U.S. Department
of Transportation

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Administration**

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September 12, 2012

HDE-WA/WA 1080

Ms. Paula J. Hammond
Secretary of Transportation
Department of Transportation
Olympia, Washington

Attention: Pasco Bakotich III, P.E.

**I-5/Port of Tacoma Road Interchange
Justification Report**

Dear Ms. Hammond:

This letter is to inform you that based upon our review of the subject Interchange Justification Report (IJR), the FHWA grants a finding of engineering and operational acceptability for the proposed modifications to the I-5/Port of Tacoma Road Interchange.

Once the project has been reviewed and approved under the provisions of the National Environmental Policy Act and other pertinent environmental mandates and if there are no major changes to the proposed project final approval of the access may be given upon your request.

This finding and final approval is also contingent upon the submission and acceptance of a conceptual signing plan for the proposal.

Please contact Don Petersen at (360) 534-9323 or Dean Moberg at (360) 534-9344 if you have any questions regarding this action.

Sincerely,

DANIEL M. MATHIS, P.E.
Division Administrator

Donald A Petersen

By: Donald A. Petersen
Division Safety/Design Engineer

Enclosure
cc: Barb De Ste Croix, MS 47336, Trent Rickman, MS 47336, Scott Zeller, MS 47329, Dean Moberg

Interchange Justification Report

Interstate 5

Port of Tacoma Road Interchange with I-5

I-5 MP 135.65 to 136.61

This ***Interchange Justification Report***, prepared under my direct supervision, has been prepared in accordance with RCW 18.43 and appropriate Washington State Department of Transportation manuals.

☐ **IJR Engineer of Record**

JILMA V. MENDEZ BLACK
STATE OF WASHINGTON
Stamp
35237
REGISTERED
PROFESSIONAL ENGINEER
EXPIRES: 9/10/13

☐ **Traffic Analysis Engineer**

By: _____ P.E.

Principal
Title

Date: June 13, 2012

☒ **Concurrence – City of Fife Public Works Director**

By: _____, P.E. Date: June 8, 2012

☐ **Concurrence – Region Traffic Review**

By: _____, P.E. Date: June 14, 2012

☐ **WSDOT Concurrence – Assistant State Design Engineer**

By: _____, P.E. Date: August 14, 2012

☐ **WSDOT Approval – Development Services & Access Manager**

By: _____, P.E. Date: Aug 14, 2012

☐ **FHWA Approval – FHWA Safety and Design Engineer**

By: _____, Date: Sept. 12, 2012

Final Interchange Justification Report

Port of Tacoma Road Interchange with Interstate 5
Fife, Washington

Submitted to

City of Fife
Fife, Washington

April 2012

Submitted by

BergerABAM
33301 Ninth Avenue South, Suite 300
Federal Way, Washington 98003-2600

In association with

Fehr and Peers
Heffron Transportation
GeoEngineers, Inc.
Widener & Associates
ESM Consulting Engineers

Job No. SAPWT-09-139

FINAL INTERCHANGE JUSTIFICATION REPORT

Port of Tacoma Road Interchange with Interstate 5
Fife, Washington

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LIST OF ABBREVIATIONS AND ACRONYMS

City	City of Fife
CTR	Commute Trip Reduction
DCE	Documented Categorical Exclusion
DM	Design Manual
EIS	Environmental Impact Statement
FHWA	Federal Highway Administration
FMSIB	Freight Mobility Strategic Investment Board
HCM	Highway Capacity Manual
HOV	High-Occupancy Vehicle
HSP	Highway System Plan
HSS	Highway of State Significance
I-5	Interstate 5
IJR	Interchange Justification Report
LOS	Level of Service
MEV	Million Entering Vehicles
MP	Milepost
MVM	Million Vehicle Mile
PDO	Property Damage Only
Port	Port of Tacoma
PSRC	Puget Sound Regional Council
ROW	Right-of-Way
SPUI	Single Point Urban Interchange
SR	State Route
TAC	Technical Advisory Committee
TDM	Transportation Demand Management
TEEM	TDM Effectiveness Estimation Methodology
TIP	Transportation Improvement Program
VA	Value Analysis
WSDOT	Washington State Department of Transportation
WTP	Washington Transportation Plan

FINAL INTERCHANGE JUSTIFICATION REPORT
PORT OF TACOMA ROAD INTERCHANGE WITH INTERSTATE 5
FIFE, WASHINGTON

EXECUTIVE SUMMARY

Project Description

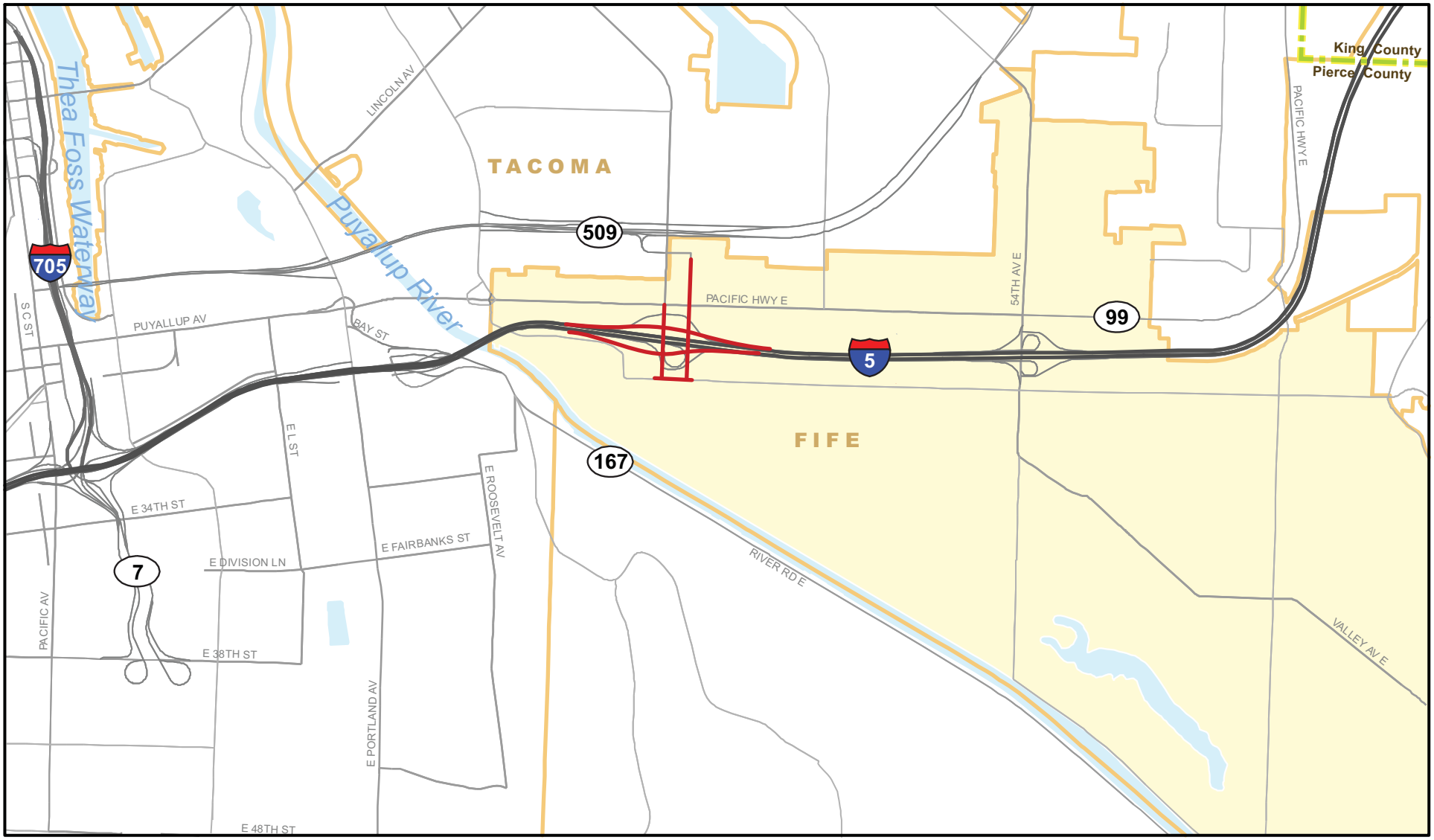
The interchange of Port of Tacoma Road with Interstate 5 (I-5) is located just east of the Puyallup River Bridge in the City of Fife (City). This interchange is an integral element of the freight and truck operations of both the City and the Port of Tacoma (Port). As its name suggests, Port of Tacoma Road is the main access between the Port and I-5; the road also connects to major arterials, such as State Route 509 (SR 509) (South Frontage Road) and Pacific Highway East. Between SR 509 and 20th Street East, Port of Tacoma Road is a principal arterial fronting local businesses. (See Vicinity Map on page viii.)

The existing interchange of Port of Tacoma Road with I-5 is a One Quad Parclo B interchange, with a single loop ramp in the southeast quadrant, which serves the northbound I-5 to northbound Port of Tacoma Road movement. Problems with the current configuration include closely spaced intersections and heavy congestion. The southbound off-ramp and on-ramps of the Port of Tacoma Road interchange are geometrically deficient with substandard alignments for exiting and entering I-5 at freeway speeds. Between 2002 and 2008, six fatal crashes occurred in the project vicinity. High truck volumes, coupled with very closely spaced intersections, make it difficult for vehicles and freight to access this area.

Description of Proposed Action

After a thorough screening process, Alternative 6 – a diamond couplet interchange—was chosen as the Proposed Alternative. With this alternative, 34th Avenue East and Port of Tacoma Road will become a set of paired one-way couplets or one-way streets that function as a single higher-capacity street; 34th Avenue East will become a one-way street to the north and Port of Tacoma Road will become a one-way street to the south. This improvement will construct a one-way couplet system by revising the northbound and southbound ramps, converting Port of Tacoma Road to a one-way road in the southerly direction, and extending and reconstructing 34th Avenue to a one-way road in the northerly direction. (See Alternative 6 –Diamond Couplet Interchange on page ix.)

Exiting the southbound ramp, vehicles will approach a traffic light at the extension of 34th Avenue East and either turn right onto 34th Avenue East or continue straight to Port of Tacoma Road. With 34th Avenue East now a one-way northbound street from 20th Street East to 12th Street East, vehicles on the southbound exit ramp continuing straight through the signal will then encounter another signal at Port of Tacoma Road, at which they may either then proceed straight onto the southbound I-5 on-ramp or turn left to cross I-5 on Port of Tacoma Road. With Port of Tacoma Road now a one-way southbound street from 12th Street East to 20th Street East, there will be no right turns on Port of Tacoma Road from the one-way westbound road connecting to the southbound on-ramp to I-5.



Alternative Alignment
City Limits
County Boundary

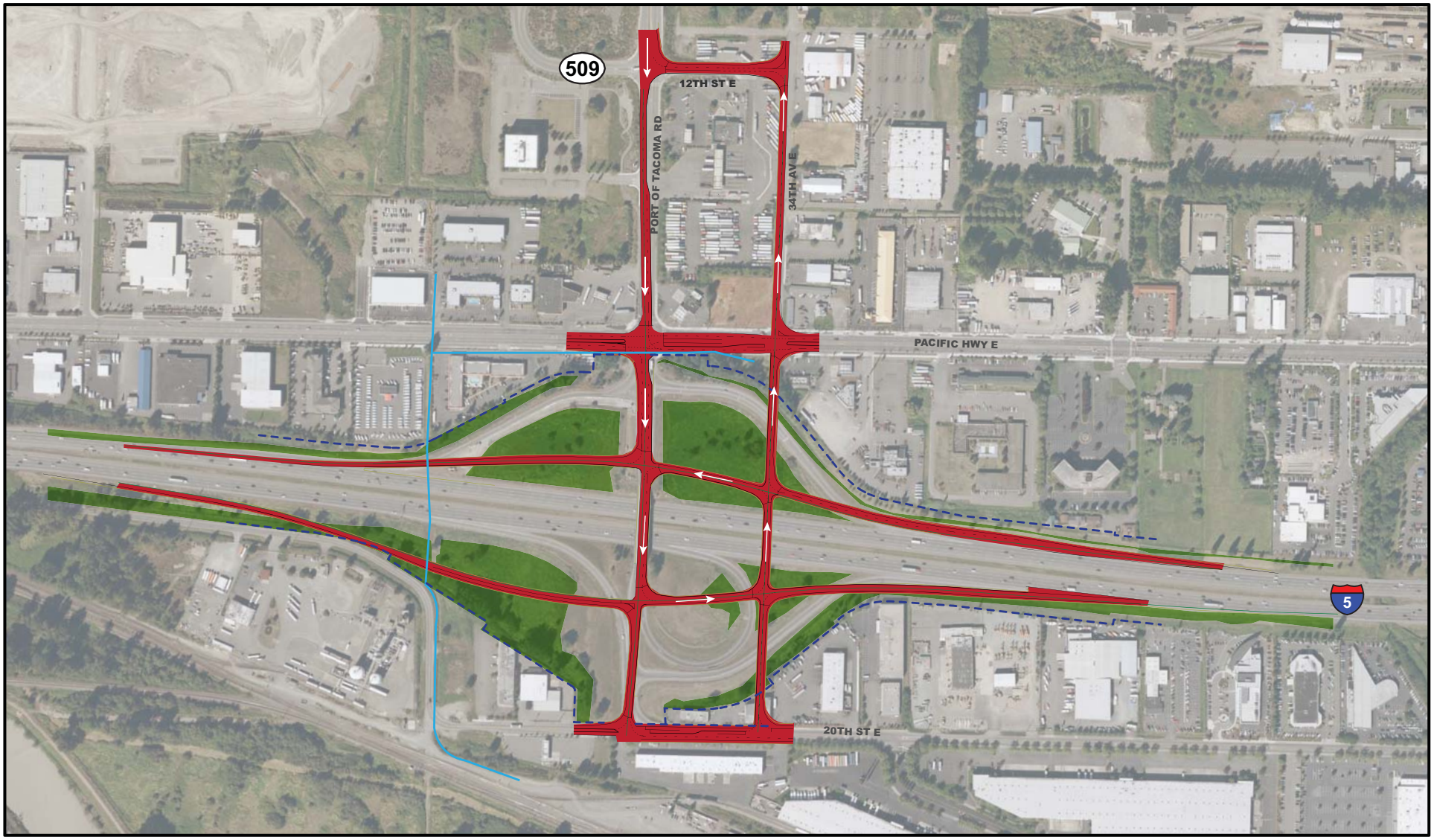
N

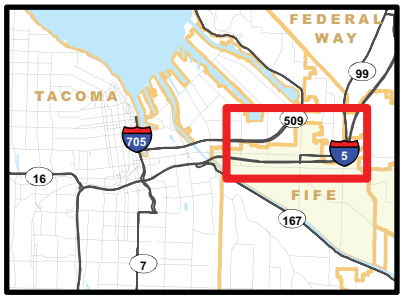
0 1,000 2,000 Feet

Source: Pierce County (2007) GIS Data (Streets, County Boundary, Water Bodies). Horizontal datum for all layers is NAD83(91), vertical datum for layers is NAVD88.

FIGURE E-1
Vicinity Map

Port of Tacoma Road Interchange with I-5 Project





Existing ROW
Erdahl Ditch
Wetlands
Proposed Interchange Reconstruction
Direction of Travel

N
0 250 500 Feet

Source: Pierce County (2007) GIS Data (Streets, County Boundary, Water Bodies). Horizontal datum for all layers is NAD83(91), vertical datum for layers is NAVD88.

FIGURE E-2
Alternative 6 - Diamond Couplet

Port of Tacoma Road Interchange with I-5 Project

Under the Proposed Alternative, vehicles leaving the northbound off-ramp will encounter a traffic signal at Port of Tacoma Road, and proceed straight to 34th Avenue East or turn right on Port of Tacoma Road. At 34th Avenue East, another traffic signal will allow vehicles to continue straight to the northbound on-ramp or turn left on 34th Avenue East. Additional local road improvements will widen 12th Street East; 20th Street East; and, on a smaller scale, Pacific Highway East.

EIGHT POLICY POINTS

The stakeholders of the Port of Tacoma Road Interchange with I-5 project have established that the purpose of the project is to provide efficient movement of traffic into and out of the Port of Tacoma and surrounding areas (especially for trucks); and to improve safety and reliability of access to local and area businesses; while balancing effects to the natural and community environments. The Proposed Alternative satisfies the project's objective. This IJR provides support for FHWA's eight policy points.

Policy Point 1 describes the need for the proposed access point revision. Freeway operational analysis documented that the Port of Tacoma Road interchange with I-5 operates below the acceptable level of service (LOS) as shown in the Washington State Department of Transportation (WSDOT) Highway System Plan (HSP). These conditions will only worsen as the Port of Tacoma (Port) continues to grow as projected.

Policy Point 2 describes all the alternatives considered in the process of finding a proposed alternative that would address the transportation demand in the project area. The alternatives included no build or limited construction alternatives, as well as build alternatives. A three-tiered screening process led to the recommended operational alternative. The recommended alternative satisfies the access needs of the Port and the City without negative impacts on freeway operations or the local network. A diamond couplet interchange was found to best satisfy the project's purpose and need and is the Proposed Alternative.

Policy Point 3 presents the Proposed Alternative's ability to improve the system's performance. Operational and collision analysis shows that the Proposed Alternative will not adversely affect the operation and safety of the freeway or local street system. The Proposed Alternative will improve freeway LOS and facilitate mobility to local and area businesses.

The Proposed Alternative provides for fully directional access between I-5 and Port of Tacoma Road, 34th Avenue East, and other local roads via interchange ramps and one-way couplet arterials. The proposed reconfiguration design accommodates spacing requirements and constraints, and meets geometric standards as described in **Policy Point 4.**

As required by **Policy Point 5**, the Proposed Alternative is compatible with the land use and transportation plans for the area, including the Washington Transportation Plan (WTP), the WSDOT HSP, the Puget Sound Regional Council (PSRC) Transportation 2040 Plan, the Pierce County Comprehensive Plan, Sound Transit Sound Move, and the comprehensive plans of the cities of Tacoma and Fife.

As required by **Policy Point 6**, the design process included future or in-progress interchanges.

Policy Point 7 documents the status of coordinating projects. While the Port of Tacoma Road interchange with I-5 is a stand-alone project that does not require the completion of other projects to function, Policy Point 7 also shares information on current funding.

Policy Point 8 documents the status of the proposal's environmental processes and the schedule for its expected completion. Project and environmental planning over the past year resulted in significant progress in determining interchange layout and assessing environmental effects. According to determinations by FHWA and WSDOT, the project is classified as a Documented Categorical Exclusion (DCE) and does not require the preparation of an environmental impact statement (EIS). Applicable permits will not be determined until an environmental review is substantially complete and the Final IJR has been reviewed.

FINAL INTERCHANGE JUSTIFICATION REPORT
PORT OF TACOMA ROAD INTERCHANGE WITH INTERSTATE 5
FIFE, WASHINGTON

PROJECT DESCRIPTION

The interchange of Port of Tacoma Road with Interstate 5 (I-5) is located just east of the Puyallup River Bridge in the City of Fife (City). This interchange is an integral element of the freight and truck operations of both the City and the Port of Tacoma (Port). As its name suggests, Port of Tacoma Road is the main access between the Port and I-5; the road also connects to major arterials, such as State Route 509 (SR 509) (South Frontage Road) and Pacific Highway East. Between SR 509 and 20th Street East, Port of Tacoma Road is a principal arterial fronting local businesses. (See Vicinity Map on page viii.)

The existing interchange of Port of Tacoma Road with I-5 is a One Quad Parclo B interchange, with a single loop ramp in the southeast quadrant, which serves the northbound I-5 to northbound Port of Tacoma Road movement. Problems with the current configuration include closely spaced intersections and heavy congestion. The southbound off-ramp and on-ramps of the Port of Tacoma Road interchange are geometrically deficient with substandard alignments for exiting and entering I-5 at freeway speeds. Between 2002 and 2008, six fatal crashes occurred in the project vicinity. High truck volumes, coupled with very closely spaced intersections, make it difficult for vehicles and freight to access this area.

Consistency with Policy Points

This Interchange Justification Report (IJR) provides support for the Federal Highway Administration's (FHWA) eight policy points as described in this summary and in the following text. Policy Point 1 describes the need for the proposed access point revision, while Policy Point 2 describes all the alternatives considered, and Policy Point 3 presents the Proposed Alternative's ability to improve the system's performance. The proposed reconfiguration design accommodates spacing requirements and constraints and meets geometric standards as described in Policy Point 4, and as detailed in Policy Point 5, is compatible with the pertinent land use and transportation plans for the area. The design process included future or in-progress interchanges as described in Policy Point 6. While the Port of Tacoma Road Interchange with I-5 is a stand-alone project, the design assumed the completion of several projects in the project vicinity (Policy Point 7). Project and environmental planning over the past year resulted in significant progress in determining interchange layout and assessing environmental effects. Policy Point 8 outlines the status of the proposal's environmental processes and the schedule for the proposal's expected completion.

1 POLICY POINT 1: NEED FOR ACCESS POINT REVISION

What are the current and projected needs and why won't the existing access points and existing or improved local system meet the needs? Is the anticipated demand short or long trips?

1.1 Summary

This project studies the need for interchange access to Port of Tacoma Road, the primary access to the Port (see Vicinity Map on page viii). The project stakeholders developed the following purpose statement to guide the development and evaluation of alternatives: "The purpose of the project is to provide efficient movement of traffic into and out of the Port of Tacoma and surrounding areas (especially for trucks) to increase the level of service and improve reliability of access to local and area businesses."

The project will serve both regional traffic oriented to the Port of Tacoma along I-5, as well as local traffic traveling between the Port and industrial businesses in the cities of Tacoma and Fife. The study considered and evaluated interchange improvements, as well as supporting intersection and roadway improvement concepts, to reduce congestion, increase freight mobility, and improve safety at the interchange.

The project limits for the study are as follows.

- On Interstate 5: From the 54th Avenue East interchange with I-5 to the Ferguson Street/Puyallup River Overcrossing; I-5 Milepost (MP) Boundaries: 135.5 to 137.0
- On Port of Tacoma Road: From 20th Street East to 12th Street East
- On 34th Avenue East: From 20th Street East to 12th Street East
- On 12th Street East: From 54th Avenue East to Port of Tacoma Road

In addition to the project area limits, a greater study area was included to capture how improvements at the Port interchange could influence operations on I-5. The greater study area captures the area along I-5 between the northbound on-ramp/southbound off-ramp at the I-705 interchange, and the northbound off-ramp/southbound on-ramp at the SR 18 interchange. This 7.7-mile corridor captures the adjacent interchanges to the east and west of Port of Tacoma Road, as well as the truck scales/rest area at MP 140.2.

