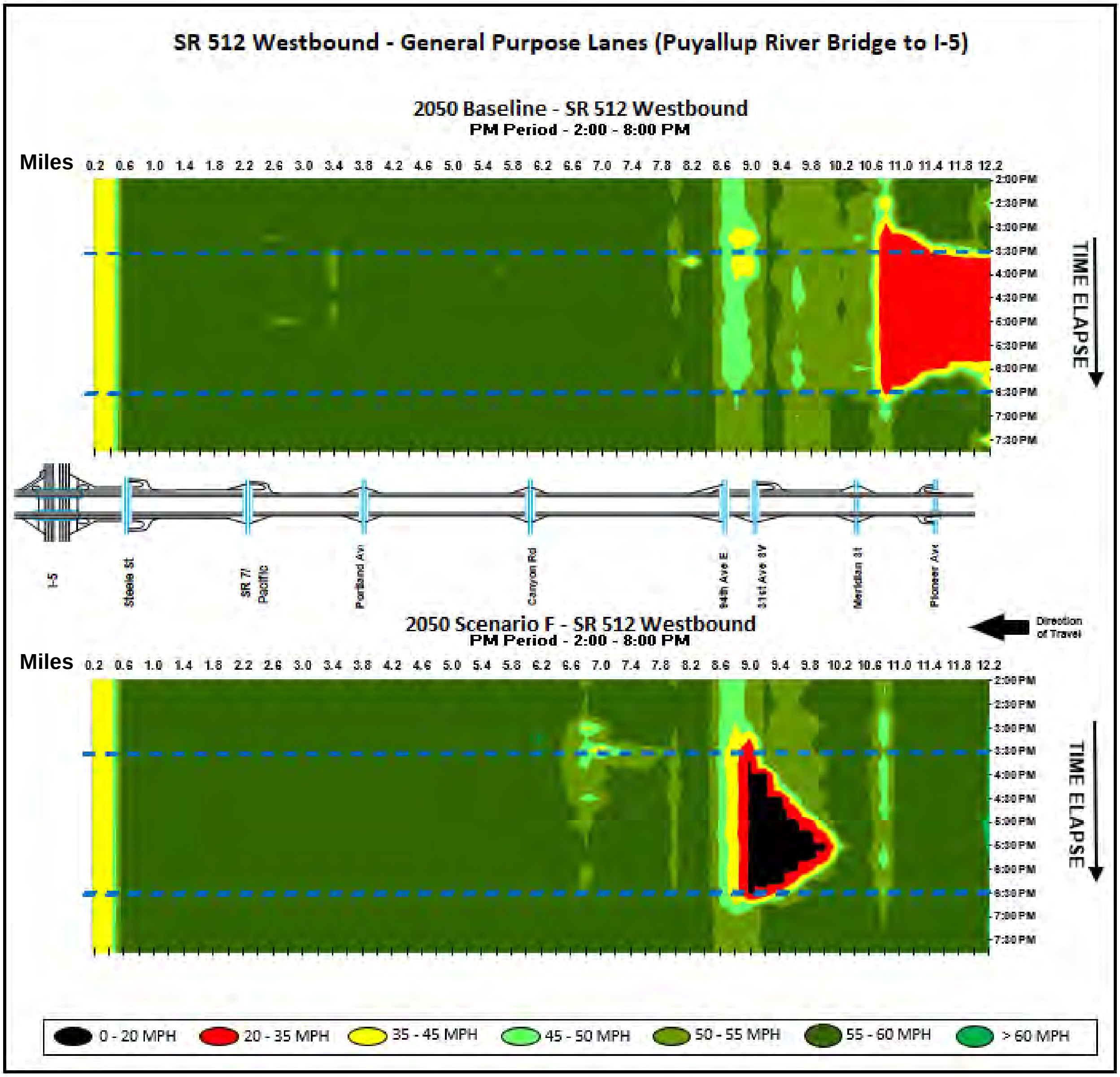
Eastbound SR 512

Unlike near-term year 2030, long-term year 2050 eastbound SR 512 has significant growth in volume in the Baseline scenario. The configuration of the ETL has no relative impact during this peak period. Congestion due to the S Meridian eastbound merge remains consistent or slightly worse in Scenario E due to the reallocated demand to SR 512 corridor from local arterials. Increased operational congestion occurs due to the prepositioning of traffic wanting to use the ETL diverge at E Pioneer.

2050 Scenario F – PM Peak

A heat map comparing 2050 Baseline and 2050 Build Scenario F freeway speeds and congestion in the study area are provided for westbound and eastbound SR 512 in Figure H-23 and Figure H-24 from the Vissim model simulation results.