1.2 Safety

The crash and safety analysis reviewed existing conditions on the I-5 mainline and ramps within the study area using 2002 to 2008 data provided by WSDOT. The crash and safety analysis reviewed existing conditions on the local arterials within the study area using 2002 to 2008 data provided by the City. The analysis summarized the number, types, and locations of crashes in the corridor by segment on the I-5 mainline and at each ramp. The following bullets summarize key findings.

- The crash rate on the mainline I-5 freeway corridor is generally low. The highest crash rate occurred between the East 28th Street and East Bay Street/SR 167 off-ramps. At this location, the crash rate is 3.46 per million vehicle mile (MVM) traveled.
- The majority of crashes recorded in the study area (58.7 percent) were rear-end crashes.
- For the I-5 freeway corridor within the study area, 43.2 percent and 44.7 percent of the crashes occurred on northbound and southbound mainlines, respectively.
- Looking at crash severity, most (64.2 percent) were property damage only (PDO). Six fatal crashes occurred in the study area during the 7 years for which data were collected. Five occurred on the southbound direction.
- The crash rates on ramps are higher compared to the I-5 mainline. The southbound off-ramp to Port of Tacoma Road has the highest crash rate, with 28.4 crashes per MVM traveled.
- Overall, almost half of the crashes that occurred on ramps (47.3 percent) were rear-end strikes.
- Overall, most of the crashes on ramps (63.9 percent) were PDO. No fatal crashes were reported on ramps between 2002 and 2008.
- The review and analysis of local arterial crashes focused on roadway segments and intersections. The segment of 54th Avenue East between 12th Street East and 20th Street East had the highest rate, with 10.73 crashes per MVM.
- Overall, most of the crashes on the analyzed arterial segments (77.5 percent) were PDO. One fatal crash was reported on the segment of Pacific Highway East between Port of Tacoma Road and 54th Avenue East.
- At the arterial intersections, a crash rate was calculated using number of crashes per million entering vehicles (MEV). The intersection of Pacific Highway East/54th Avenue East had the highest rate with 0.64 crashes per MEV.
- Overall, most (74.7 percent) of the crashes at the analyzed intersections were PDO. No fatal crashes were reported between 2002 and 2008.

1.3 Capacity/Congestion

The freeway analysis investigated the congestion on I-5, the major north-south freeway in Washington. I-5 is a highway of state significance (HSS) and a principal north-south arterial for the National Defense System. Regionally, I-5 connects the major cities of western Washington, including Bellingham, Everett, Seattle, Tacoma, Olympia, and Vancouver, and is a major freight route. Within the study area, I-5 experiences traffic congestion during the AM and PM peak hours, as well as heavy traffic volumes during midday.

Intersection analyses indicate that the Port of Tacoma Road/I-5 southbound ramps and the intersection of Port of Tacoma Road/Pacific Highway South are heavily congested during peak periods, particularly for the southbound I-5 off-ramp movement.

1.4 Transportation Demand

Traffic volumes in the project area are expected to increase in the next 30 years due to increased trade activities at the Port and Port of Seattle, as well as regional growth in population and employment throughout the Puget Sound. Existing (2006) AM peak hour traffic volumes on I-5, east of Port of Tacoma Road, are 7,500 southbound and 6,100 northbound during the PM peak hour. Freeway mainline volumes are approximately 180,000 vehicles per day with large truck traffic representing 7 to 10 percent of the traffic flow. Peak volumes exceed the capacity of I-5, which currently has eight lanes. Between 1990 and 2005, mainline traffic volumes grew at 1.8 percent per year. Figure 1-1 shows the unconstrained annual growth and transportation demand trend lines for I-5, assuming continuation of the 1990 through 2005 trends. Because the freeway has limited capacity, peak hour discretionary travel may be reduced, delayed, or diverted to alternative routes, resulting in less growth than would be suggested by the historic growth trend. In more recent years, growth has been flat, with peak hour volumes exceeding the capacity for an eight-lane facility, indicating that trips may be diverting to alternative routes, foregone, or made during nonpeak periods.

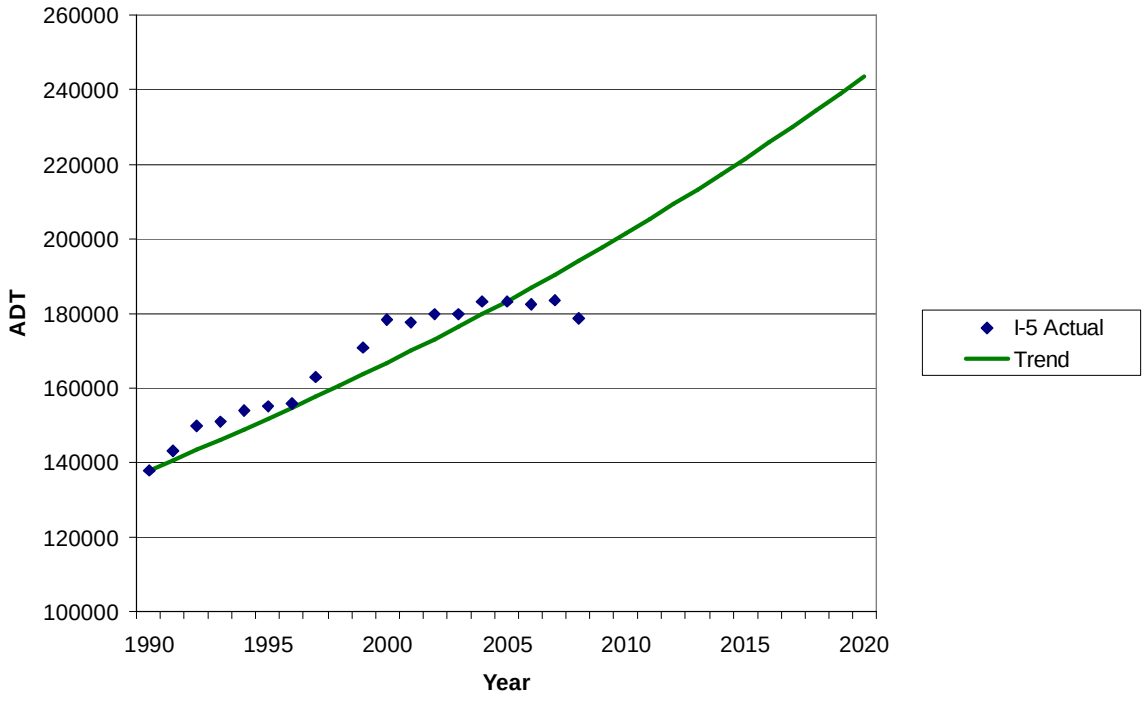


Figure 1-1. Interstate 5 Mainline Freeway Growth Rates

For a more accurate forecast, a detailed travel demand analysis was performed using land use forecasts and the regional travel demand model developed by PSRC, along with land use data from the City's traffic model. These forecasts assume the addition of roadway and transit improvements, as well as diversion of traffic onto alternative routes that provide travel time savings.

1.4.1 Roadway Deficiencies

The regional freeways and local arterials within the project study area operate as a system, with congestion and delays affecting both upstream and downstream operations. Traffic queues at an intersection can back up onto the freeway mainline, resulting in increased congestion and delay.

1.5 Analysis and Data

To demonstrate the need for the proposed improvements at the Port of Tacoma Road interchange, crash and operation analyses were performed using methods and procedures endorsed by the Port stakeholders (Appendix A: Method and Assumptions Technical Memorandum). The analysis considered 2020 as the opening year for a realistic target time line for obtaining funding, completing design and environmental documentation, acquiring necessary right-of-way (ROW) and permits, and completing construction on any selected improvements. Year 2040 was identified as the design year based on available land use and traffic forecasts. Other important assumptions are as follows.

- PSRC-funded improvements are assumed in the 2020 baseline model. These include a number of regional widening projects, such as high-occupancy vehicle (HOV) lanes on I-5 and widening projects on state routes. The model also includes arterial widening projects found in the transportation improvement programs (TIPs) of Pierce County and the cities of Tacoma, Federal Way, and Fife.

- The 2020 baseline model also includes the effects of funded improvements to the regional transit system, such as planned extensions to Sound Transit light rail, and enhancements to commuter rail and express bus, King County Rapid Ride, and park-and-rides.

- The baseline analysis also considered increases in freight activity at the Port terminal acreage based on observed truck counts and classification.

- The 2040 analysis assumed that the SR 167 extension project was in place. This project is not currently completely funded and is not assumed to be by 2020.

- Both AM and PM peak periods were analyzed to determine operational conditions for the following three scenarios: existing (2006), opening year (2020), and design year (2040). The existing conditions analysis was based on 2006 counts, which may represent more typical conditions than do counts collected during the current (2009) economic climate.

1.5.1 Forecasting

Appendix A describes the forecasting methodology for developing future year travel demand volume forecasts. This memorandum details the travel demand forecasting model's development and lists the assumptions used. It also reviews the microsimulation assumptions used for the evaluation of the interchange alternatives.

1.5.2 Planned Improvements

Table 1-1 presents improvements assumed to be constructed by the year of opening (2020) and design year (2040). The analysis of the alternatives conducted for the 2040 period assumed the extension of SR 167 to I-5, an assumption that was critical to the 2040 analysis because the extension will be needed to maintain sufficient operations in the study area. Without the improvement, the model's forecast indicated that the area's transportation system would be over capacity, which would lead to severe congestion and poor systemwide operations.

Table 1-1. Planned Network Improvements for 2020 and 2040

Sponsor	Project	2020	2040
WSDOT	I-5 HOV lanes, SR 16 to 320th Street vicinity	✓	✓
WSDOT	SR 16 HOV lanes, I-5 to Olympic Drive	✓	✓
Kent, Tukwila, SeaTac, Federal Way, WSDOT	SR 99 HOV lane extensions, South 138th Street to South 170th Street, Kent-Des Moines Road to Dash Point Road	✓	✓
WSDOT	SR 161 widening, South 360th Street to 24th Street East	✓	✓
WSDOT	SR 167, extend the SB HOV lane north to I-405; add a SB auxiliary lane from I-405 to the off-connection at SW 41st Street		✓
WSDOT	SR 167, add one SB GP lane and extend SB HOV, SE 180th Street to I-405	✓	✓
WSDOT	I-405 widening project includes new interchanges at SR 515 and 132nd Street NE and an HOV interchange at North 8th Street in Renton	✓	✓
WSDOT	SR 410, widen to 4-lanes, 214th Avenue to 234th Avenue	✓	✓
WSDOT	SR 518 - add EB lane, North Airport Expressway to I-5/I-405 interchange	✓	✓
WSDOT	SR 167 extension from Puyallup to I-5		✓
Federal Way	South 356th Street - widen to 5 lanes to SR 99	✓	✓
Fife	Valley Avenue East - upgrade to major arterial	✓	✓
Pierce County	176th Street East - widen to 4 lanes, SR 7 to SR 161	✓	✓
Pierce County	Canyon Road East - 106th Street East to 192nd Street East	✓	✓
Pierce County	Canyon Road East - extend major arterial from 192nd Street East to SR 7	✓	✓
Pierce County	Canyon Road East - widen to 5 lanes, 84th Street East to 99th Street East	✓	✓
Tacoma	D Street Overpass construction - Puyallup Avenue to South 23rd Street	✓	✓
Fife	Reconstruct 70th, 20th to Valley Avenue	✓	✓
Fife	Reconstruct 20th, 54th to 63rd	✓	✓
Fife	Reconstruct 70th Avenue East – North Segment	✓	✓
Fife	34th Avenue East and 12th Street East intersection reconstruction	✓	✓
Fife	Pacific Highway East and 54th Avenue East intersection improvements	✓	✓

Sponsor	Project	2020	2040
Fife	20th Street East and Frank Albert Signal	✓	✓
Fife	20th Street East and Port of Tacoma Road signal*	✓	✓
Fife	20th Street East reconstruction – Port of Tacoma Road to Industry Drive	✓	✓
Fife	20th Street East and Industry Drive signal	✓	✓
Fife	20th Street East reconstruction – Industry Drive to 54th Avenue East	✓	✓
Sound Transit	Light Rail Initial Segment - Sea-Tac International Airport to UW (2016)	✓	✓
Sound Transit	Light Rail Extension - UW to Northgate, Seattle to Bellevue (2020)	✓	✓
Sound Transit	Light Rail Extension - Bellevue to Overlake Transit Center (2021)		✓
Sound Transit	Light Rail Extension - Northgate to Lynnwood, SeaTac to South 272nd (2023)		✓
Sound Transit	Light Rail Stations - Redondo/Star Lake, Jackson Park, Shoreline, Bel-Red, Overlake		✓
Sound Transit	Express Bus Service Increase (17% increase in service)	✓	✓
Sound Transit	Commuter Rail Service Increase (65% increase in capacity) Tacoma-Seattle	✓	✓
Sound Transit	Commuter Rail Extension - Tacoma to Lakewood	✓	✓
Sound Transit	Commuter Rail Station Improvements - Everett, Mukilteo, Edmonds, Tukwila, South Tacoma, Lakewood	✓	✓
Sound Transit	Parking Garage at Sounder stations - Mukilteo, Auburn, Sumner, Puyallup, South Tacoma, Lakewood	✓	✓
Sound Transit, WSDOT, Pierce Transit	Park & Ride Expansions - Everett LRT Station, Mercer Island, Mountlake Terrace I- 5, South 200th, South Bellevue, Lynnwood Transit Center, Tacoma Dome Station, Kent vicinity of I-405, Puyallup, Kent Station, Burien, Marysville, SR 9/SR 2/Lake Stevens, Highline Community College Intermodal Transit facility, SR 16 Peninsula	✓	✓
King County Metro	Rapid-Ride Bus Rapid Transit - Pacific Highway South, Redmond TC to Bellevue TC, West Seattle to Downtown, Ballard to Downtown, Aurora to Downtown	✓	✓

1.5.3 Operational and Safety Analysis Methods and Assumptions

Operational analysis methods and assumptions are based on the Highway Capacity Manual (HCM) 2000 methodology (Appendix B). To provide a better understanding of existing and future conditions, a VISSIM microsimulation model (version 5.10) was constructed to provide a detailed analysis of intersection and freeway operations. The VISSIM model shows the interactions between factors that include signal timing, traffic volumes, free-flow speeds, saturation flows, and roadway geometrics. Appendix A contains a summary of these assumptions.

1.5.4 Existing Conditions (2006)

The existing conditions analysis reviewed the traffic operations and safety of the current facility. The traffic operations analysis evaluated the freeway and intersection performance for 2006 conditions in the study area. The safety analysis reviewed the historical crash data, including the frequency and types of crashes on freeways, corridors, ramps, and at intersections.

1.5.5 Traffic Operations

The regional freeways and local arterials within the study area operate as a system, with congestion and delays affecting both upstream and downstream operations. Using the VISSIM model, the analysis evaluated freeway operations, including merge and weave analyses,

density, and calculated the intersection LOS and arterial queues of study area roadways. Freeway LOS is determined by the *density* of traffic based on the passenger cars per mile per lane. Table 1-2 summarizes the LOS criteria for each freeway segment type.

Table 1-2. Levels of Service Criteria for Freeway Analysis

LOS	Density (pc/mi/ln)		
	Basic Freeway Segment	Freeway Weaving Segment	Merge and Diverge Area
A	0-11	<=10	<=10
B	>11-18	>10-20	>10-20
C	>18-26	>20-28	>20-28
D	>26-35	>28-35	>28-35
E	>35-45	>35-43	>35
F	>45	>43	Demand exceeds capacity

pc/mi/ln = passenger cars/mile/lane

The VISSIM model was also used to evaluate the performance of the intersections using a LOS measure that calculates the average delay per vehicle at the intersection. The intersection delay for a signalized intersection takes into account the delay caused by the signal control and the queue delay caused by spilling and storage blockage from the adjacent intersections in the network. Table 1-3 summarizes the LOS criteria for signalized and unsignalized intersections.

Table 1-3. Levels of Service Criteria for Signalized and Unsignalized Intersections

LOS	Signalized Stopped Delay per Vehicle (seconds)	Unsignalized Average Total Delay per Vehicle (seconds)	Description
A	0-10	0-10	Little or no delay
B	10-20	10-15	Short delays
C	20-35	15-25	Average delays
D	35-55	25-35	Long delays
E	55-80	35-50	Very long delays
F	>80	>50	Failure - extreme congestion

1.5.5.1 Freeway Operations

Table 1-4 summarizes the AM and PM peak hour results of the freeway LOS analysis for I-5. Freeway LOS operations are measured by the density of traffic in passenger cars per mile per lane during the AM and PM peak hours.

Table 1-4. Existing Freeway Levels of Service

Location	Type	AM Peak Hour		PM Peak Hour	
		LOS	Density	LOS	Density
I-5 Northbound					
I-5 NB onramp from I-705	Merge	**E**	**35**	**E**	**42**
I-5 NB offramp to E 28th Street /Portland Avenue	Diverge	**E**	**42**	**F**	**44**
I-5 NB between E 28th St and SR 167 (River Road)	Basic	**E**	**38**	D	33
I-5 NB offramp to E Bay Street	Diverge	**E**	**36**	D	34
I-5 NB between E Bay Street off/onramps	Basic	**E**	**38**	D	34
I-5 NB onramp from E 28th Street	Merge	D	33	D	29
I-5 NB between E 28th Street. Onramp and POT Road offramp	Basic	D	33	D	29
I-5 NB offramp to POT Road SB	Diverge	D	34	D	29
I-5 NB offramp to POT Road NB	Diverge	D	30	C	27
I-5 NB between POT Road NB off/onramps	Basic	D	30	D	27
I-5 NB onramp from POT Road	Merge	C	27	C	26
I-5 NB between POT Road NB off/onramps	Basic	D	30	D	29
I-5 NB offramp to 54th Avenue E	Diverge	D	31	D	30
I-5 NB between 54th Avenue E on/offramps	Basic	D	27	C	26
I-5 NB onramp from 54th Avenue E	Merge	C	27	D	28
I-5 NB between 54th Ave onramp and HOV lane start	Basic	D	29	D	28
I-5 NB between HOV lane start and truck scales offramp	Basic	D	28	D	28
I-5 NB truck scales offramp	Diverge	D	29	D	29
I-5 NB between truck scales offramp and onramp	Basic	D	28	D	28
I-5 NB truck scales onramp	Merge	D	29	D	30
I-5 NB between truck scales and SR 18	Basic	D	33	D	33
I-5 NB offramp to SR 18	Diverge	**E**	**39**	**E**	**40**

Note:
Average volumes based on 13 VISSIM runs.
***Bold** indicates unacceptable operation.*
Source: Fehr & Peers, 2010.

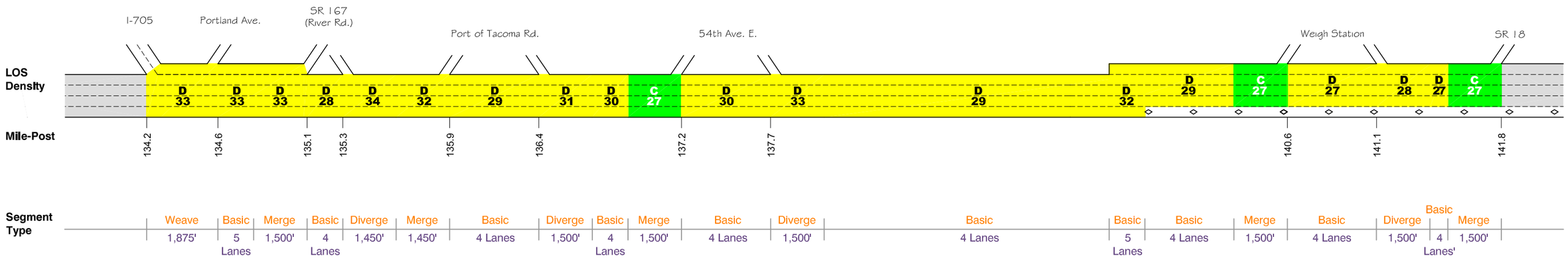
Table 1-4. Existing Freeway Levels of Service

	Type	AM Peak Hour		PM Peak Hour	
		LOS	Density	LOS	Density
I-5 Southbound					
I-5 SB onramp from SR 18	Merge	C	27	D	30
I-5 SB between SR 18 and truck scales	Basic	D	27	D	30
I-5 SB offramp to truck scales	Diverge	D	28	D	31
I-5 SB between truck scales off/onramps	Basic	D	27	D	30
I-5 SB onramp from truck scales	Merge	C	27	D	31
I-5 SB between truck scales and HOV lane end	Basic	D	29	D	34
I-5 SB between HOV lane end and lane drop	Basic	D	32	**E**	**36**
I-5 SB between lane drop and 54th Ave E	Basic	D	29	D	34
I-5 SB offramp to 54th Avenue E	Diverge	D	33	**E**	**38**
I-5 SB between 54th Avenue E on/offramps	Basic	D	30	**E**	**43**
I-5 SB onramp from 54th Avenue E	Merge	C	27	D	29
I-5 SB between 54th Ave E and POT Road	Basic	D	30	**E**	**36**
I-5 SB offramp to POT Road	Diverge	D	31	**E**	**41**
I-5 SB between POT Road off/onramps	Basic	D	29	**F**	**56**
I-5 SB onramp from POT Road	Merge	D	32	**E**	**39**
I-5 SB offramp to Bay Street	Diverge	D	34	**F**	**44**
I-5 SB between Bay Street off/onramps	Basic	D	28	D	30
I-5 SB onramp from Bay Street	Merge	D	33	D	34
I-5 SB between Bay St and E 27th St/Portland Ave	Basic	D	33	**E**	**36**
I-5 SB weave between E 27th St/Portland Ave and I-705	Weave	D	33	D	30

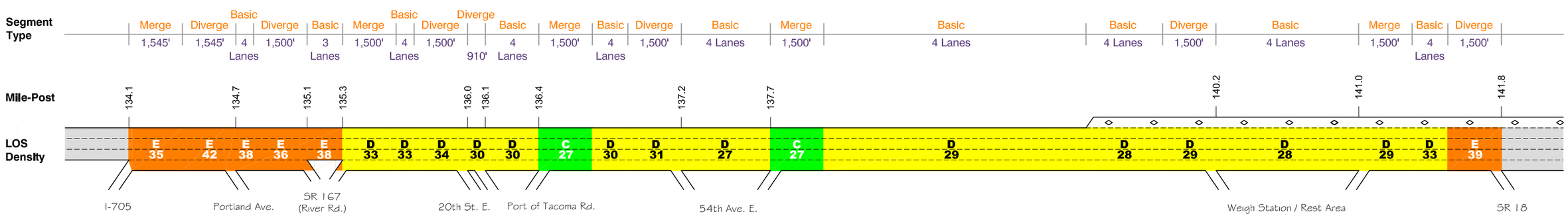
Note:
Average volumes based on 13 VISSIM runs.
***Bold** indicates unacceptable operation.*
Source: Fehr & Peers, 2010.

There are three interchanges on I-5 between I-705 and SR 18: (1) SR 167/Portland Avenue, (2) Port of Tacoma Road, and (3) 54th Avenue East, as well as a set of northbound and southbound truck scales. The three interchanges vary in configuration from a weaved set of ramps at SR 167/Portland Avenue to modified diamonds at Port of Tacoma Road and 54th Avenue East, where loop ramps serve one or more movements. Figures 1-2 and 1-3 provide a schematic representation of the existing freeway lanes, density, and LOS operating conditions at different freeway segments on the I-5 corridor within the study area.

Interstate 5: State Route 18 to Interstate 705 (Southbound)



Interstate 5: Interstate 705 to State Route 18 (Northbound)



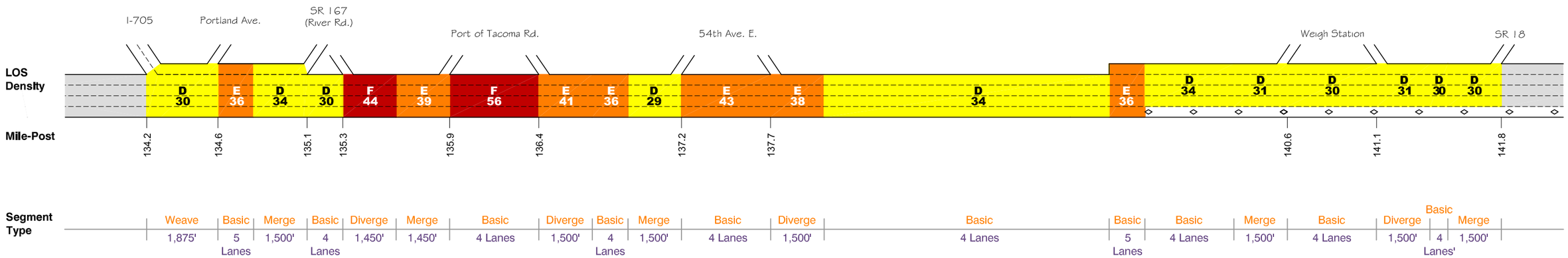
LEGEND

		Level of Service
6.0	Mile-Post	A - C
◊	HOV Bypass Lane	D
D — Level of Service 32 — Density (Vehicles / Lane Mile)		E
		F

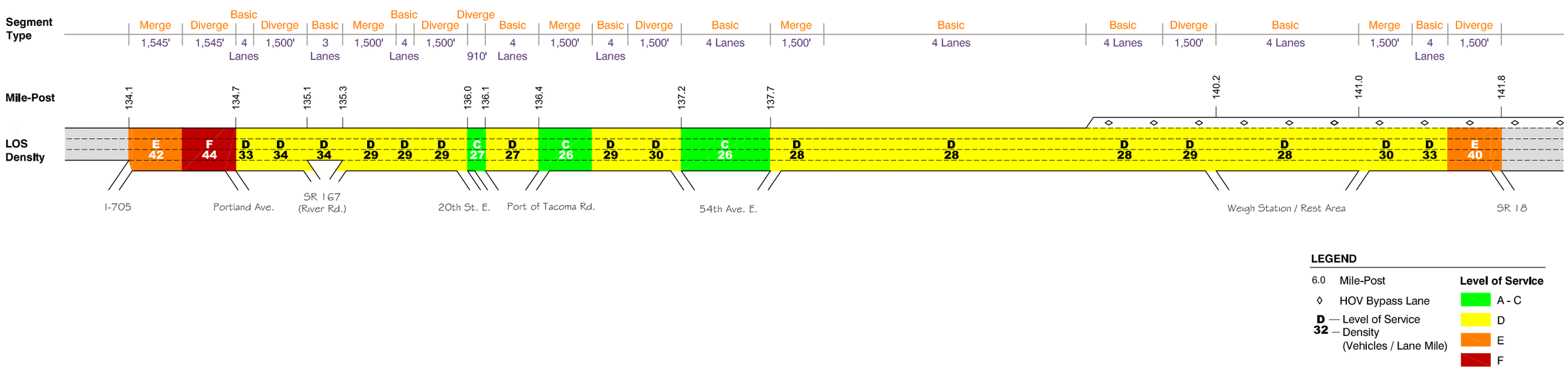
AM PEAK HOUR LANE CONFIGURATIONS AND LEVEL OF SERVICE - EXISTING CONDITIONS

FIGURE 1-2

Interstate 5: State Route 18 to Interstate 705 (Southbound)



Interstate 5: Interstate 705 to State Route 18 (Northbound)



PM PEAK HOUR LANE CONFIGURATIONS AND LEVEL OF SERVICE - EXISTING CONDITIONS

FIGURE 1-3

During the AM peak hour, all southbound freeway segments operate at LOS D or better; however, 6 of the 18 northbound freeway segments on I-5 operate at LOS E: the I-705 on-ramp, off-ramp diverge to East 28th Street/Portland Avenue, the segment between Portland Avenue and SR 167 (River Road), the SR 167 off-ramp diverge, the segment between SR 167 (River Road) off/on-ramps, and the off-ramp to SR 18.

During the PM peak hour, three northbound and nine southbound freeway segments operate at LOS E or LOS F. In the northbound direction, the I-705 merge, Portland Avenue diverge, and the SR 18 diverge, operate at LOS E or LOS F. All other northbound segments operate at LOS D or better.

In the southbound direction, all but one of the seven segments from the diverge at 54th Avenue East to the diverge at SR 167 operates at LOS E or LOS F. In addition, the basic segments approaching Portland Avenue and south of the HOV lane terminus operate at LOS E. The two failing southbound segments are between the Port of Tacoma Road on/off-ramps, and the diverge approaching SR 167.

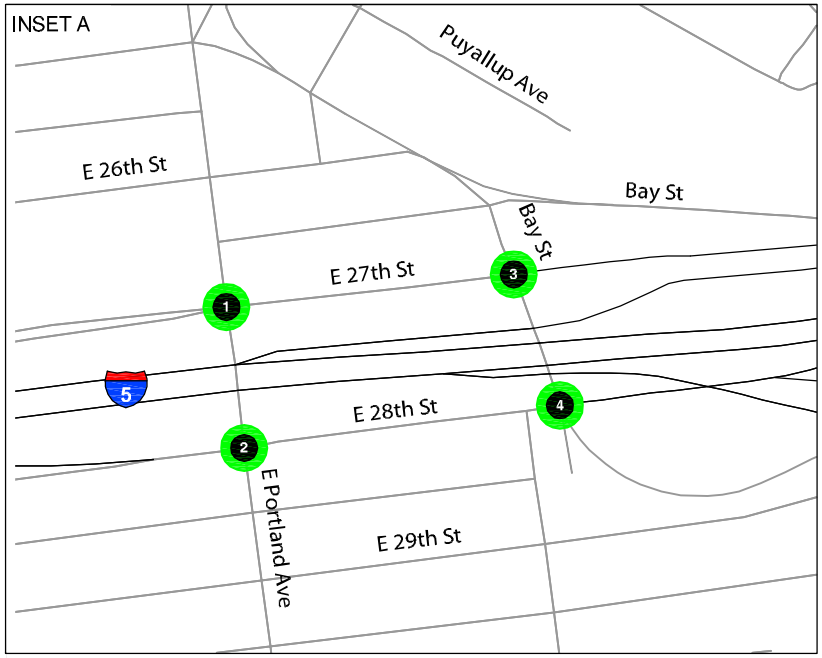
Existing freeway volumes are directional, with higher northbound volumes in the AM peak hour and higher southbound volumes in the PM peak hour. Total volumes on I-5 during the PM peak hour are 10 to 20 percent higher than the AM peak hour volumes.

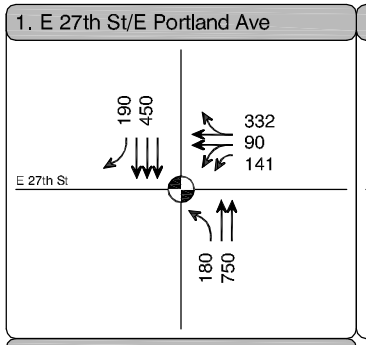
1.5.5.2 Intersections

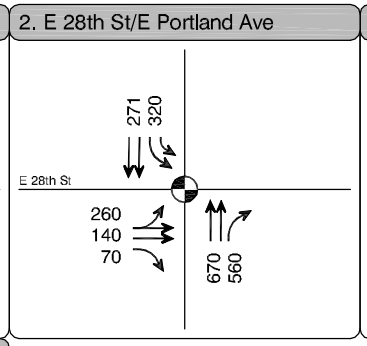
The evaluation examined 15 intersections, including major intersections and ramp termini, in the study area. Figures 1-4 to 1-9 show the AM or PM peak hour volumes by movement, the overall LOS operation, and the intersection channelization and traffic controls for each intersection. Table 1-5 summarizes the intersection control delay and LOS conditions for the AM and PM peak hours. The LOS at each intersection is determined by average control and queue delays per vehicle in seconds. Table 1-5 reports the LOS by individual approach and for the overall intersection.

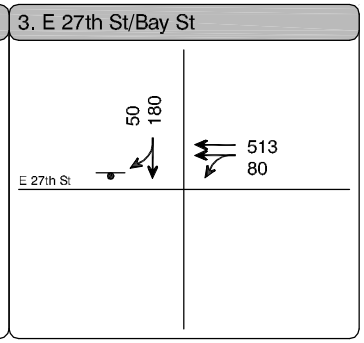
Three of the study intersections have minor street stop-controls and nine are signalized. Two intersections are uncontrolled, with the intersection serving a freeway on-ramp. In the AM peak hour, all intersections operate overall at LOS C or better. Of the individual approaches, the westbound approach of the Port of Tacoma Road/I-5 southbound off-ramp operates at LOS E during the AM peak hour.

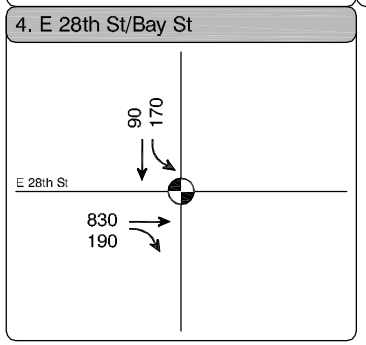
In the PM peak hour, the signal at East Portland Avenue/East 27th Street operates at LOS F with westbound and southbound failing approaches. The East Portland Avenue/East 28th Street intersections operate at LOS E overall, with the northbound approach operating at LOS F. The Port of Tacoma Road/Pacific Highway East/I-5 southbound ramps intersection has overall operations of LOS E, with the I-5 southbound ramp westbound Pacific Highway South approaches operating at LOS F. The intersection of 54th Avenue East/Pacific Highway East operates at LOS E overall, with the eastbound and southbound approaches operating at LOS F. All other intersections operate overall at LOS D or better in the PM peak hour.

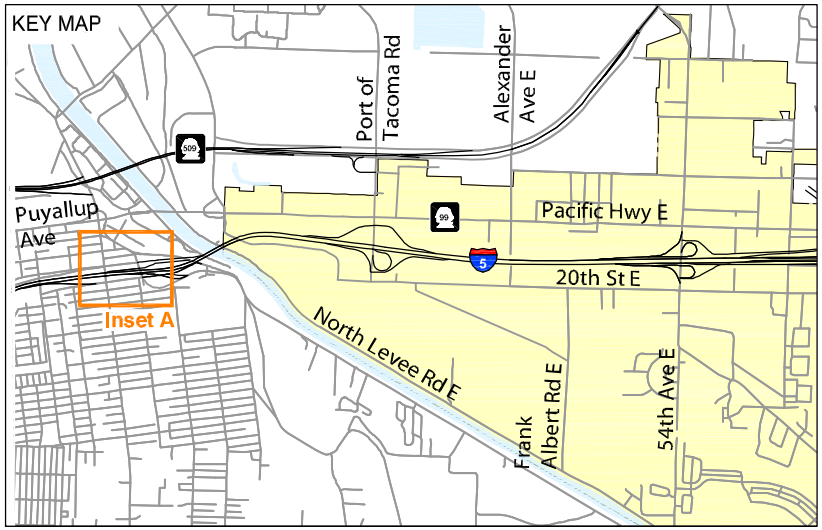












N

NOT TO SCALE

LEGEND

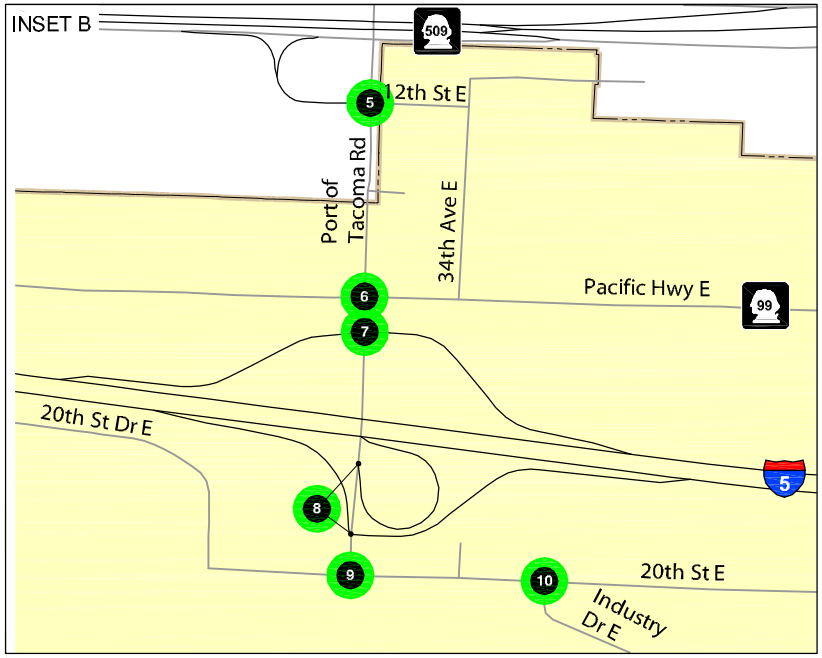
	Turn Lane	1	Study Intersection		Stop Sign
XX	Peak Hour Traffic Volume		Traffic Signal		City of Fife

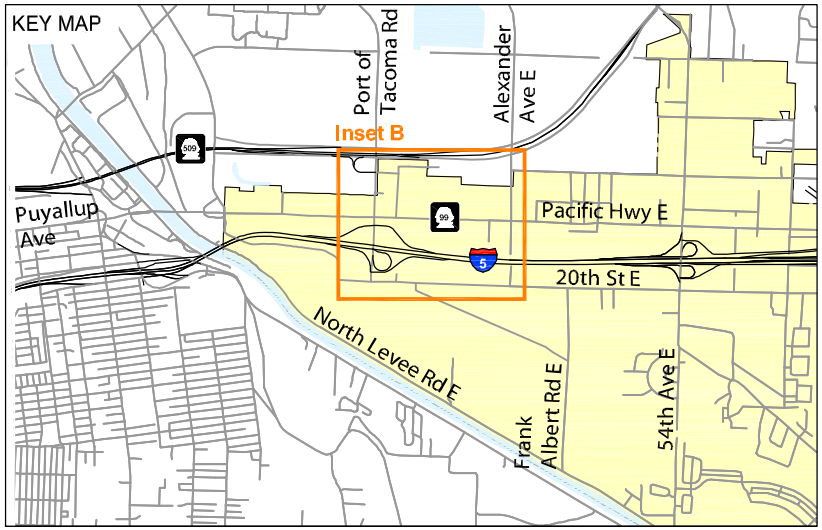
Level of Service

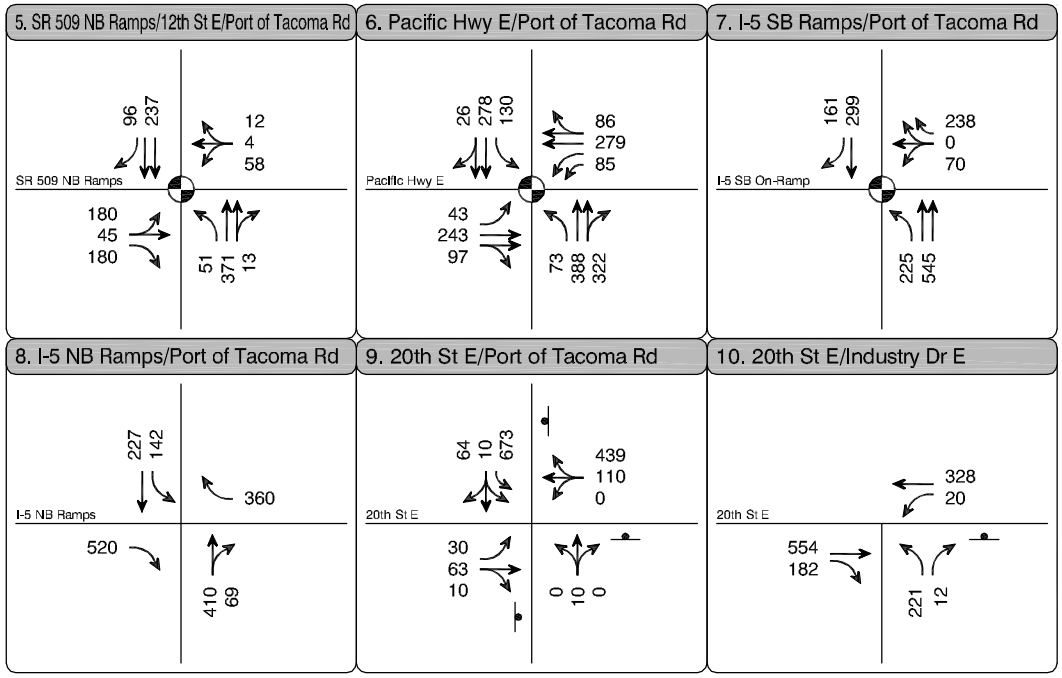
A - D	E	F

AM PEAK HOUR TRAFFIC VOLUMES AND LANE CONFIGURATIONS - EXISTING CONDITIONS (INSET A)

FIGURE 1-4







N

NOT TO SCALE

LEGEND

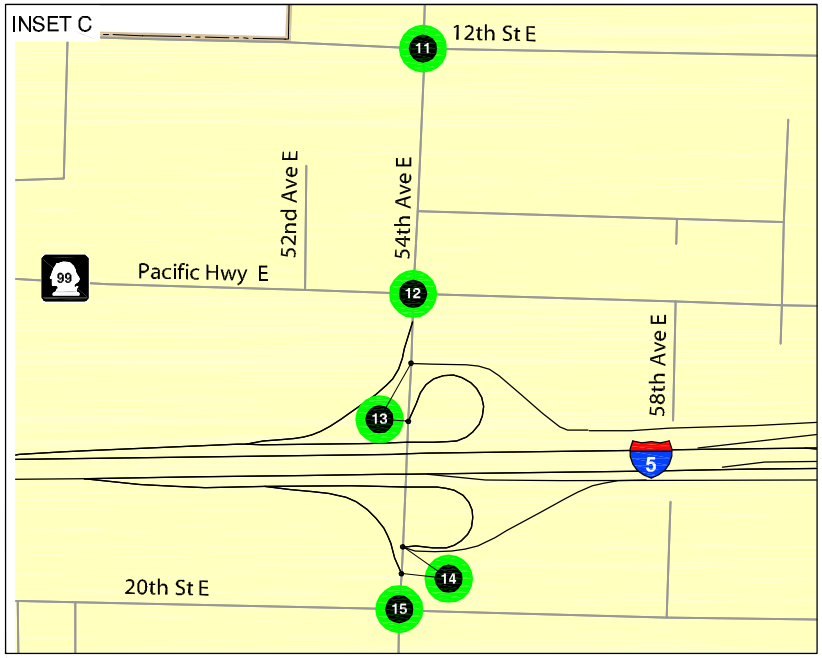
	Turn Lane		Study Intersection		Stop Sign
XX	Peak Hour Traffic Volume		Traffic Signal		City of Fife

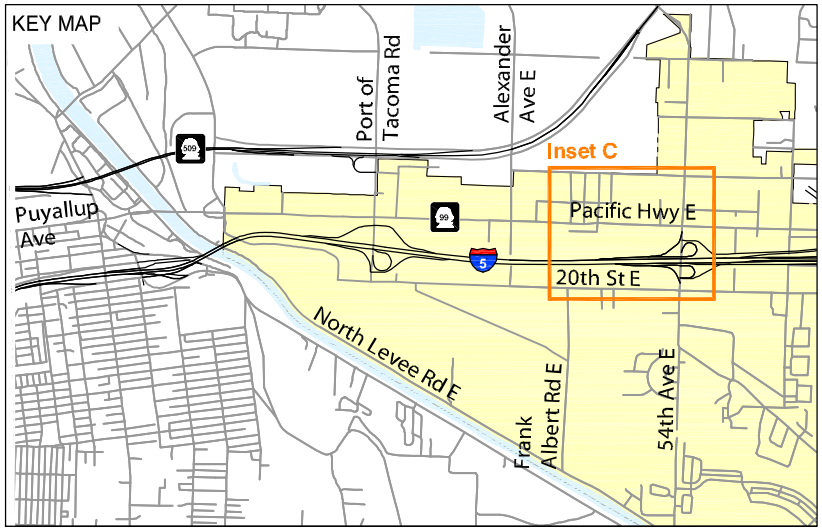
Level of Service

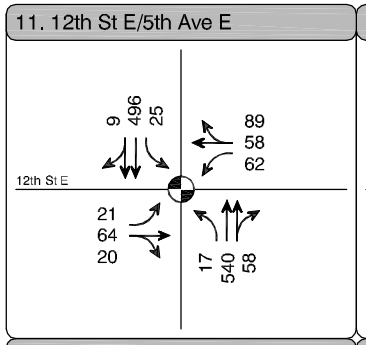
	A - D		E		F

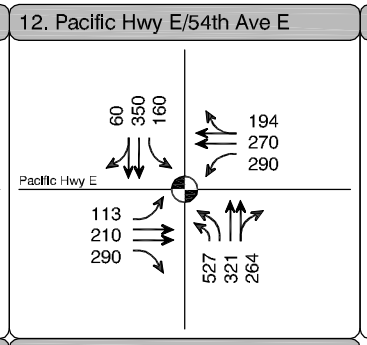
AM PEAK HOUR TRAFFIC VOLUMES AND LANE CONFIGURATIONS - EXISTING CONDITIONS (INSET B)