Figure H-23. 2050 PM Period Baseline vs Build Scenario F Westbound SR 512 Heat Maps

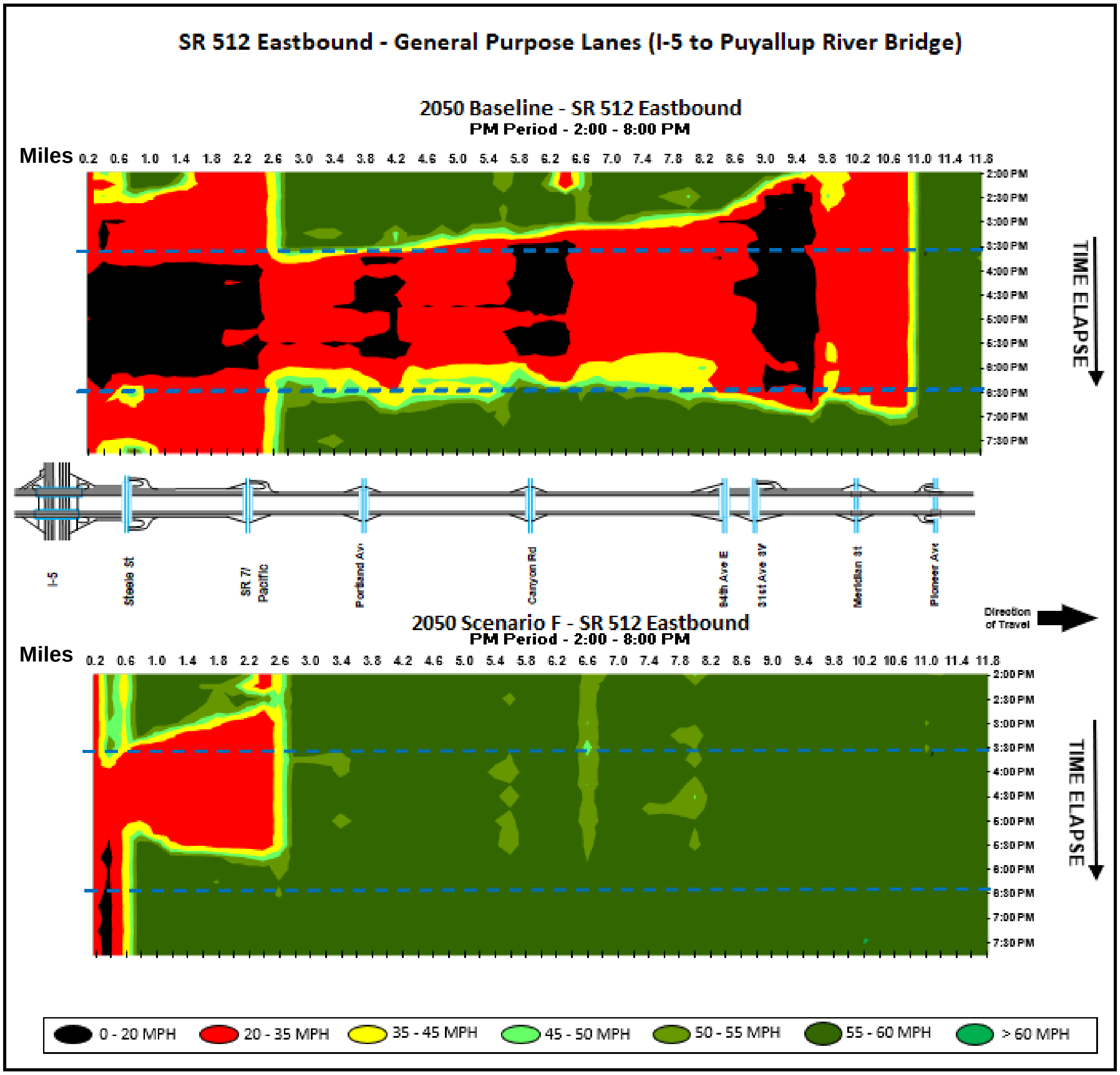


Westbound SR 512

The ETL continues westbound on SR 512 as a transition lane, which improves the weaves between E Pioneer and S Meridian, and S Meridian and 31st Avenue SW. The additional diverge lane to 31st Avenue SW helps reduce congestion needing to position early to get off at 31st Avenue SW. The congestion occurring east of E Pioneer is the SR 167 to SR 512 merge, where queuing affects SR 167 beyond SR 410. This congestion does not occur in Scenario C due to the ETL being separated as its own lane and transitioning to an auxiliary-lane as far as 31st

Avenue SW. In Scenario F, there is a capacity constraint west of the 94th Avenue merge and the increased demand due to the ETL bottlenecks at this location.