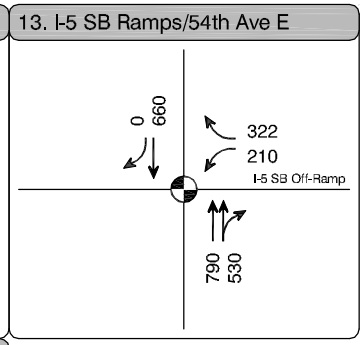
FIGURE 1-5

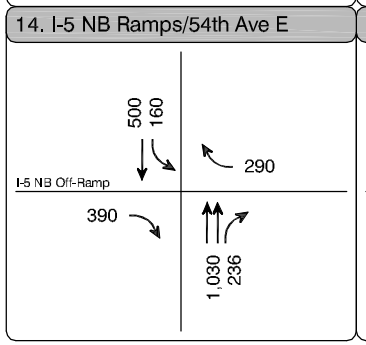


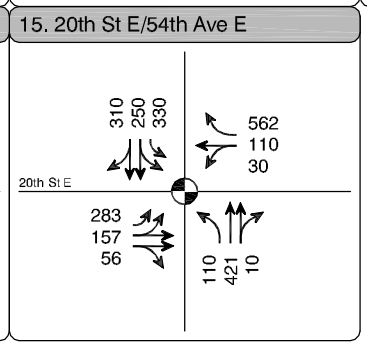












N

NOT TO SCALE

LEGEND

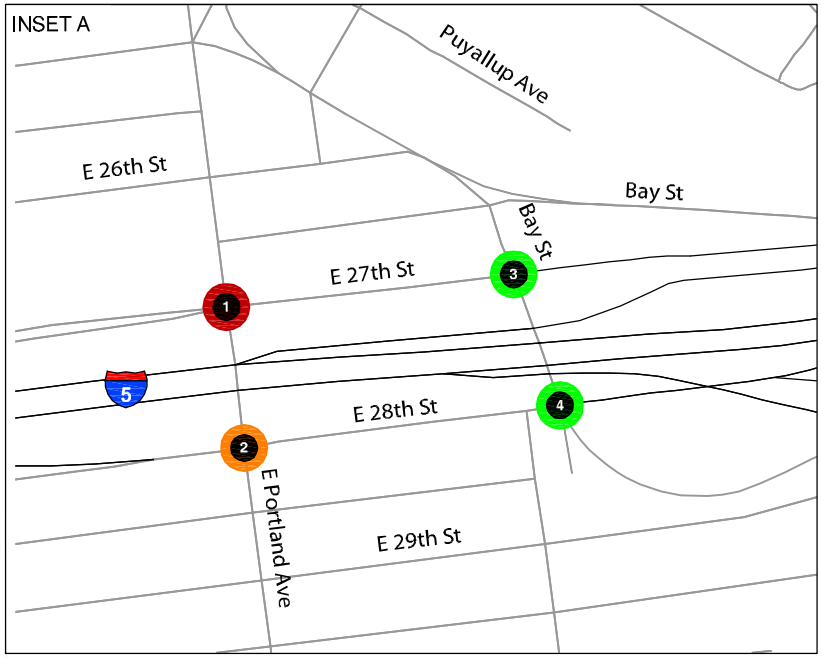
	Turn Lane		Study Intersection		Stop Sign
XX	Peak Hour Traffic Volume		Traffic Signal		City of Fife

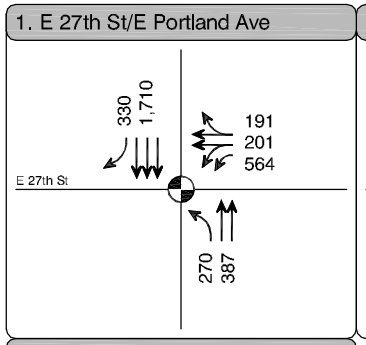
Level of Service

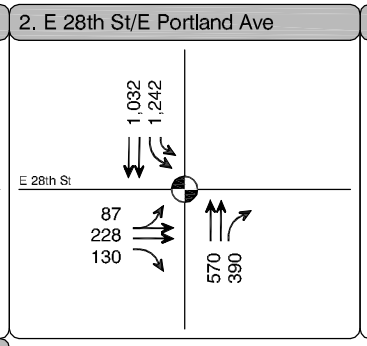
	A - D		E		F

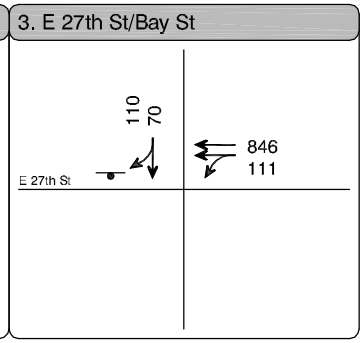
AM PEAK HOUR TRAFFIC VOLUMES AND LANE CONFIGURATIONS - EXISTING CONDITIONS (INSET C)

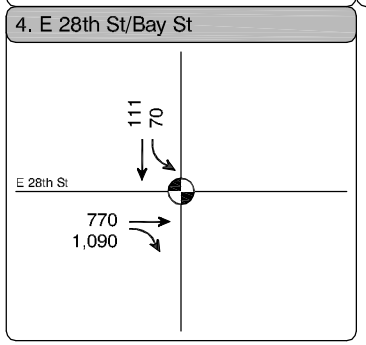
FIGURE 1-6

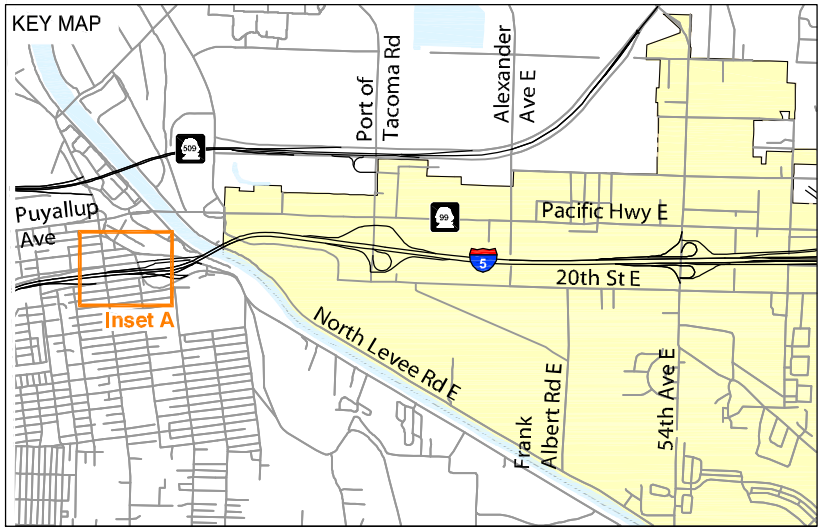












N

NOT TO SCALE

LEGEND

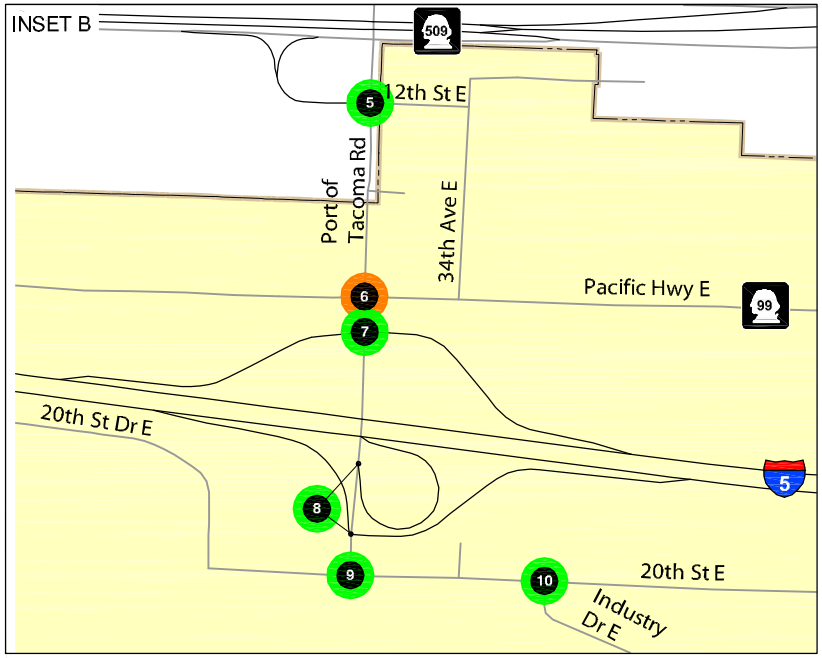
	Turn Lane		Study Intersection		Stop Sign
XX	Peak Hour Traffic Volume		Traffic Signal		City of Fife

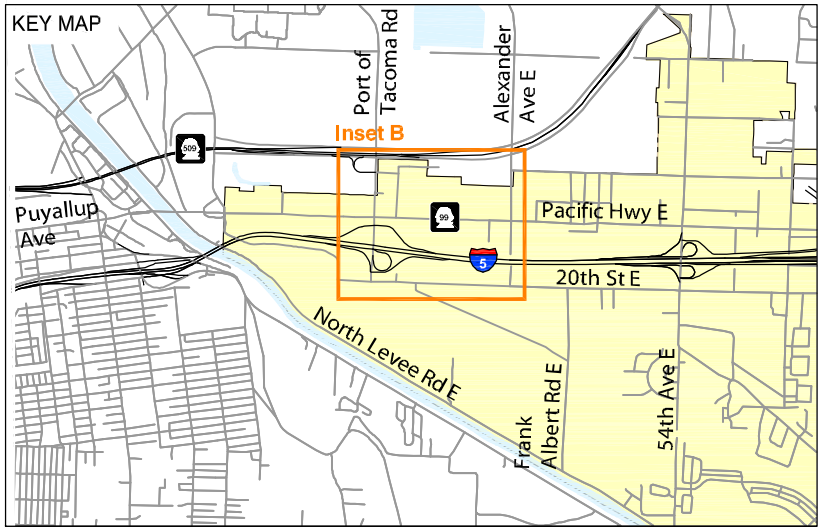
Level of Service

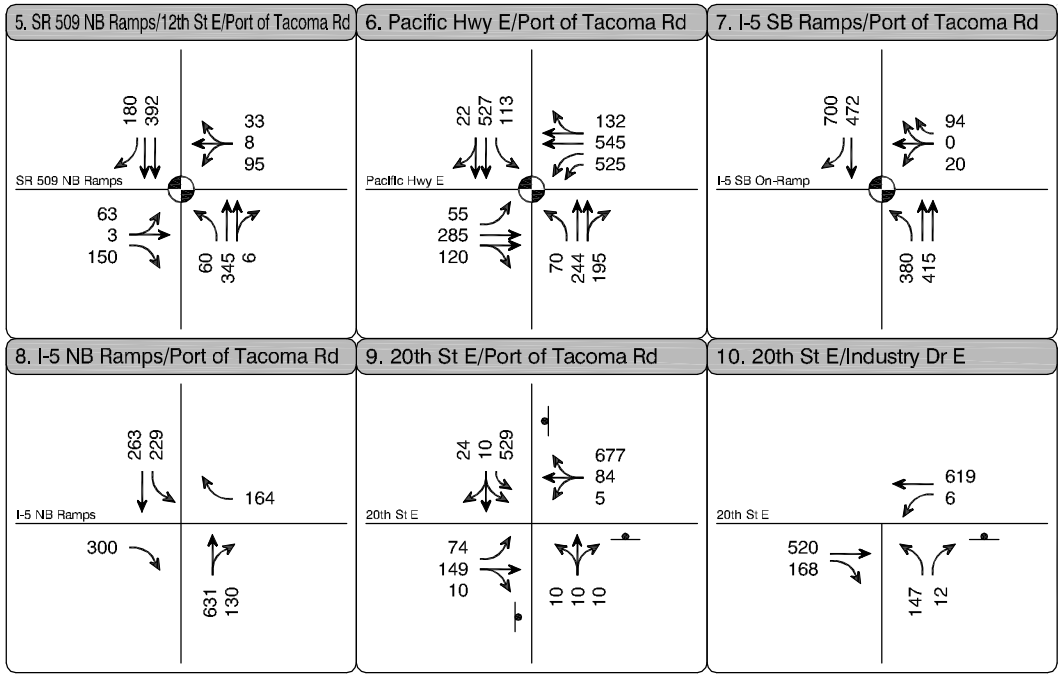
	A - D		E		F

PM PEAK HOUR TRAFFIC VOLUMES AND LANE CONFIGURATIONS - EXISTING CONDITIONS (INSET A)

FIGURE 1-7







N

NOT TO SCALE

LEGEND

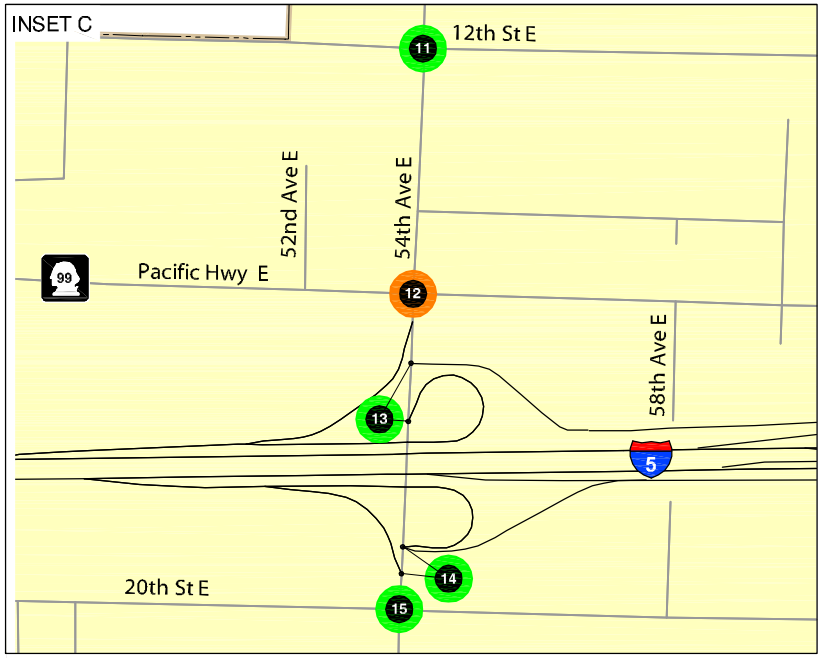
	Turn Lane		Study Intersection		Stop Sign
XX	Peak Hour Traffic Volume		Traffic Signal		City of Fife

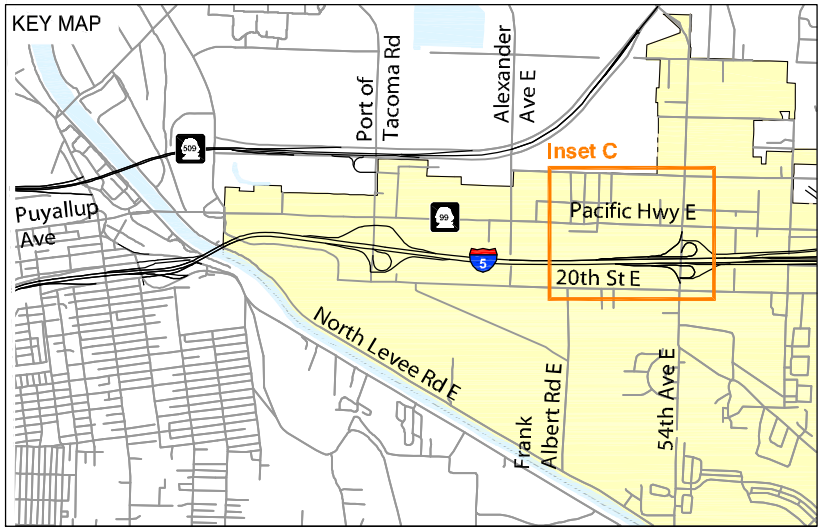
Level of Service

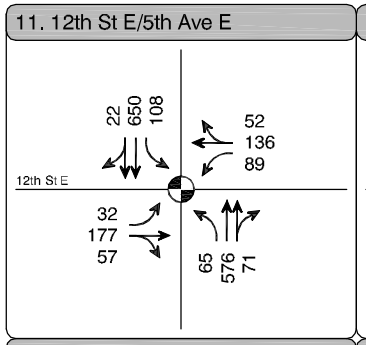
	A - D		E		F

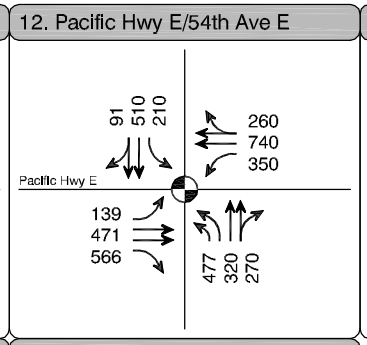
PM PEAK HOUR TRAFFIC VOLUMES AND LANE CONFIGURATIONS - EXISTING CONDITIONS (INSET B)

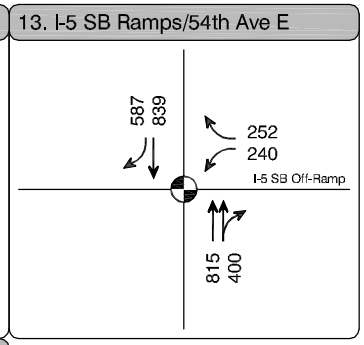
FIGURE 1-8

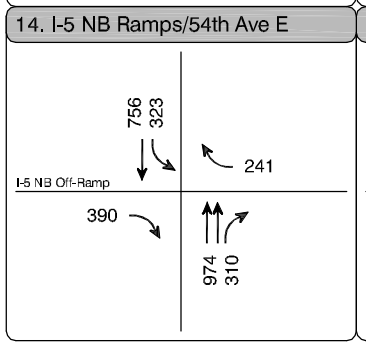


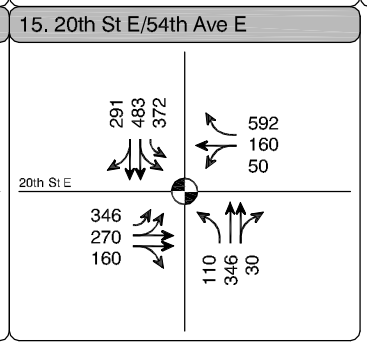












N

NOT TO SCALE

LEGEND

	Turn Lane		Study Intersection		Stop Sign
XX	Peak Hour Traffic Volume		Traffic Signal		City of Fife

Level of Service

	A - D		E		F

PM PEAK HOUR TRAFFIC VOLUMES AND LANE CONFIGURATIONS - EXISTING CONDITIONS (INSET C)

FIGURE 1-9

Table 1-5. Intersection Levels of Service - Existing Peak Hour Conditions

Intersection		Traffic Control	AM Peak Hour					PM Peak Hour				
			NB	SB	EB	WB	Total	NB	SB	EB	WB	Total
1	E. Portland Ave/E. 27th St	Signal	B/12	B/12		B/19	B/14	D/36	**F/182**		**F/97**	**F/133**
2	E. Portland Ave/E. 28th St	Signal	B/14	C/22	D/36		C/21	**F/94**	C/28	D/49		**E/56**
3	E. Bay St/E. 27th St	SSSC		A/6		A/2	A/3		C/16		B/14	B/15
4	E. Bay St/E. 28th St	Signal		B/20	A/8		B/11		C/32	D/43		D/42
5	POT Rd/I-509 EB Ramps	Signal	B/13	B/13	B/17	A/1	B/13	B/10	A/9	B/15	A/2	B/10
6	POT Rd/Pacific Hwy	Signal	A/8	D/50	D/54	D/49	C/35	B/13	**E/70**	**E/76**	**F/110**	**E/79**
7	POT Rd/I-5 SB Ramps	Signal	D/39	A/1		**E/64**	C/33	D/48	A/1		**F/91**	C/25
8	POT Rd/I-5 NB Ramps	Unct.	A/0	A/7	A/2		A/3	A/0	C/30	A/2		A/10
9	POT Rd/20th St E	SSSC	A/6	A/1	B/13	B/13	A/6	B/14	A/1	B/14	A/7	A/6
10	Industry Dr. E/20th St E	SSSC	C/26		A/2	A/2	A/7	C/27		A/2	A/2	A/5
11	54th Ave E/12th St E	Signal	A/6	A/5	B/16	B/15	A/8	A/9	B/10	B/19	B/19	B/12
12	54th Ave E/Pacific Hwy	Signal	C/25	D/44	D/47	C/33	C/35	C/33	**F/129**	**F/131**	D/42	**E/79**
13	54th Ave E/I-5 SB Ramps	Signal	A/7	A/2		C/35	B/12	A/8	A/9		D/55	B/18
14	54th Ave E/I-5 NB Ramps	Unct.	A/0	B/12	A/9		A/5	A/1	**E/66**	D/47		C/32
15	54th Ave E/20th St E	Signal	D/42	C/21	D/42	C/23	C/30	D/52	C/24	D/46	C/30	D/35

Notes:
SSSC = Side-Street Stop-Controlled.
Unct. = Uncontrolled
Source: Fehr & Peers, 2010.
Bold indicates unacceptable operation.

1.5.6 Safety[1]

The safety analysis is based on historical crash data collected between 2002 and 2008 from WSDOT and the City. The analysis looks at crash rates by facility type (freeway, ramp, corridor, and intersection), by crash type, and severity. A review of historical crash data provided an indication of the location and severity of incidents at intersections and along corridors.

Historical analysis is useful in understanding the typical types of crashes that occur at a particular location; however, the data may not be indicative of future crash rates or causes. A number of factors can contribute to crashes, including

- Traffic congestion (ability to maneuver)
- Driver skills (driver age and experience)
- Driver behavior (speeding, aggressiveness, driving while intoxicated)
- Roadway geometrics (sight distance)
- Weather conditions (rain, glare, snow)
- Nature (animals, fallen trees)
- Vehicle condition, equipment, and maintenance (brakes, tires)
- Roadway condition (pavement condition)

Because multiple factors often are responsible for crashes, not all crashes are attributable to a single cause. However, consistent trends in the frequency or type of crashes over time may indicate issues related to geometrics of the facility.