Figure H-24. 2050 PM Period Baseline vs Build Scenario F Eastbound SR 512 Heat Maps



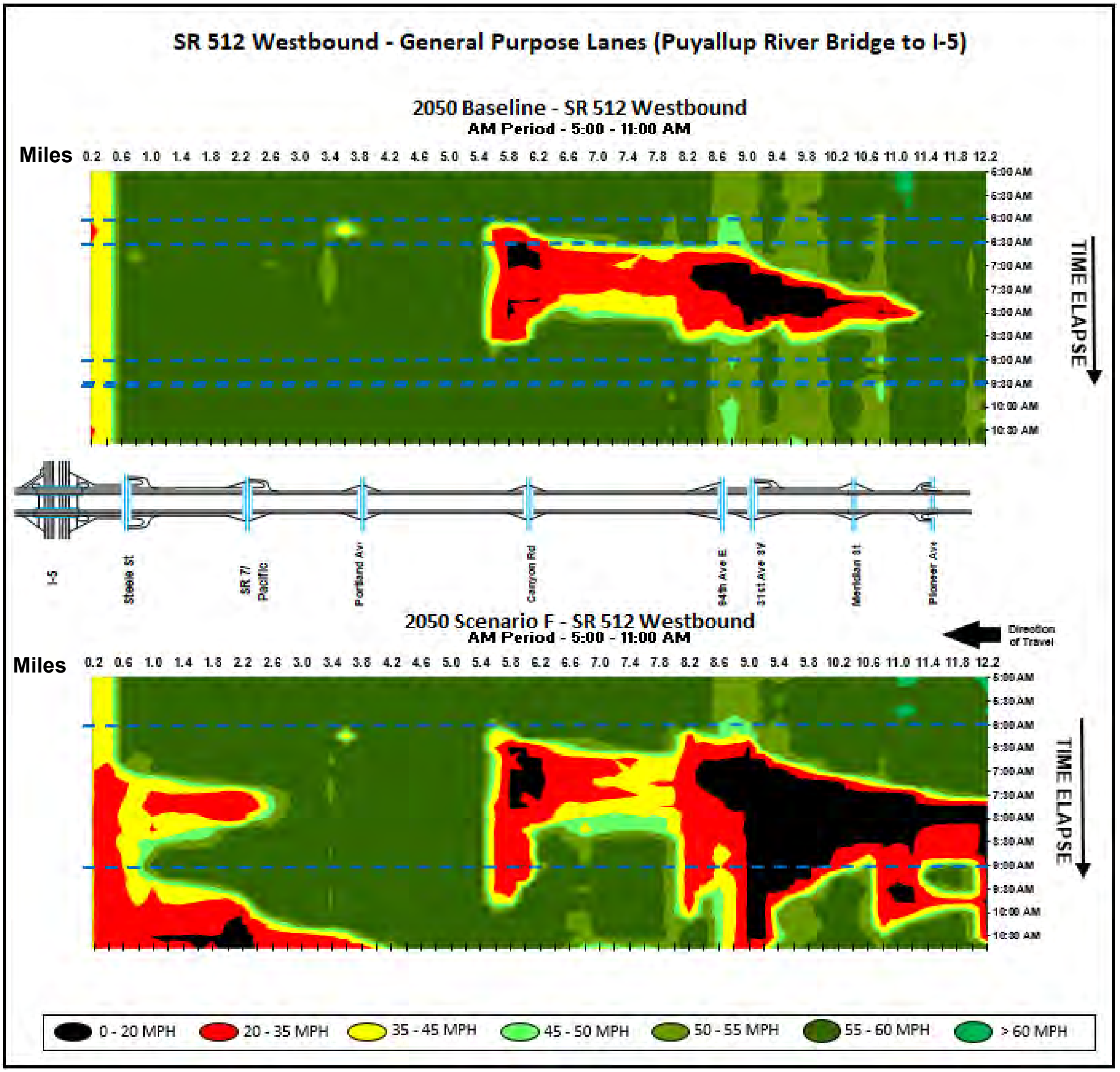
Eastbound SR 512

The ETL increases SR 512 demand, which increases the need for an auxiliary lane from 31st Avenue SW. This allows ETL traffic to travel free flow until the separated ETL diverge at E Pioneer.

2050 Scenario F – AM Peak

A heat map comparing 2050 Baseline and 2050 Build Scenario F freeway speeds and congestion in the study area are provided for westbound and eastbound SR 512 in Figure H-25 and Figure H-26 from the Vissim model simulation results

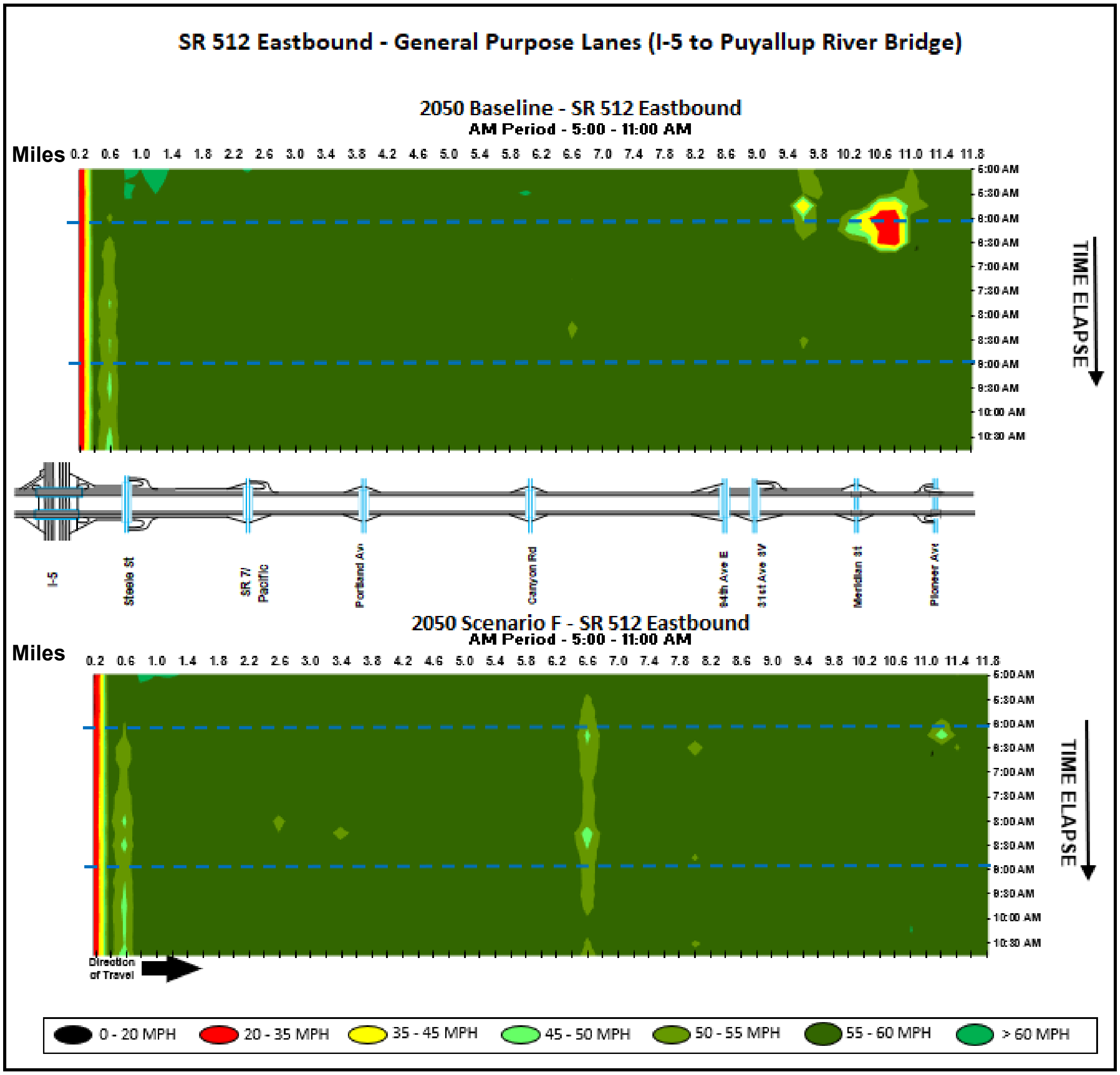
Figure H-25. 2050 AM Period Baseline vs Build Scenario F Westbound SR 512 Heat Maps



Westbound SR 512

Congestion in near-term year 2030 was due to the I-5 and SR 512 interchange ramps not having sufficient capacity to serve peak SR 512 demand. For long-term year 2050, an improvement is made to these ramps that serves all traffic demand exiting SR 512. The congestion occurring along SR 512 is now prevalent at the Canyon Road merge. Scenario F would increase demand in this merge, as well demand at the 94th Avenue two-lane section.