1.5.6.1 Freeway Segments

Seven years (2002 to 2008) of freeway crash data are summarized in the following tables. Reviewing the trends over the period for I-5 corridor, there were no significant changes in the corridor frequency, type, or severity of crash. WSDOT uses crashes per million vehicle miles (MVM) to calculate a rate that allows comparison between the segments of the freeway. The formula for the crash rate is as follows.

Freeway Segment Crash Rate = (Total Crashes x 1 million)/(7 x ADT x 365 x length)

The freeway mainline collision analysis identifies the segment location, traffic volume, and severity, as well as the crash and fatality rate. Within the project area, freeway mainline crashes were highest northbound on I-5 between the East 28th Street off-ramp to the East Bay Street/SR 167 off-ramp (3.4 crashes per MVM) and lowest at the Port of Tacoma Road on-ramp to 54th Avenue East off-ramp segment. Injury crashes were more than one-third of the total, and six fatalities were recorded over the 7-year period. Table 1-6 summarizes the results of the freeway mainline crash rates for 2002 to 2008.

[1] Under Section 409 of Title 23 of the United States Code, collision data is prohibited from use in any litigation against state, tribal, or local government that involves the location(s) mentioned in the collision data.

Table 1-6. Freeway Mainline Crash Rates (2002 to 2008)

Mainline Segment	ADT	Total (2002 to 2008)				Crash Rate (MVM)	Fatality Rate (100 MVM)
		PDO	Injury	Fatality	Total		
I-5 Northbound							
I-705 on-ramp to E 28th St off-ramp	73,910	189	103	0	292	3.290	0.000
E 28th St off-ramp SR 167 (River Rd) off-ramp	69,530	129	92	0	221	3.456	0.000
SR 167 (River Rd) off-ramp to E 28th St on-ramp	57,555	35	18	1	54	1.266	0.023
E 28th St on-ramp to POT Rd off-ramp to South	66,755	118	51	0	169	1.548	0.000
POT Rd off-ramp to South to POT Rd off-ramp to North	62,655	26	12	0	38	1.583	0.000
POT Rd off-ramp to North to POT Rd on-ramp	60,035	27	15	0	42	0.595	0.000
POT Rd on-ramp to 54th Ave E off-ramp	62,885	32	20	0	52	0.506	0.000
54th Ave E off-ramp to 54th Ave E on-ramp	56,330	51	20	0	71	0.649	0.000
54th Ave E on-ramp to weigh station off-ramp	61,475	182	110	0	292	0.826	0.000
Weigh station off-ramp to weigh station on-ramp	61,120	75	42	0	117	0.727	0.000
Weigh station on-ramp to SR 18 off-ramp	61,475	46	25	0	71	1.005	0.000
Subtotal		910	508	1	1,419		
I-5 Southbound							
SR 18 on-ramp to weigh station off-ramp	64,965	95	56	0	151	1.685	0.000
Weigh station off-ramp to weigh station on-ramp	64,580	71	39	2	112	0.970	0.017
Weigh station on-ramp to 54th Ave E off-ramp	64,965	308	178	1	487	1.103	0.002
54th Ave E off-ramp to 54th Ave E on-ramp	59,845	81	38	1	120	1.207	0.010
54th Ave E on-ramp to POT Rd off-ramp	69,830	47	24	0	71	0.585	0.000
POT Rd off-ramp to POT Rd on-ramp	67,720	94	43	1	138	1.139	0.008
POT Rd on-ramp to E 27th Street off-ramp	75,050	74	33	0	107	1.508	0.000
E 27th St off-ramp to SR 167 (River Rd) on-ramp	67,300	65	40	0	105	1.454	0.000
SR 167 (River R) on-ramp to E 27th St (Portland Ave) on-ramp	80,740	88	49	0	137	1.089	0.000
E 27th St on-ramp to I-705 off-ramp	86,140	25	21	0	46	1.900	0.000
Subtotal		948	521	5	1,474		
Total		1,858	1,029	6	2,893		

According to the *2008 Washington State Collision Data Summary*, the crash rate for interstates in urban areas was 1.41 per MVM. The following locations exceed the statewide average rate for urban interstates.

- I-5 northbound I-705 on-ramp to East 28th Street off-ramp
- I-5 northbound East 28th Street off-ramp to SR 167 (River Road) off-ramp
- I-5 northbound East 28th Street on-ramp to Port of Tacoma Road off-ramp to south

- I-5 northbound Port of Tacoma Road off-ramp to south to Port of Tacoma Road off-ramp to north
- I-5 southbound SR 18 on-ramp to weigh station off-ramp
- I-5 southbound Port of Tacoma Road on-ramp to East 27th Street off-ramp
- I-5 southbound East 27th Street off-ramp to the SR 167 on-ramp

The predominant types of crashes on freeways are rear-end crashes, which account for 58.7 percent of the total within the corridor (Codes 6 and 16; see below). Sideswipe categories made up 17.5 percent of the total, while single vehicle crashes made up 18.7 percent of freeway crashes. Table 1-7 summarizes the types of crashes for freeways.

Table 1-6. Types of Freeway Crashes (2002 to 2008)

Code	Crash Type	2002 to 2009	
		Total	Percentage
Multi-Vehicle			
1	Strikes other vehicle HEAD ON	3	0.1%
2	Strikes LEFT SIDE of other vehicle AT ANGLE	38	1.3%
3	Strikes RIGHT SIDE of other vehicle AT ANGLE	36	1.2%
4	SIDESWIPES LEFT SIDE of other vehicle	242	8.4%
5	SIDESWIPES RIGHT SIDE of other vehicle	190	6.6%
6	Strikes REAR END of other vehicle	1,503	52.0%
7	Strikes FRONT END of other vehicle (not head on)	17	0.6%
11	Was STRUCK by other vehicle HEAD ON	2	0.1%
12	Was struck on LEFT SIDE at ANGLE by other vehicle	15	0.5%
13	Was struck on RIGHT SIDE at ANGLE by other vehicle	14	0.5%
14	Was SIDESWIPED on LEFT SIDE by other vehicle	32	1.1%
15	Was SIDESWIPED on RIGHT SIDE by other vehicle	41	1.4%
16	Was STRUCK in REAR END by other vehicle	193	6.7%
17	Was STRUCK in FRONT END by other vehicle	5	0.2%
27	Strikes or was struck by OBJECT from other vehicle	3	0.1%
29	All other MULTI-VEHICLE involvements	3	0.1%
Subtotal		2,351	81.3%
Single Vehicle			
33	Strikes APPURTENANCE	373	12.9%
34	Strikes other OBJECT	45	1.6%
35	Strikes or was struck by WORKING OBJECT	4	0.1%
50	Vehicle OVERTURNED	56	1.9%
54	Noncollision FIRE	22	0.8%
60	Ran into roadway DITCH	20	0.7%
61	Ran into RIVER, LAKE, etc.	2	0.1%
62	Ran OVER EMBANKMENT – no guardrail present	5	0.2%

Table 1-6. Types of Freeway Crashes (2002 to 2008)

Code	Crash Type	2002 to 2009	
		Total	Percentage
98	Jackknife trailer	4	0.1%
99	All other SINGLE VEHICLE involvements	11	0.4%
Subtotal		542	18.7%
Total		2893	100.0%

1.5.6.2 Freeway Ramps

Typical crash rates on the ramps within the project area ranged from more than 28 crashes per MVM to less than 1 per MVM. The 54th Avenue East on-ramp to I-5 southbound had the lowest rate and the Port of Tacoma off-ramp from southbound I-5 had the highest.

Table 1-8 presents the freeway ramp crash rates in the study area. The following ramp locations had rates above 10 crashes per MVM.

- Northbound 54th Avenue East off-ramp to the south
- Northbound 54th Avenue East off-ramp to the north
- Southbound 54th Avenue East off-ramp
- Southbound Port of Tacoma Road off-ramp

Table 1-7. Freeway Ramp Crash Rates (2002 to 2008)

	Length	ADT	Total (2002-2008)				Crash Rate (MVM)	Fatality Rate (100 MVM)
			PDO	Injury	Fatality	Total		
I-5 Northbound								
E 28th St off-ramp	0.28	4,380	17	13	0	30	9.574	0.000
SR 167 off-ramp	0.29	11,975	12	2	0	14	1.578	0.000
E 28th St on-ramp	0.22	9,200	4	3	0	7	1.354	0.000
POT Rd off-ramp to south	0.23	4,100	5	2	0	7	2.905	0.000
POT Rd off-ramp to north	0.29	2,620	9	3	0	12	6.181	0.000
POT Rd on-ramp	0.45	2,850	4	0	0	4	1.221	0.000
54th Ave E off-ramp to south	0.31	3,900	48	33	0	81	26.222	0.000
54th Ave E off-ramp to north	0.24	2,655	22	14	0	36	22.112	0.000
54th Ave E on-ramp	0.5	5,145	9	2	0	11	1.674	0.000
Subtotal			130	72	0	202		

Table 1-7. Freeway Ramp Crash Rates (2002 to 2008)

	Length	ADT	Total (2002-2008)				Crash Rate (MVM)	Fatality Rate (100 MVM)
			PDO	Injury	Fatality	Total		
I-5 Southbound								
54th Ave E off-ramp	0.29	5,120	23	16	0	39	10.280	0.000
54th Ave E on-ramp from south	0.28	4,650	1	1	0	2	0.601	0.000
54th Ave E on-ramp from north	0.41	5,335	8	6	0	14	2.505	0.000
POT Rd off-ramp	0.32	2,110	33	16	0	49	28.404	0.000
POT Rd on-ramp	0.41	7,330	16	5	0	21	2.735	0.000
E 27th St off-ramp	0.28	7,750	19	17	0	36	6.493	0.000
SR 167 on-ramp	0.38	13,440	17	9	0	26	1.993	0.000
E 27th St on-ramp	0.60	5,400	10	3	0	13	1.570	0.000
Subtotal			127	73	0	200		
Total			257	145	0	402		

Rear-end crashes dominated freeway ramp crashes, accounting for 47 percent of the total. Single vehicle crashes made up 38.6 percent, with two-thirds of these crashes related to striking a ramp appurtenance or other stationary object. Table 1-9 summarizes the types of crashes occurring on freeway ramps.

1.5.6.3 Local Corridors

Local corridors were analyzed for the 7-year period between 2002 and 2008. Overall, more than 100 crashes occurred along the six major corridors within the study area, which include 12th Street East, Pacific Highway East, 20th Avenue East, Port of Tacoma Road, Alexander Avenue East, and 54th Avenue East. Tables 1-10 and 1-11 summarize the local corridor results for roadway segments and intersections, respectively.

Table 1-8. Freeway Ramp Crash Types (2002 to 2008)

Code	Crash Type	2002 to 2008	
		Total	Percentage
Multi-Vehicle			
1	Strikes other vehicle HEAD ON	3	0.7%
2	Strikes LEFT SIDE of other vehicle AT ANGLE	6	1.5%
3	Strikes RIGHT SIDE of other vehicle AT ANGLE	6	1.5%
4	SIDESWIPES LEFT SIDE of other vehicle	11	2.7%
5	SIDESWIPES RIGHT SIDE of other vehicle	4	1.0%
6	Strikes REAR END of other vehicle	158	39.3%
7	Strikes FRONT END of other vehicle (not head on)	6	1.5%
12	Was struck on LEFT SIDE at ANGLE by other vehicle	4	1.0%
13	Was struck on RIGHT SIDE at ANGLE by other vehicle	4	1.0%
14	Was SIDESWIPED on LEFT SIDE by other vehicle	8	2.0%
15	Was SIDESWIPED on RIGHT SIDE by other vehicle	3	0.7%
16	Was STRUCK in REAR END by other vehicle	32	8.0%
17	Was STRUCK in FRONT END by other vehicle (not head on)	2	0.5%
29	All other MULTI-VEHICLE involvements	1	0.2%
Subtotal		247	61.4%
Single Vehicle			
33	Strikes APPURTENANCE	89	22.1%
34	Strikes other OBJECT	7	1.7%
35	Strikes or was struck by WORKING OBJECT	1	0.2%
50	Vehicle OVERTURNED	35	8.7%
54	Noncrash FIRE	2	0.5%
60	Ran into roadway DITCH	10	2.5%
61	Ran into RIVER, LAKE, etc.	2	0.5%
62	Ran OVER EMBANKMENT – no guardrail present	6	1.5%
73	Pedal cyclist STRUCK by vehicle	2	0.5%
99	All other SINGLE VEHICLE involvements	1	0.2%
Subtotal		155	38.6%
Total		402	100.0%

Table 1-9. Corridor Segment Crash Rates (2002 to 2008)

Corridor		Length	ADT	2002-2008 Total				Crash Rate (MVM)	Fatality Rate (100 MVM)
Street	Segment			PDO	Injury	Fatal	Total		
12th St E	Alexander Ave E - 54th Ave E	0.74	3,626	19	1	0	20	2.92	0.00
Pacific Hwy E	POT Rd - 54th Ave E	1.20	16,241	209	70	1	280	5.62	0.02
20th St E	POT Rd - 54th Ave E	1.47	11,103	91	29	0	120	2.88	0.00
POT Rd	12th St E - 20th St E	0.4	11,503	37	12	0	49	4.17	0.00
Alexander Ave E	12th St E - Pacific Hwy E	0.2	6,145	7	1	0	8	2.55	0.00
54th Ave E	12th St E - 20th St E	0.41	18,508	168	40	0	208	10.73	0.00
Other Locations				21	6	0	27		
Total				552	159	1	712		

Table 1-10. Intersection Crash Rates (2002 to 2008)

Intersection		ADT	2002-2008 Total				Crash Rate (MEV)	Fatality Rate (100 MEV)
East-West	North-South		PDO	Injury	Fatal	Total		
12th St E	POT Rd	12,910	1	0	0	1	0.03	0.00
12th St E	Alexander Ave E	9,185	0	1	0	1	0.04	0.00
12th St E	54th Ave E	17,470	6	4	0	10	0.22	0.00
Pacific Hwy E	POT Rd	24,415	14	2	0	16	0.26	0.00
Pacific Hwy E	Alexander Ave E	18,865	6	4	0	10	0.21	0.00
Pacific Hwy E	54th Ave E	37,265	45	16	0	61	0.64	0.00
20th St E	POT Rd	15,005	12	1	0	13	0.34	0.00
20th St E	Frank Albert Rd E	13,035	4	2	0	6	0.18	0.00
20th St E	54th Ave E	29,195	23	4	0	27	0.36	0.00
I-5 off-ramp SB	POT Rd	10,765	1	0	0	1	0.04	0.00
I-5 on-ramp SB	POT Rd	15,985	2	0	0	2	0.05	0.00
I-5 off-ramp NB	POT Rd	14,375	0	0	0	0	0.00	0.00
I-5 on-ramp NB	POT Rd	10,505	0	0	0	0	0.00	0.00
I-5 off-ramp SB	54th Ave E	19,590	2	2	0	4	0.08	0.00
I-5 on-ramp SB	54th Ave E	24,455	2	1	0	3	0.05	0.00
I-5 off-ramp NB	54th Ave E	22,855	3	0	0	3	0.05	0.00
I-5 on-ramp NB	54th Ave E	21,445	2	0	0	2	0.04	0.00
Other Locations			54	23	0	77		
Total			177	60	0	237		

The analysis used the same segment methodology to calculate the crash rate for each corridor. The formula for the crash rate for corridors is as follows.

Corridor Crash Rate = (Total Crashes x 1 million)/(7 x ADT x 365 x length)

Corridors crashes (Table 1-10) include collisions at driveways and minor intersections within each segment, but do not include major intersections in the planning area; they were evaluated separately. Crash rates for roadway segments ranged from a high of 10.73 crashes per MVM on 54th Avenue East to 2.55 per MVM on Alexander Avenue East. Typical crash rates (source: *2008 Washington State Collision Data Summary)* for Puget Sound principal arterials average 2.5 to 3.0 per MVM, while rates on minor arterials average 3.5 to 4.0 per MVM. On this basis, most of the corridor segment crash rates are higher than average, notably along Pacific Highway and 54th Avenue East.

1.5.6.4 Local Intersections

The analysis used the number of crashes and the annual daily traffic entering an intersection to evaluate the rates of crashes at local intersections between 2002 and 2008. The formula for the intersection crash rate is as follows.

Intersection Crash Rate = (Total Crashes x 1 million)/(7 years x ADT x 365)

The intersection crashes include all crashes occurring at intersections as identified by the City. Average urban area signalized intersection crash rates are typically in the 0.7 to 0.9 per million entering vehicles (MEV) range (source: *King County collision records, 2008*). The highest crash rate occurred at Pacific Highway East/Port of Tacoma Road with 0.64 crash per MEV. The I-5 northbound on- and off-ramps had no recorded crashes during this period.

1.6 No-Build Conditions for 2020 (Year of Opening)

The analysis of the No-Build alternative represents the operating conditions without the construction of the Proposed Alternative. The no-build conditions for 2020 provide a comparison for the Proposed Alternative at its year of opening. The No-Build condition assumes no additional improvements to freeways, interchanges, arterials, or ramps within the study area, other than those identified in local and regional planning documents. For 2020, the No-Build analysis assumes that the SR 167 interchange and extension are not constructed. Table 1-1 lists assumed improvements.

1.6.1 No-Build 2020 Traffic Operations

The evaluation analyzed traffic conditions for the 2020 AM and PM peak hours for freeways and major intersections.

1.6.1.1 Freeway Operations (2020 No-Build)

The analysis of 2020 No-Build conditions included freeway basic mainline segments, merge and diverge, and weaving segments.

The northbound I-5 mainline in the AM peak hour would generally operate at LOS E with 12 out of 20 mainline segments operating at LOS E during the AM peak hour. The LOS E

segments extend from the 28th Street on-ramp to SR 18. While only six segments operate at LOS E in the northbound direction in the AM peak hour under existing conditions, all of these segments are south of the 28th Street on-ramp. The extension of the HOV lane through the study area would shift the location of the freeway bottleneck to the north, improving segments south of the 28th Street on-ramp to LOS D, but worsening segments further north to LOS E.

The southbound I-5 mainline in the AM peak hour would operate better than the northbound mainline. In the 2020 No-Build conditions, only two southbound segments would operate at LOS E and one would operate at LOS F. The diverge segment at the off-ramp to 54 Avenue East would operate at LOS F due to queues extending back from the local street intersection. Under existing conditions, all segments operate at LOS D or better.

During the PM peak hour, 3 of 20 northbound I-5 segments would operate at LOS E. These segments include the diverge segment at the off-ramp to East 28th Street/Portland Avenue, the basic segment between Port of Tacoma Road off- and on-ramps, and the merge segment at the on-ramp from the truck scales. The analysis of existing conditions showed that two segments currently operate at LOS E and one operates at LOS F.

Under 2020 No-Build conditions, fewer segments along the southbound I-5 mainline would operate at LOS E or F during the PM peak hour than under existing conditions because the assumed extension of the HOV lane south to Tacoma would remove the existing bottlenecks and improve traffic operations.

Table 1-12 summarizes the I-5 mainline operations under 2020 No-Build conditions. Figures 1-10 and 1-11 represent the 2020 No-Build freeway lanes, density, and LOS operating conditions schematically at different freeway segments on the I-5 corridor within the study area.

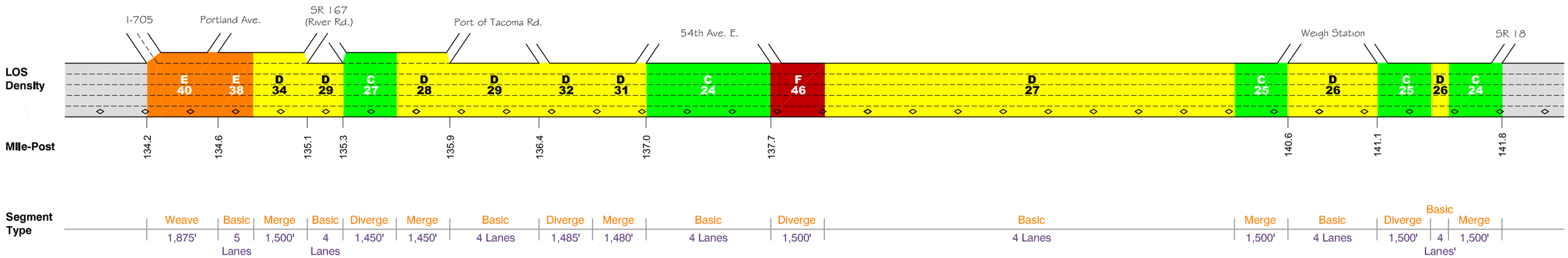
Table 1-11. 2020 No-Build I-5 Mainline Freeway Operations Summary

	Type	AM Peak Hour		PM Peak Hour	
		LOS	Density	LOS	Density
I-5 Northbound					
I-5 NB on-ramp from I-705	Merge	D	29	D	35
I-5 NB off-ramp to E 28th Street/Portland Ave	Diverge	C	28	E	36
I-5 NB off-ramp to E Bay Street	Diverge	D	31	D	34
I-5 NB between E Bay Street off/on-ramps	Basic	D	33	D	27
I-5 NB on-ramp from E 28th Street	Merge	D	31	C	25
I-5 NB between E 28th Street. On-ramp and POT Rd off-ramp	Basic	E	35	D	29
I-5 NB off-ramp to POT Rd SB	Diverge	E	36	D	30
I-5 NB off-ramp to POT Rd NB	Diverge	E	41	D	33
I-5 NB between POT Rd NB off/on-ramps	Basic	E	41	E	35
I-5 NB on-ramp from POT Rd	Merge	C	27	C	24
I-5 NB between POT Rd and 54th Ave E	Basic	E	36	D	32

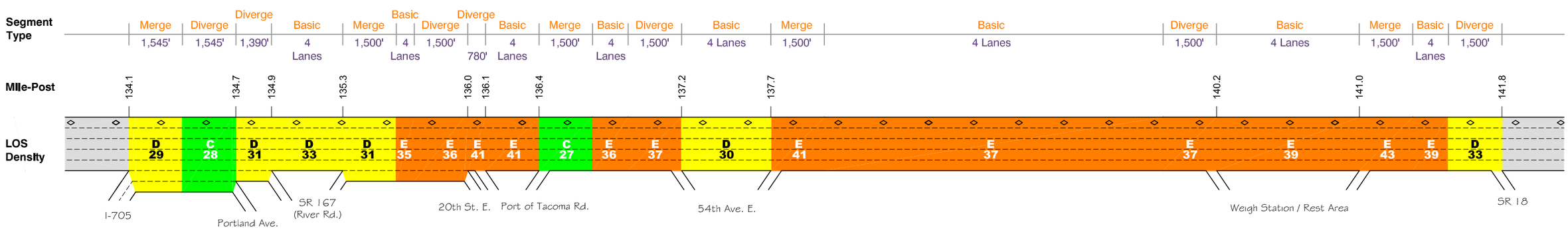
Table 1-11. 2020 No-Build I-5 Mainline Freeway Operations Summary

	Type	AM Peak Hour		PM Peak Hour	
		LOS	Density	LOS	Density
I-5 NB off-ramp to 54th Ave E	Diverge	**E**	37	D	33
I-5 NB between 54th Ave E on/off-ramps	Basic	D	30	D	26
I-5 NB on-ramp from 54th Ave E	Merge	**E**	41	D	33
I-5 NB between 54th Ave E on-ramp and truck scales off-ramp	Basic	**E**	37	D	32
I-5 NB off-ramp to truck scales	Diverge	**E**	37	D	33
I-5 NB between truck scales off/on-ramps	Basic	**E**	39	D	35
I-5 NB on-ramp from truck scales	Merge	**E**	43	**E**	40
I-5 NB between truck scales and SR 18	Basic	**E**	39	D	35
I-5 NB off-ramp to SR 18	Diverge	D	33	D	31
Notes: Average volumes based on 13 VISSIM runs. Bold indicates unacceptable operation. Source: Fehr & Peers, 2010.					
I-5 Southbound					
I-5 SB on-ramp from SR 18	Merge	C	24	C	26
I-5 SB between SR 18 and truck scales	Basic	D	26	D	31
I-5 SB off-ramp to truck scales	Diverge	C	25	C	28
I-5 SB between truck scales off/on-ramps	Basic	D	26	D	30
I-5 SB on-ramp from truck scales	Merge	C	25	C	28
I-5 SB between truck scales and 54th Ave E off-ramp	Basic	D	27	D	30
I-5 SB off-ramp to 54th Ave E	Diverge	**F**	46	**E**	36
I-5 SB between 54th Ave E on/off-ramps	Basic	C	24	D	28
I-5 SB on-ramp from 54th Ave E	Merge	D	31	D	34
I-5 SB off-ramp to POT Rd	Diverge	D	32	D	34
I-5 SB between POT Rd off/on-ramps	Basic	D	29	D	32
I-5 SB on-ramp from POT Rd	Merge	D	28	D	34
I-5 SB off-ramp to Bay Street	Diverge	C	27	D	34
I-5 SB between Bay Street on/off-ramps	Basic	D	29	D	33
I-5 SB on-ramp from Bay Street	Merge	D	34	D	29
I-5 SB between Bay Street and E 27th Street/Portland Ave	Basic	**E**	38	D	32
I-5 SB weave between E 27th Street/Portland Ave and I-705	Weave	**E**	40	D	35
Notes: Average volumes based on 13 VISSIM runs. **Bold** indicates unacceptable operation. Source: Fehr & Peers, 2010.					