Figure H-26. 2050 AM Period Baseline vs Build Scenario F Eastbound SR 512 Heat Maps



Eastbound SR 512

In both Baseline scenario and Scenario F, the congestion downstream on SR 167 does not exist due to the SR 167 ETL addition. The minimal congestion present in the Baseline scenario is due to the S Meridian merge; this is improved in Scenario F with ETL traffic utilizing the auxiliary lane prior to the diverge at E Pioneer. Unlike Scenario C, traffic destined for the ETL originates from localized interchanges, and by the year 2050, extends to the west to include other interchange origins, minimizing the demand increases from both 31st Avenue SW and S Meridian.

2050 Ramp-Terminal and Arterial Intersection Analysis Results

Figure H-27 shows the percent of intersection meeting LOS performance thresholds (peak hour LOS D or better). This metric is calculated based on the average delay of all movements and approaches. Figure H-27 represents all 2050 Scenarios for the PM peak hour only. Future traffic demands to/from arterials increase as capacity is added over the Puyallup River bridge2, which is most prevalent in Scenario C. Signal timing optimization was implemented at all studied intersections, but intersections around the South Hill Mall and along S Meridian cannot operate efficiently with the induced traffic demands due to the ETLs.

Figure H-27. 2050 PM Peak Hour Percent of Intersections meeting LOS Performance Thresholds (Synchro Results)

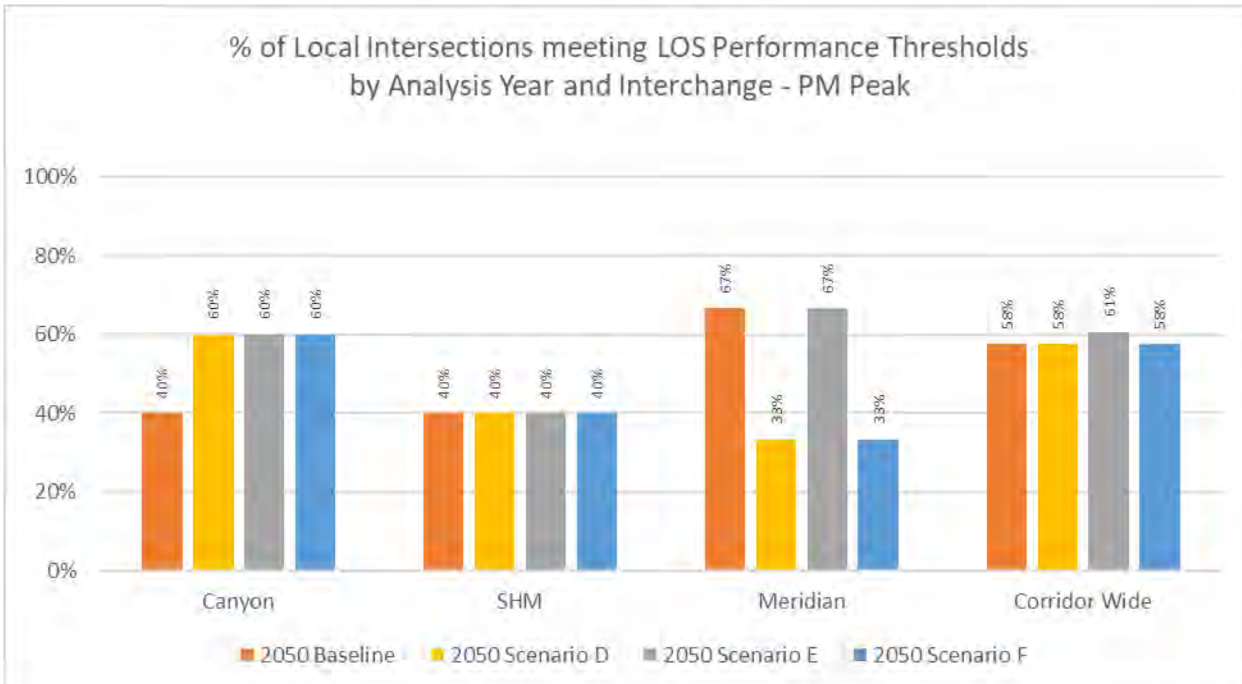


Figure H-28 shows the percent of intersection meeting LOS performance thresholds (LOS D or better). This metric is calculated based on the average delay of all movements and approaches. Figure H-28 represents only 2030 Baseline and Scenario C for the AM Peak hour. The traffic demands in the AM Peak hour had no significant impact to the ramp-terminal and local intersections.

Figure H-28. 2030 AM Peak Hour Percent of Intersections meeting LOS Performance Thresholds (Synchro Results)