Interstate 5: State Route 18 to Interstate 705 (Southbound)



Interstate 5: Interstate 705 to State Route 18 (Northbound)



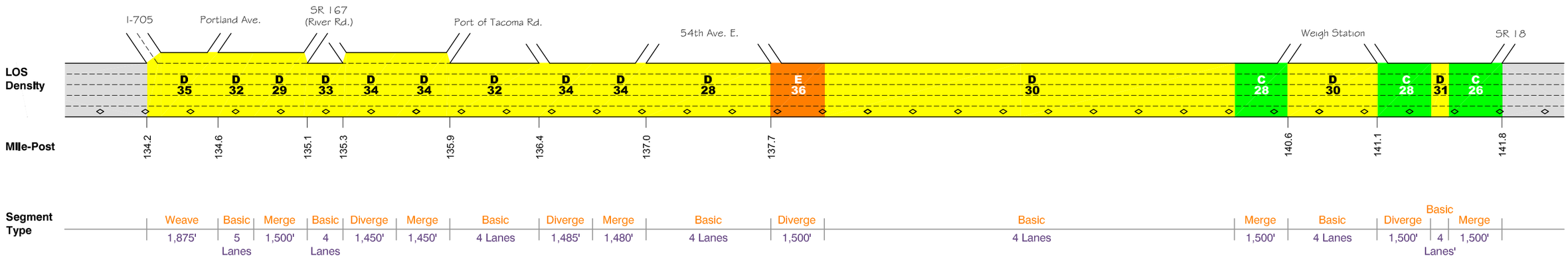
LEGEND

		Level of Service
6.0	Mile-Post	A - C
◊	HOV Bypass Lane	D
D — 32.8	Level of Service / Density (Vehicles / Lane Mile)	E
		F

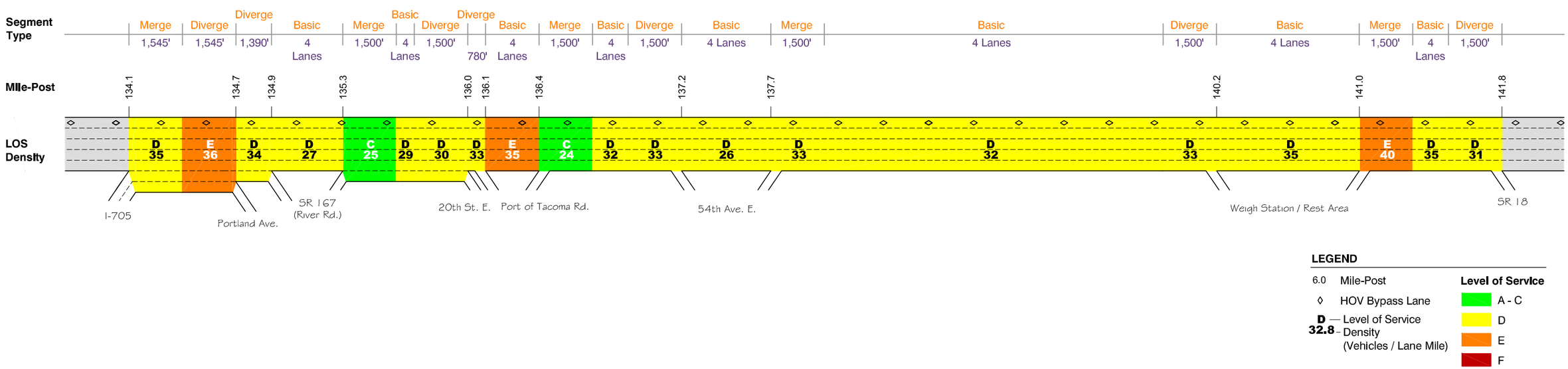
AM PEAK HOUR LANE CONFIGURATIONS AND LEVEL OF SERVICE - 2020 NO ACTION

FIGURE 1-10

Interstate 5: State Route 18 to Interstate 705 (Southbound)



Interstate 5: Interstate 705 to State Route 18 (Northbound)



PM PEAK HOUR LANE CONFIGURATIONS AND LEVEL OF SERVICE - 2020 NO ACTION

FIGURE 1-11

Compared with the results for 2006, traffic volumes, density, and congestion increase significantly under the 2020 No-Build condition in the AM peak hour in the northbound direction and in the southbound direction during PM peak hour.

1.6.1.2 Intersections Operations (2020 No-Build)

The operational analysis of the 15 major intersections within the study area for the 2020 No-Build condition considered the system improvements listed in Table 1-1. The evaluation examined the traffic volumes and LOS for each of the study area intersections with these system improvements. As part of corridor improvements, study intersections are planned to be improved by 2020 with additional turn lanes or other traffic control improvements. The 20th Street East/Port of Tacoma Road and 20th Street East/Industry Drive stop-controlled intersections are planned to be signalized during this period.

Under 2020 No-Build conditions, the Port of Tacoma Road/I-5 southbound ramps and 54th Avenue East/20th Street East intersections would operate at LOS E in the AM peak hour. All other study intersections would operate at LOS D or better during this time period. During the PM peak hour, six intersections would operate at LOS E or F. The longest delays would occur at the 54th Avenue East/Pacific Highway East intersection. All other study intersections would operate at LOS D or better in the PM peak hour

Table 1-13 summarizes the LOS operations and calculated delay at study intersections during the AM and PM peak hours, as observed in the 2020 No-Build analysis. Figures 1-12 through 1-14 present intersection LOS, geometry, and volume for the AM peak hour and Figures 1-15 through 1-17 display the same information for the PM peak hour.

1.6.2 No-Build 2020 Safety

Increases in congestion can result in higher incidences of crashes on freeways and intersections within the study area. Higher congestion levels can lead to higher levels of rear-end and sideswipe crashes as periods of extreme traffic congestion become more common throughout the day. Intersections without capacity improvements may have higher crash rates as drivers become more aggressive and take more risks in congested conditions. Even if crash rates remain the same, the total yearly crashes will likely increase due to the growth in traffic volumes. Tables 1-14 to 1-17 show the crash forecast, including PDO, injury, and fatality, on freeway mainline segments, ramps, local corridors, and intersections.

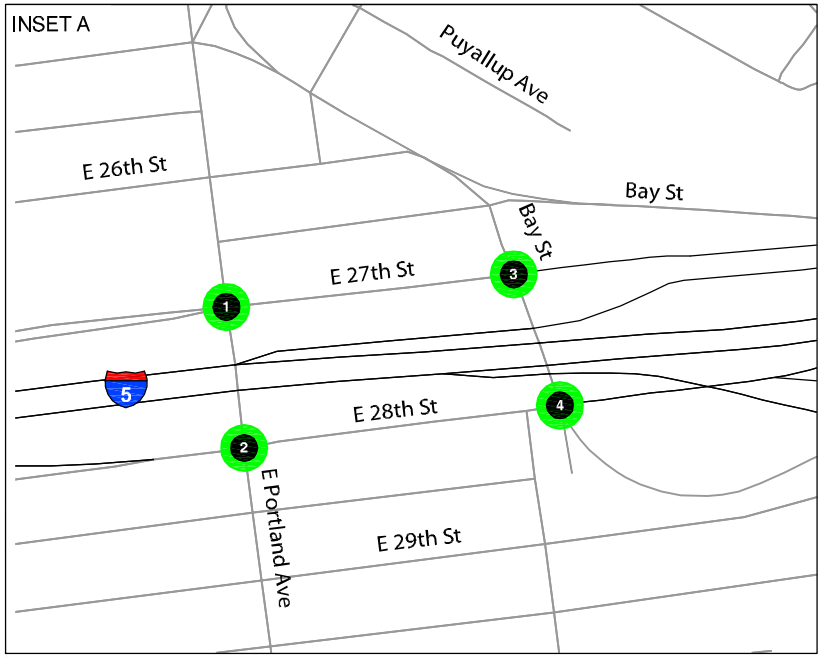
1.6.2.1 No-Build Conditions for 2040 (Design Year)

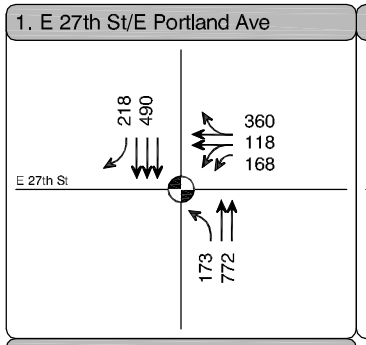
The No-Build analysis represents the operating conditions if the Proposed Alternative was not constructed. The No-Build conditions for 2040 provides a comparison for the Proposed Alternative for the design year. The No-Build condition assumes additional improvements to freeways, interchanges, arterials, or ramps within the study area other than those identified in local and regional planning documents, including the SR 167 interchange and extension. The complete list of planned network improvements for 2040 is found in Table 1-1.

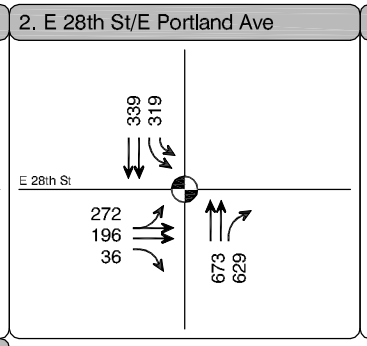
Table 1-12. Intersection Levels of Service – 2020 Peak Hour Conditions – No-Build

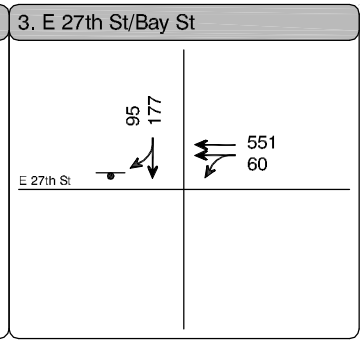
Intersection		Traffic Control	AM Peak Hour					PM Peak Hour				
			NB	SB	EB	WB	Total	NB	SB	EB	WB	Total
1	E. Portland Ave/E. 27th St	Signal	C/29	B/15		D/43	C/28	D/44	**F/81**		**E/65**	**E/71**
2	E. Portland Ave/E. 28th St	Signal	D/35	B/16	**E/56**		D/38	C/33	B/15	C/34		C/23
3	E. Bay St/E. 27th St	SSSC		A/8		A/2	A/4		B/13		A/4	A/5
4	E. Bay St/E. 28th St	Signal		B/15	A/7		A/8		C/25	B/13		B/14
5	POT Rd/I-509 EB Ramps	Signal	B/14	B/14	B/17	B/15	B/15	B/13	B/19	B/16	B/14	B/16
6	POT Rd/Pacific Hwy	Signal	B/12	**F/86**	D/52	D/48	D/45	B/11	**F/146**	**E/76**	**E/66**	**E/75**
7	POT Rd/I-5 SB Ramps	Signal	**F/122**	A/1		**E/74**	**E/78**	**F/140**	A/1		**E/79**	**E/62**
8	POT Rd/I-5 NB Ramps	Unct.	A/1	A/3	A/4		A/3	A/5	A/9	A/4		A/6
9	POT Rd/20th St E	Signal	B/14	A/8	B/14	A/5	A/8	C/25	A/10	C/24	**E/65**	D/38
10	Industry Dr. E/20th St E	Signal	C/21		A/9	A/6	B/11	**E/63**		A/10	**F/171**	**F/85**
11	54th Ave E/12 St E	Signal	A/9	A/10	D/50	D/44	B/17	B/18	D/50	**F/166**	D/52	D/47
12	54th Ave E/Pacific Hwy	Signal	C/28	D/39	**E/56**	D/51	D/42	C/32	**F/112**	**F/>200**	**F/158**	**F/>200**
13	54th Ave E/I-5 SB Ramps	Signal	A/10	A/4		**F/144**	D/37	C/32	C/33		C/30	C/32
14	54th Ave E/1-5 NB Ramps	Unct.	A/6	C/28	C/35		B/17	A/3	**E/72**	B/11		C/30
15	54th Ave E/20th St E	Signal	**E/78**	C/25	D/52	**F/188**	**E/79**	**F/>200**	A/1	**F/125**	D/40	**F/92**

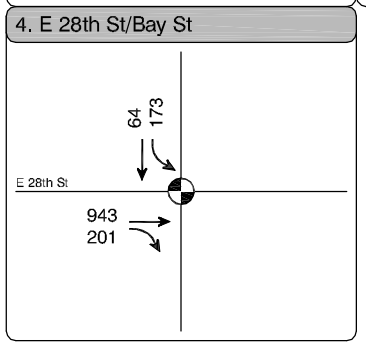
Notes: SSSC = Side-Street Stop-Controlled.
Unct. = Uncontrolled.
Source: Fehr & Peers, 2010
Bold indicates unacceptable operation.

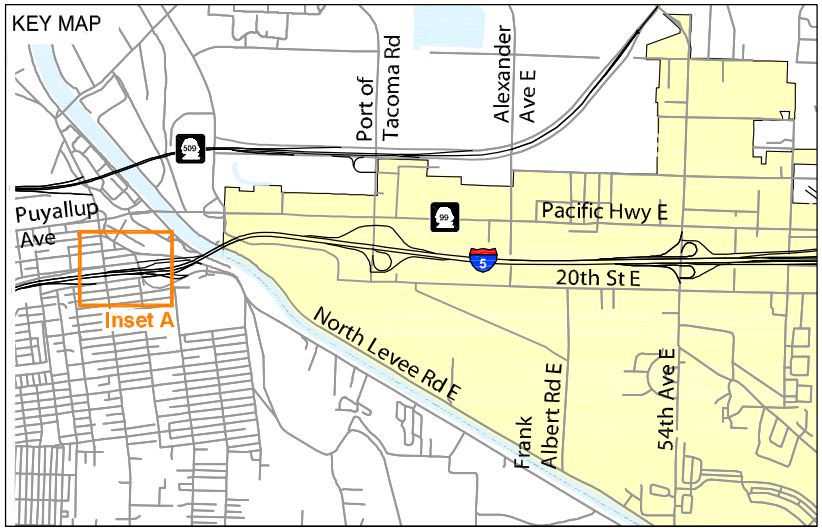












N

NOT TO SCALE

LEGEND

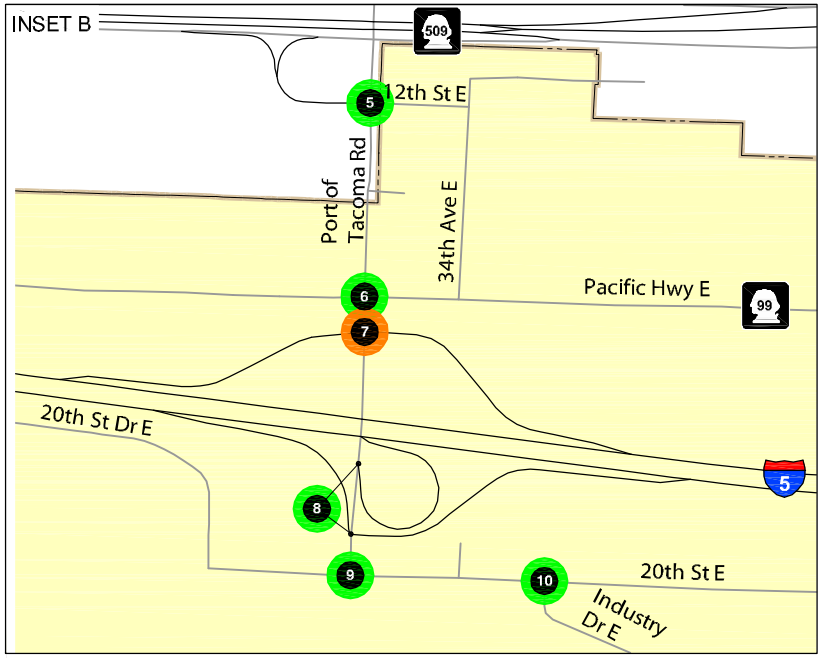
	Turn Lane	1	Study Intersection		Stop Sign
XX	Peak Hour Traffic Volume		Traffic Signal		City of Fife

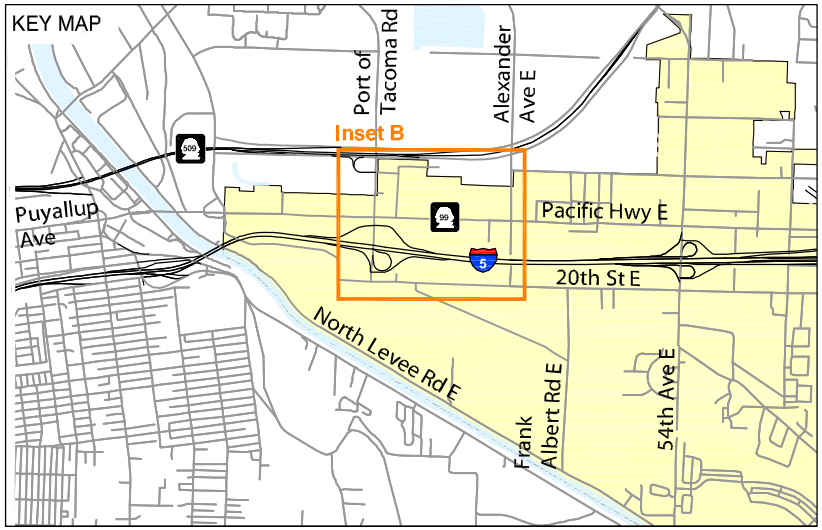
Level of Service

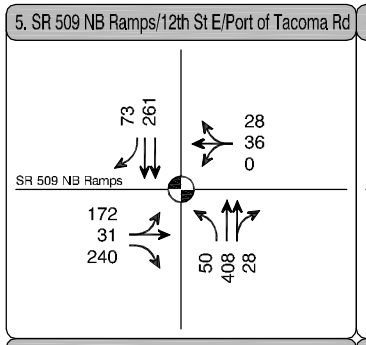
	A - D		E		F

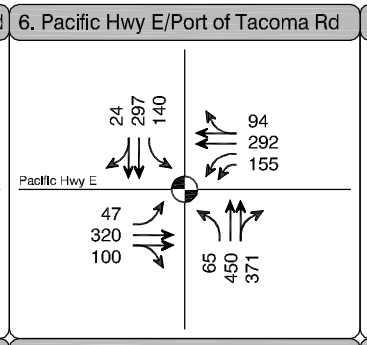
AM PEAK HOUR TRAFFIC VOLUMES AND LANE CONFIGURATIONS - 2020 NO ACTION (INSET A)

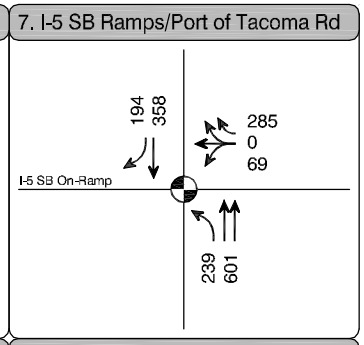
FIGURE 1-12

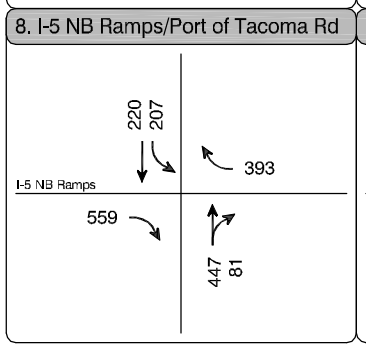


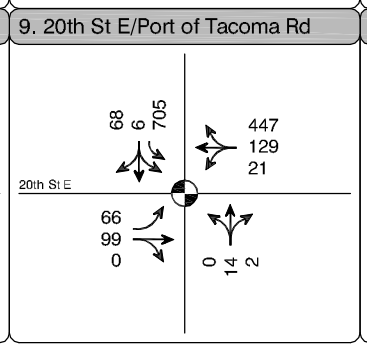


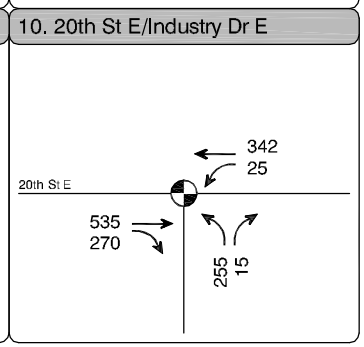












N

NOT TO SCALE

LEGEND

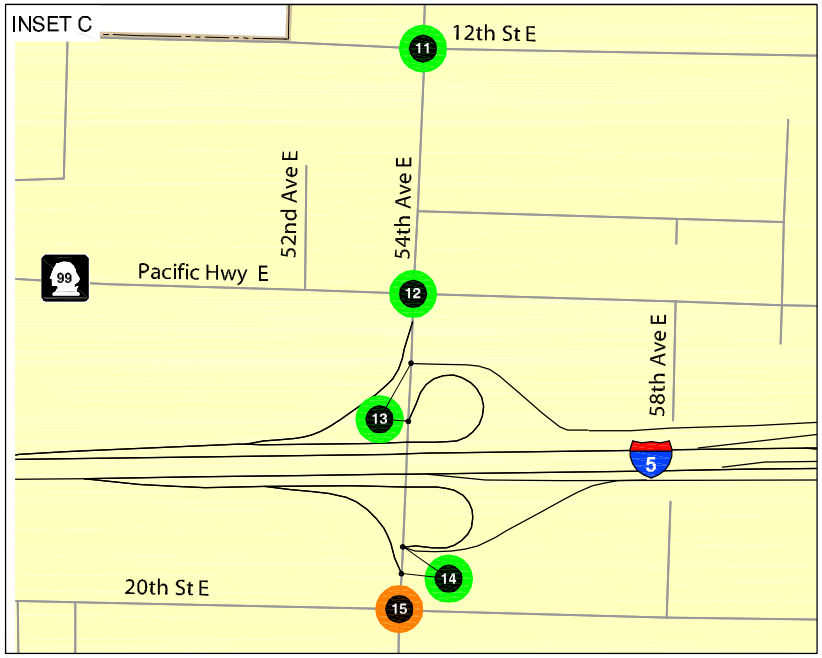
	Turn Lane		Study Intersection		Stop Sign
XX	Peak Hour Traffic Volume		Traffic Signal		City of Fife

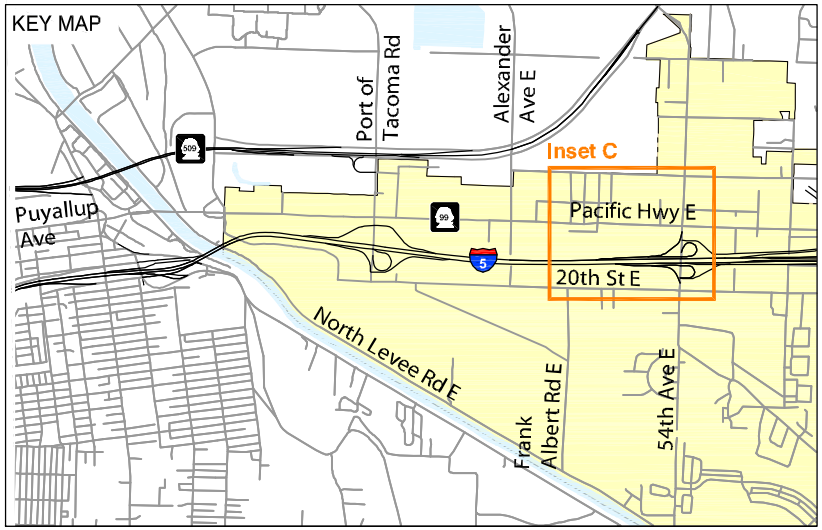
Level of Service

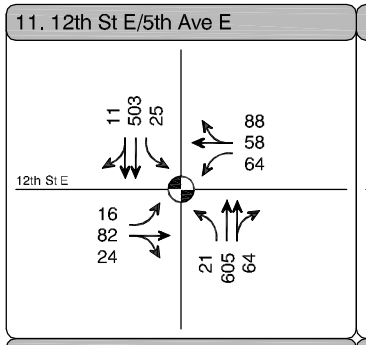
	A - D		E		F

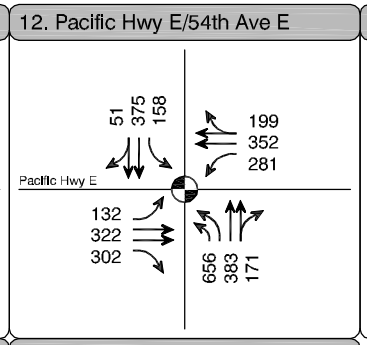
AM PEAK HOUR TRAFFIC VOLUMES AND LANE CONFIGURATIONS - 2020 NO ACTION (INSET B)

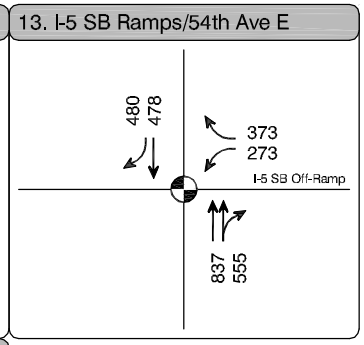
FIGURE 1-13

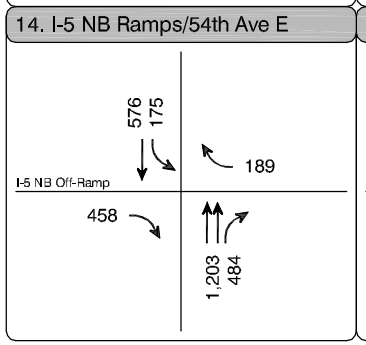


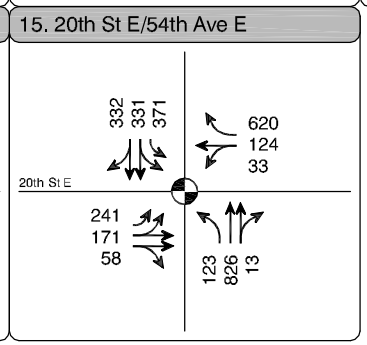












N

NOT TO SCALE

LEGEND

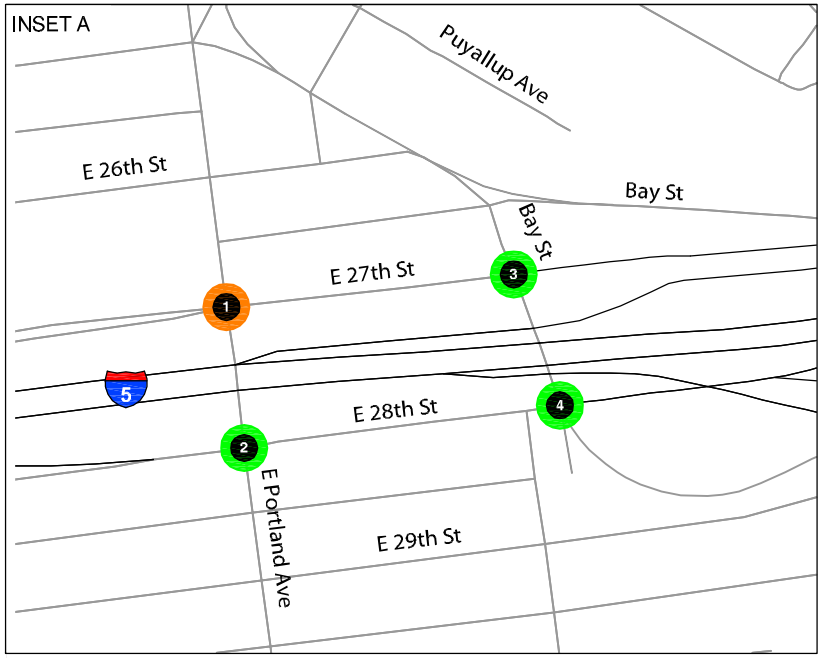
	Turn Lane		Study Intersection		Stop Sign
XX	Peak Hour Traffic Volume		Traffic Signal		City of Fife

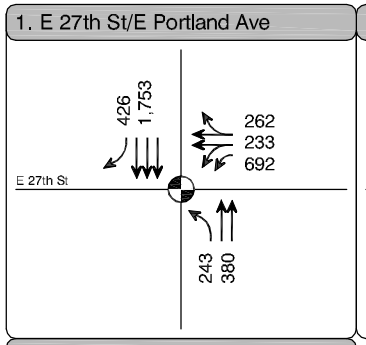
Level of Service

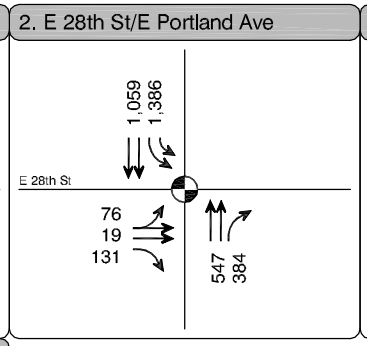
	A - D		E		F

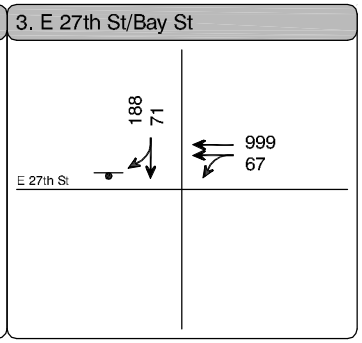
AM PEAK HOUR TRAFFIC VOLUMES AND LANE CONFIGURATIONS - 2020 NO ACTION (INSET C)

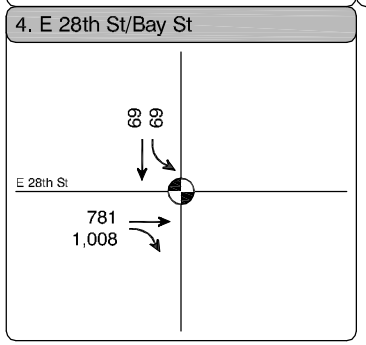
FIGURE 1-14

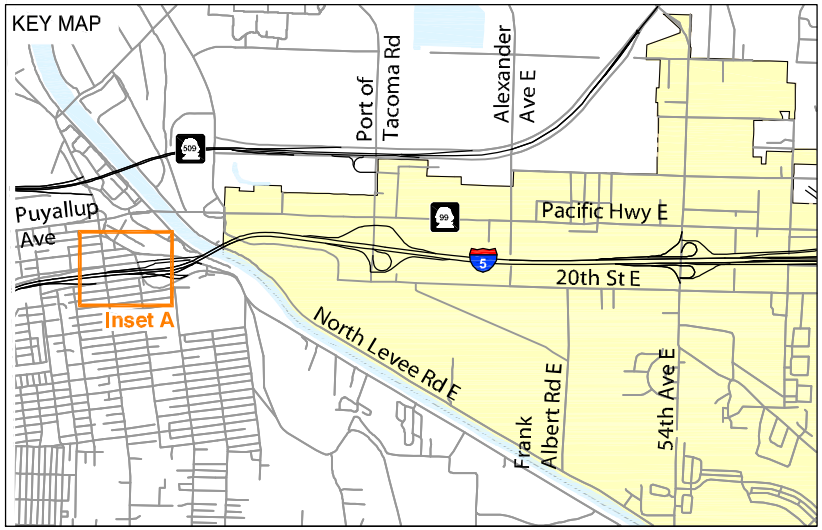












N

NOT TO SCALE

LEGEND

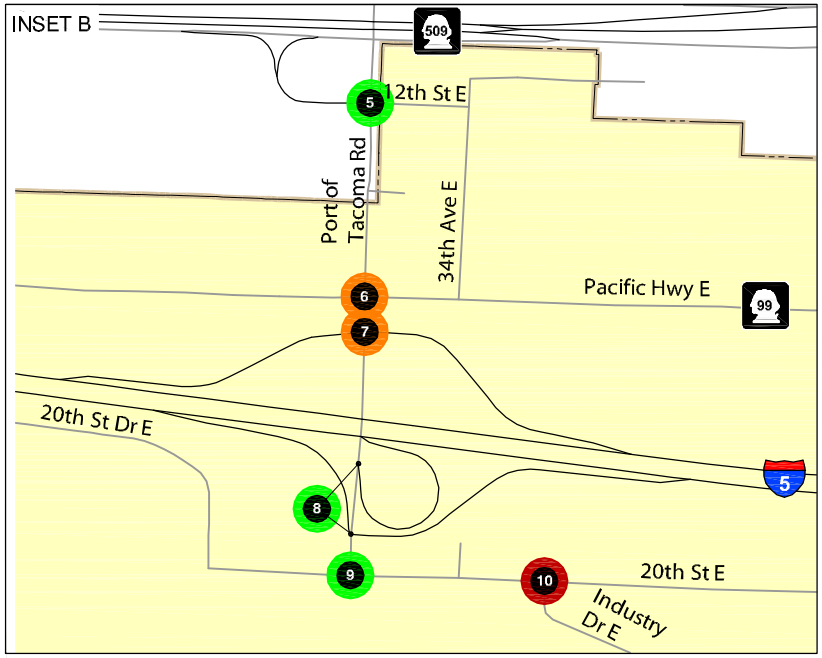
	Turn Lane	1	Study Intersection		Stop Sign
XX	Peak Hour Traffic Volume		Traffic Signal		City of Fife

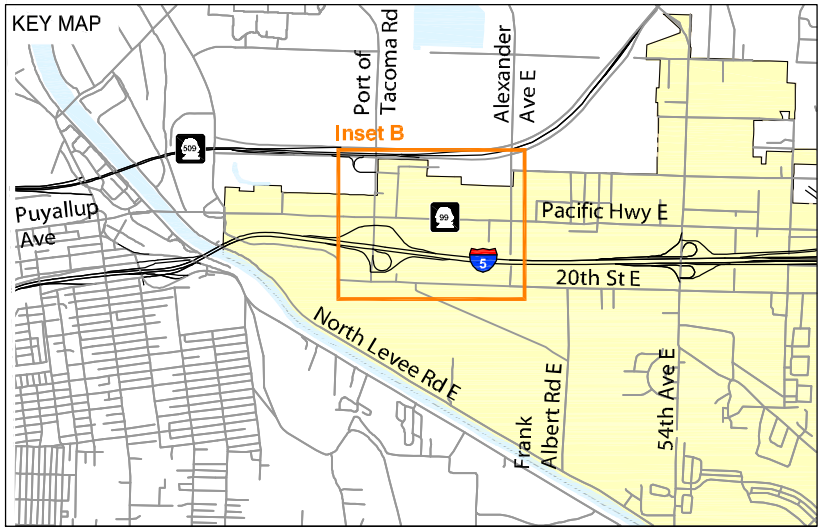
Level of Service

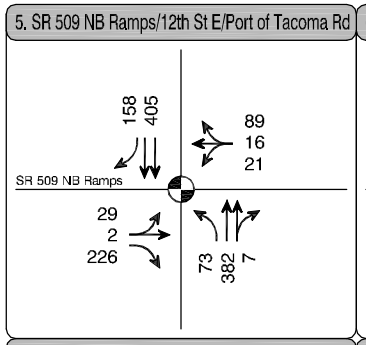
A - D	E	F

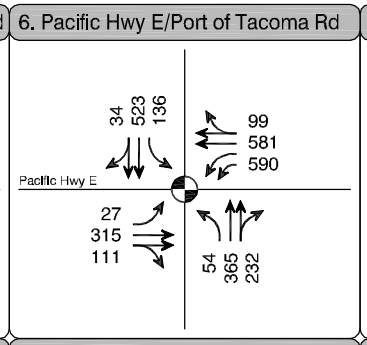
PM PEAK HOUR TRAFFIC VOLUMES AND LANE CONFIGURATIONS - 2020 NO ACTION (INSET A)

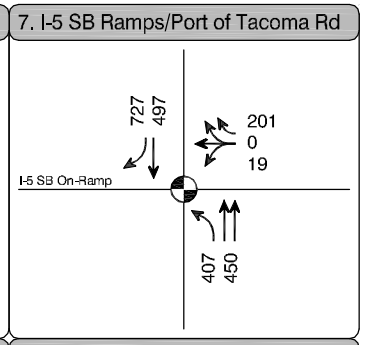
FIGURE 1-15

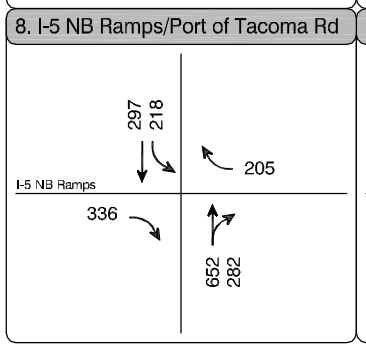


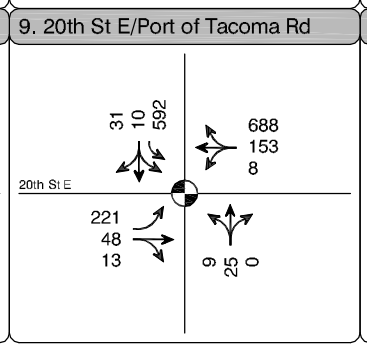


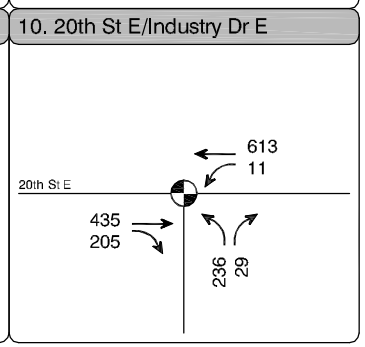












N

NOT TO SCALE

LEGEND

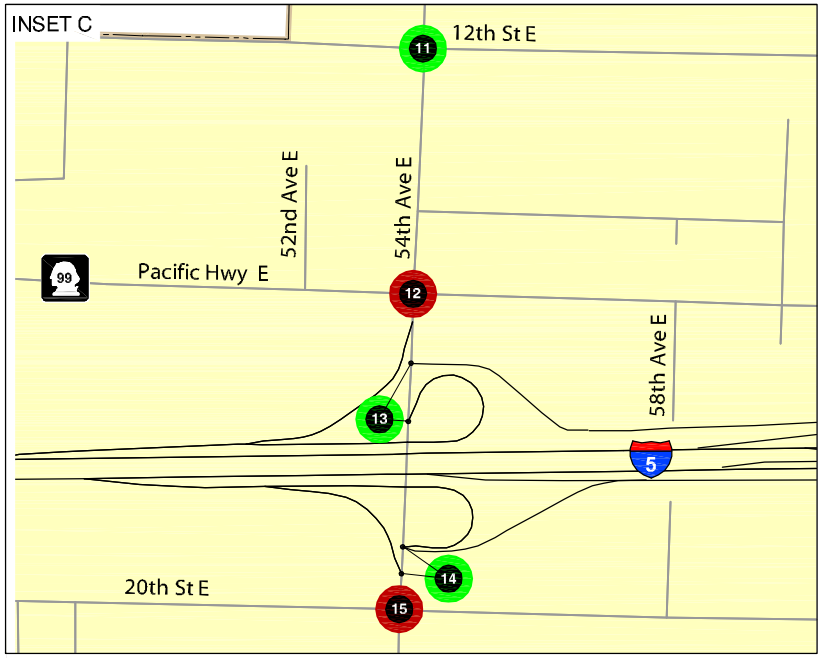
- Turn Lane
- XX Peak Hour Traffic Volume
- Study Intersection
- Traffic Signal
- Stop Sign
- City of Fife

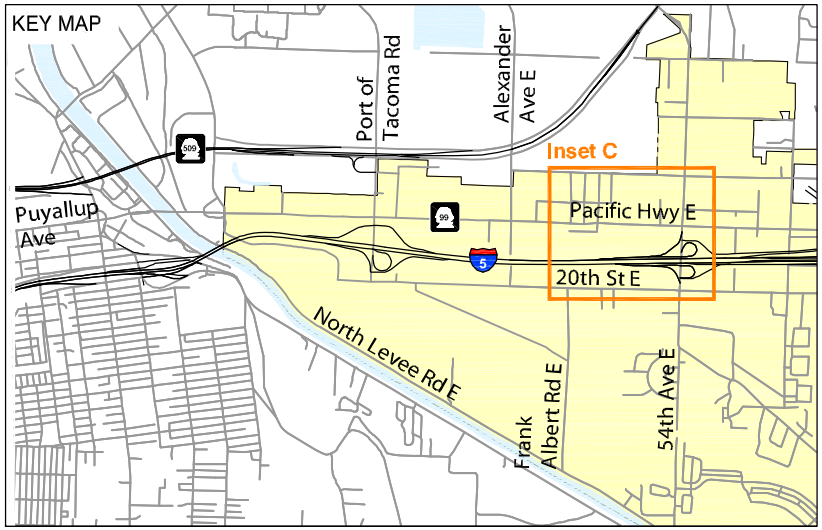
Level of Service

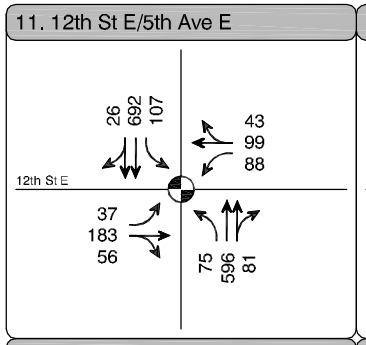
- A - D
- E
- F

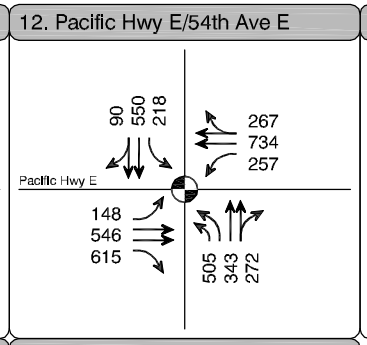
PM PEAK HOUR TRAFFIC VOLUMES AND LANE CONFIGURATIONS - 2020 NO ACTION (INSET B)

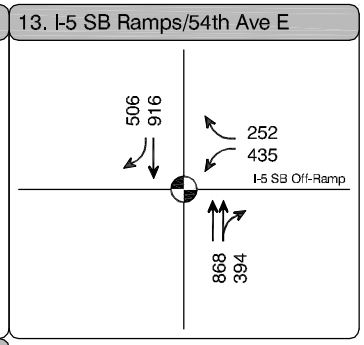
FIGURE 1-16

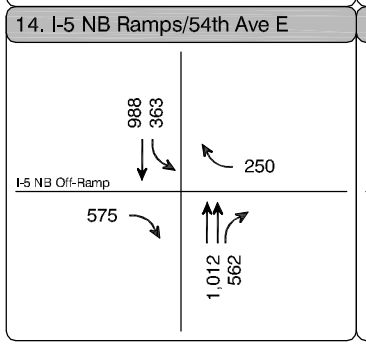


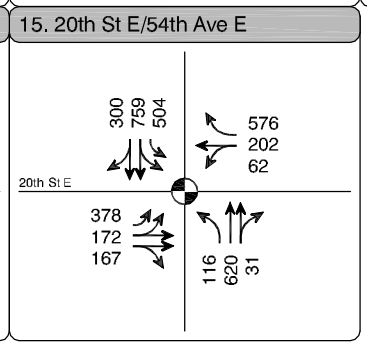












N

NOT TO SCALE

LEGEND

	Turn Lane		Study Intersection		Stop Sign
XX	Peak Hour Traffic Volume		Traffic Signal		City of Fife

Level of Service

	A - D		E		F

PM PEAK HOUR TRAFFIC VOLUMES AND LANE CONFIGURATIONS - 2020 NO ACTION (INSET C)

FIGURE 1-17

Table 1-13. Freeway Mainline Crash Forecast (2020 No-Build)

Mainline Segment	ADT	Total (2020 No-Build)				Crash Rate (MVM)	Fatality Rate (100 MVM)
		PDO	Injury	Fatality	Total		
I-5 Northbound							
I-705 on-ramp to E 28th St off-ramp	80,335	205	112	0	317	3.290	0.000
E 28th St off-ramp SR 167 (River Rd) off-ramp	76,938	143	102	0	245	3.456	0.000
SR 167 (River Rd) off-ramp to E 28th St on-ramp	64,125	39	20	1	60	1.266	0.023
E 28th St on-ramp to POT Rd off-ramp to South	73,955	131	56	0	187	1.548	0.000
POT Rd off-ramp to South to POT Rd off-ramp to North	69,482	29	13	0	42	1.583	0.000
POT Rd off-ramp to North to POT Rd on-ramp	66,489	30	17	0	47	0.595	0.000
POT Rd on-ramp to 54th Ave E off-ramp	70,426	36	22	0	58	0.506	0.000
54th Ave E off-ramp to 54th Ave E on-ramp	63,072	57	22	0	79	0.649	0.000
54th Ave E on-ramp to weigh station off-ramp	70,990	210	127	0	337	0.826	0.000
Weigh station off-ramp to Weigh station on-ramp	70,455	87	48	0	135	0.727	0.000
Weigh station on-ramp to SR 18 off-ramp	70,795	53	29	0	82	1.005	0.000
Subtotal		1,019	569	1	1,589		
I-5 Southbound							
SR 18 on-ramp to weigh station off-ramp	73,280	107	63	0	170	1.685	0.000
Weigh station off-ramp to Weigh station on-ramp	72,915	80	44	2	126	0.970	0.017
Weigh station on-ramp to 54th Ave E off-ramp	73,385	348	201	1	550	1.103	0.002
54th Ave E off-ramp to 54th Ave E on-ramp	66,720	90	42	1	134	1.207	0.010
54th Ave E on-ramp to POT Rd off-ramp	76,399	52	26	0	78	0.585	0.000
POT Rd off-ramp to POT Rd on-ramp	73,535	102	47	1	150	1.139	0.008
POT Rd on-ramp to E 27th Street off-ramp	81,370	80	36	0	116	1.508	0.000
E 27th Street off-ramp to SR 167 (River Rd) on-ramp	72,985	71	43	0	114	1.454	0.000
SR 167 (River Rd) on-ramp to E 27th St (Portland Ave) on-ramp	86,530	94	53	0	147	1.089	0.000
E 27th St on-ramp to I-705 off-ramp	92,295	27	22	0	49	1.900	0.000
Subtotal		1,051	578	6	1,634		
Total		2,070	1,147	7	3,223		

Table 1-14. Freeway Ramp Crash Forecast (2020 No-Build)

	Length	ADT	Total (2020 No-Build)				Crash Rate (MVM)	Fatality Rate (100 MVM)
			PDO	Injury	Fatality	Total		
I-5 Northbound								
E 28th St off-ramp	0.28	3,397	13	10	0	23	9.574	0.000
SR 167 off-ramp	0.29	12,813	13	2	0	15	1.578	0.000
E 28th St on-ramp	0.22	9,830	4	3	0	7	1.354	0.000
POT Rd off-ramp to south	0.23	4,473	5	2	0	8	2.905	0.000
POT Rd off-ramp to north	0.29	2,993	10	3	0	14	6.181	0.000
POT Rd on-ramp	0.45	3,937	6	0	0	6	1.221	0.000
54th Ave E off-ramp to south	0.31	5,162	64	44	0	107	26.222	0.000
54th Ave E off-ramp to north	0.24	2,192	18	12	0	30	22.112	0.000
54th Ave E on-ramp	0.5	7,918	14	3	0	17	1.674	0.000
Subtotal			147	79	0	226		
I-5 Southbound								
54th Ave E off-ramp	0.29	6,665	30	21	0	51	10.280	0.000
54th Ave E on-ramp from south	0.28	4,745	1	1	0	2	0.601	0.000
54th Ave E on-ramp from north	0.41	4,934	7	6	0	13	2.505	0.000
POT Rd off-ramp	0.32	2,864	45	22	0	67	28.404	0.000
POT Rd on-ramp	0.41	7,835	17	5	0	22	2.735	0.000
E 27th St off-ramp	0.28	8,385	21	18	0	39	6.493	0.000
SR 167 on-ramp	0.38	13,545	17	9	0	26	1.993	0.000
E 27th St on-ramp	0.60	5,765	11	3	0	14	1.570	0.000
Subtotal			149	85	0	234		
Total			296	164	0	460		

Table 1-15. Corridor Segment Crash Forecast (2020 No-Build)

Corridor		Length	ADT	2020 No-Build Total				Crash Rate (MVM)	Fatality Rate (100 MVM)
Street	Segment			PDO	Injury	Fatal	Total		
12th St E	Alexander Ave E - 54th Ave E	0.74	3,658	19	1	0	20	2.92	0.00
Pacific Hwy E	POT Rd - 54th Ave E	1.20	18,126	233	78	1	312	5.62	0.02
20th St E	POT Rd - 54th Ave E	1.47	11,188	92	29	0	121	2.88	0.00
POT Rd	12th St E - 20th St E	0.4	12,667	41	13	0	54	4.17	0.00
Alexander Ave E	12th St E - Pacific Hwy E	0.2	7,398	9	1	0	10	2.55	0.00
54th Ave E	12th St E - 20th St E	0.41	20,879	190	45	0	235	10.73	0.00
Other Locations									
Total					584	167	1	752	

Table 1-16. Intersection Crash Forecast (2020 No-Build)

Intersection		ADT	2020 No-Build Total				Crash Rate (MEV)	Fatality Rate (100 MEV)
East-West	North-South		PDO	Injury	Fatal	Total		
12th St E	POT Rd	13,673	1	0	0	1	0.03	0.00
12th St E	Alexander Ave E	10,502	0	1	0	1	0.04	0.00
12th St E	54th Ave E	18,219	6	4	0	10	0.22	0.00
Pacific Hwy E	POT Rd	27,105	16	2	0	18	0.26	0.00
Pacific Hwy E	Alexander Ave E	21,312	7	4	0	11	0.21	0.00
Pacific Hwy E	54th Ave E	39,635	48	17	0	65	0.64	0.00
20th St E	POT Rd	16,770	14	1	0	15	0.34	0.00
20th St E	Frank Albert Rd E	12,850	4	2	0	6	0.18	0.00
20th St E	54th Ave E	35,655	28	5	0	33	0.36	0.00
I-5 off-ramp SB	POT Rd	12,393	1	0	0	1	0.04	0.00
I-5 on-ramp SB	POT Rd	17,364	2	0	0	2	0.05	0.00
I-5 off-ramp NB	POT Rd	15,544	0	0	0	0	0.00	0.00
I-5 on-ramp NB	POT Rd	12,015	0	0	0	0	0.00	0.00
I-5 off-ramp SB	54th Ave E	22,158	3	3	0	6	0.08	0.00
I-5 on-ramp SB	54th Ave E	25,172	2	1	0	3	0.05	0.00
I-5 off-ramp NB	54th Ave E	26,253	3	0	0	3	0.05	0.00
I-5 on-ramp NB	54th Ave E	26,817	3	0	0	3	0.04	0.00
Other Locations								
Total				138	40	0	178	

1.6.3 No-Build 2040 Traffic Operations (Design Year)

Traffic conditions were analyzed for the 2040 AM and PM peak hours for the freeway and major intersections.

1.6.3.1 Freeway Operations (2040 No-Build)

For the freeway mainline, the basic, merge and diverge, and weaving segments were analyzed for the 2040 No-Build conditions for comparison with the design year for the Proposed Alternative. The 2040 analysis includes regional improvements to I-5, including the extension of the HOV lanes through the study area and the construction of the SR 167 extension project. Table 1-18 summarizes the LOS operation for the northbound and southbound directions for the 2040 No-Build Alternative.

Under 2040 No-Build conditions, the northbound I-5 mainline in the AM peak hour would be congested throughout almost the entire study corridor. Of the 27 mainline segments in the northbound direction, 24 would operate at LOS E or F during the AM peak hour. Of the 16 merge/diverge/weave segments in the northbound direction, 14 would operate at either LOS E or F. During the PM peak hour, the northbound I-5 mainline segments would have similarly poor operations – 22 of 27 segments would operate at LOS E or F. The most congested segments are the East 28th Street interchange in the AM peak hour and the truck scale interchange in the PM peak hour.

In the southbound direction, 18 segments would operate at LOS E or F in the AM peak hour, with 15 segments operating at LOS E or F in the PM peak hour. In the southbound direction, the most congested segments are 54th Avenue East interchange in the AM peak hour and the truck scale interchange in the PM peak hour.

By comparison to either existing or 2020 No-Build conditions, there would be substantially more congestion under 2040 No-Build conditions.

Table 1-18 shows the 2040 No-Build I-5 mainline freeway LOS and density for all segments within the study area. Figures 1-18 and 1-19 present a schematic representation of the 2040 No-Build freeway lanes, density, and LOS operating conditions at different freeway segments on the I-5 corridor within the study area.

1.6.3.2 Intersections Operations (2040 No-Build)

The operational analysis of the 15 intersections within the study area considers the system improvements listed in Table 1-1 for the 2040 No-Build analysis. Assuming that these improvements are in place by 2040, the traffic volumes and LOS operation were calculated for each of the study area intersections.

Table 1-17. 2040 No-Build I-5 Mainline Freeway Operations Summary

	Type	AM Peak Hour		PM Peak Hour	
		LOS	Density	LOS	Density
I-5 Northbound					
I-5 NB on-ramp from I-705	Merge	F	**107**	E	**36**
I-5 NB off-ramp to E 28th Street/Portland Ave	Diverge	F	**100**	E	**37**
I-5 NB off-ramp to E Bay Street	Diverge	F	**104**	E	**38**
I-5 NB between E Bay Street off/on-ramps	Basic	F	**106**	E	**36**
I-5 NB on-ramp from E 28th Street	Merge	F	**110**	D	31
I-5 NB between E 28th Street. On-ramp and POT Rd off-ramp	Basic	F	**101**	D	32
I-5 NB off-ramp to POT Rd SB	Diverge	F	**100**	E	**41**
I-5 NB off-ramp to POT Rd NB	Diverge	F	**94**	E	**40**
I-5 NB between POT Rd NB off-/on-ramps	Basic	F	**66**	E	**37**
I-5 NB on-ramp from POT Rd	Merge	F	**75**	E	**39**
I-5 NB between POT Rd and 54th Ave E	Basic	F	**67**	E	**42**
I-5 NB off-ramp to 54th Ave E	Diverge	F	**70**	F	**50**
I-5 NB off-ramp to SR 167	Diverge	D	31	E	**37**
I-5 NB off-ramp to SR 167 HOV	Diverge	C	24	C	25
I-5 NB between SR 167 HOV and 54th Ave E on-ramps	Basic	D	31	D	28
I-5 NB on-ramp from 54th Ave E	Merge	E	**39**	E	**37**
I-5 NB between 54th Ave E and SR 167 HOV	Basic	F	**47**	E	**41**
I-5 NB on-ramp from SR 167 HOV	Merge	E	**42**	D	32
I-5 NB between SR 167 HOV and SR 167	Basic	F	**53**	F	**47**
I-5 NB on-ramp from SR 167	Merge	E	**36**	E	**36**
I-5 NB between SR 167 and 6-lane section ends	Basic	E	**44**	E	**41**
I-5 NB between 5-lane section and truck scales off-ramp	Basic	F	**53**	F	**48**
I-5 NB off-ramp to truck scales	Diverge	F	**51**	F	**48**
I-5 NB between truck scales off/on-ramps	Basic	F	**49**	F	**50**
I-5 NB on-ramp from truck scales	Merge	F	**53**	F	**53**
I-5 NB between truck scales and SR 18	Basic	F	**47**	F	**46**
I-5 NB off-ramp to SR 18	Diverge	E	**39**	E	**40**

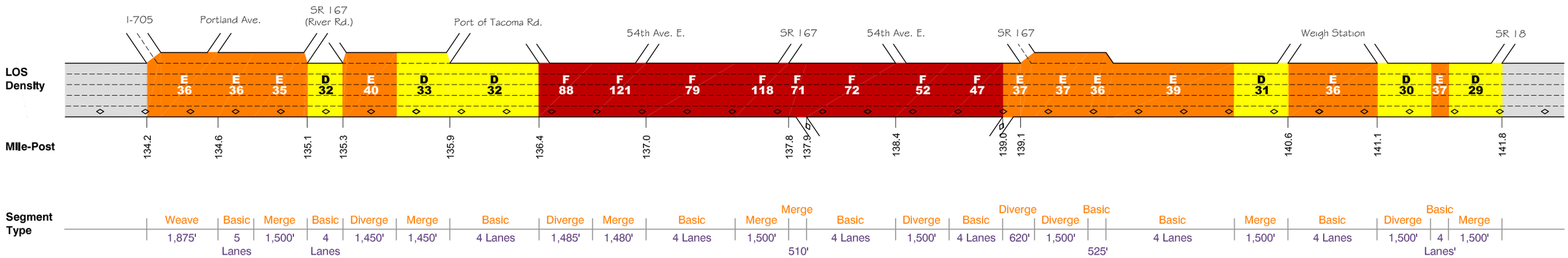
Notes: Average volumes based on 13 VISSIM runs
Bold indicates unacceptable operation.
Source: Fehr & Peers, 2010.

Table 1-18. 2040 No-Build I-5 Mainline Freeway Operations Summary

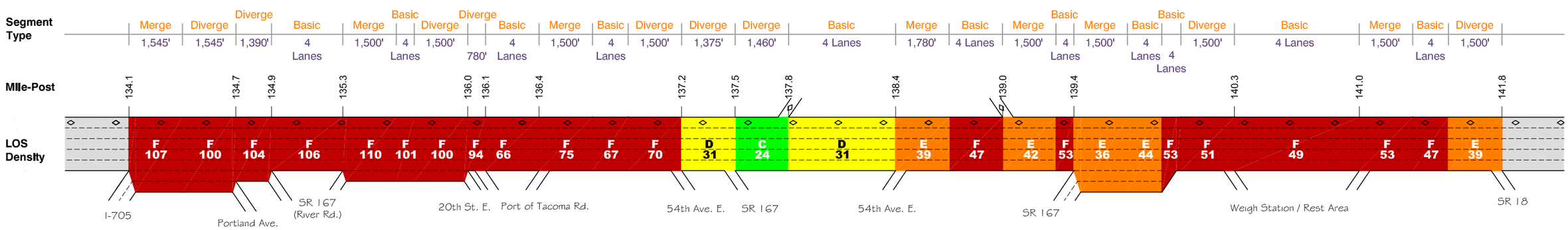
	Type	AM Peak Hour		PM Peak Hour	
		LOS	Density[1]	LOS	Density[1]
I-5 Southbound					
I-5 SB on-ramp from SR 18	Merge	D	29	F	**79**
I-5 SB between SR 18 and truck scales	Basic	E	**37**	F	**90**
I-5 SB off-ramp to truck scales	Diverge	D	30	F	**92**
I-5 SB between truck scales off/on-ramps	Basic	E	**36**	F	**91**
I-5 SB on-ramp from truck scales	Merge	D	31	F	**100**
I-5 SB between truck scales and 5-lane section ends	Basic	E	**39**	F	**78**
I-5 SB between 6-lane section and SR 167	Basic	E	**36**	E	**35**
I-5 SB off-ramp to SR 167	Diverge	E	**37**	D	31
I-5 SB off-ramp to SR 167 HOV	Diverge	E	**37**	D	31
I-5 SB between SR 167 HOV end and 54th Ave E	Basic	F	**47**	D	29
I-5 SB off-ramp to 54th Ave E	Diverge	F	**52**	C	20
I-5 SB between 54th Ave E and SR 167 HOV	Basic	F	**72**	D	27
I-5 SB on-ramp from SR 167 HOV	Merge	F	**71**	C	25
I-5 SB on-ramp from SR 167	Merge	F	**118**	D	28
I-5 SB between SR 167 and 54th Ave E	Basic	F	**79**	E	**38**
I-5 SB on-ramp from 54th Ave E	Merge	F	**121**	E	**35**
I-5 SB off-ramp to POT Rd	Diverge	F	**88**	F	**53**
I-5 SB between POT Rd off/on-ramps	Basic	D	32	E	**37**
I-5 SB on-ramp from POT Rd	Merge	D	33	E	**36**
I-5 SB off-ramp to Bay Street	Diverge	E	**40**	E	**41**
I-5 SB between Bay Street on/off-ramps	Basic	D	32	E	**38**
I-5 SB on-ramp from Bay Street	Merge	E	**35**	D	34
I-5 SB between Bay Street and E 27th Street/Portland Ave	Basic	E	**36**	D	34
I-5 SB weave between E 27th Street/Portland Ave and I-705	Weave	E	**36**	E	**36**

Notes: Average volumes based on 13 VISSIM runs.
Bold indicates unacceptable operation.
Source: Fehr & Peers, 2010.

Interstate 5: State Route 18 to Interstate 705 (Southbound)



Interstate 5: Interstate 705 to State Route 18 (Northbound)



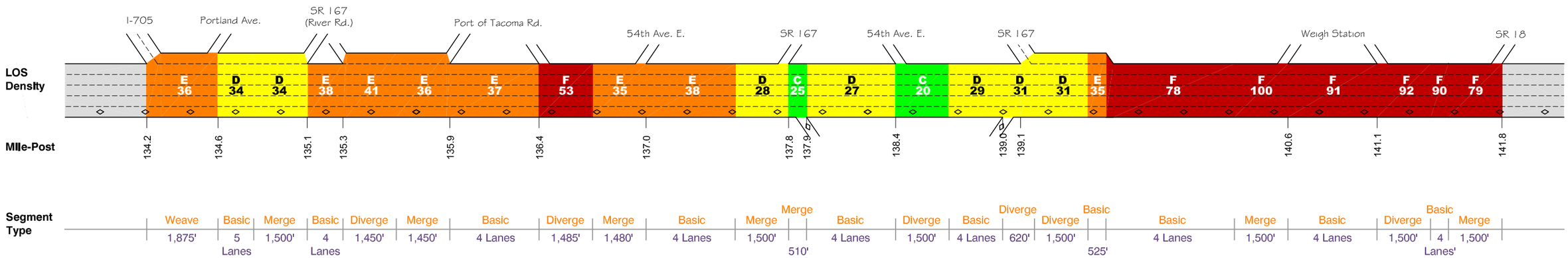
LEGEND

		Level of Service
6.0	Mile-Post	A - C
◊	HOV Bypass Lane	D
D — 32.8	Level of Service — Density (Vehicles / Lane Mile)	E
		F

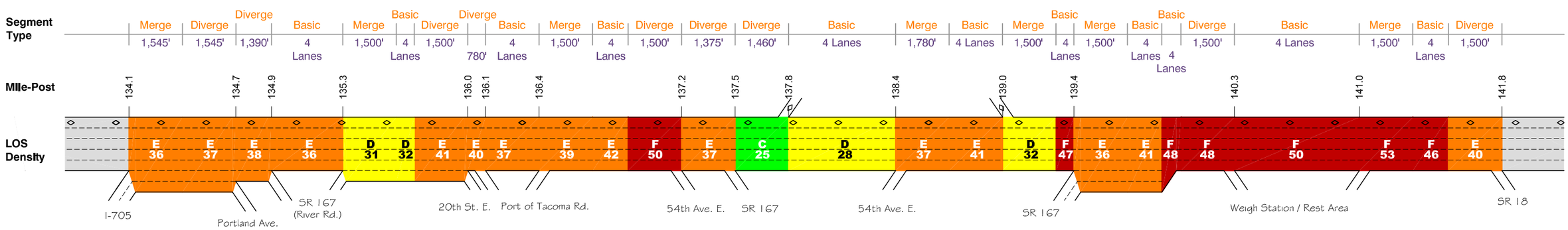
AM PEAK HOUR LANE CONFIGURATIONS AND LEVEL OF SERVICE - 2040 NO ACTION

FIGURE 1-18

Interstate 5: State Route 18 to Interstate 705 (Southbound)



Interstate 5: Interstate 705 to State Route 18 (Northbound)



LEGEND

		Level of Service
6.0	Mile-Post	A - C
◊	HOV Bypass Lane	D
D — 32.8	Level of Service / Density (Vehicles / Lane Mile)	E
		F

PM PEAK HOUR LANE CONFIGURATIONS AND LEVEL OF SERVICE - 2040 NO ACTION

FIGURE 1-19

Under the No-Build conditions, there would be significant congestion during the 2040 peak periods. During the AM peak hour, six intersections would operate LOS F, including three intersections along Port of Tacoma Road between the SR 509 ramps and the southbound I-5 ramps. Most of the intersections along 54th Avenue East would operate at LOS F during the AM peak hour, with the exception of the ramp terminal intersections. The traffic volumes, lane configurations, and LOS for the AM peak hour under 2040 No-Build conditions are presented in Figures 1-20 through 1-22.

During the PM peak hour, 7 of the 15 intersections would operate at LOS F, including three along Port of Tacoma Road: the I-509 ramps, Pacific Highway East, and the I-5 southbound ramps. Other failing intersections in the study area would include East Portland Avenue/East 27th Street, 54th Avenue East/12th Street East, 54th Avenue East/Pacific Highway East, and Industry Drive East/20th Street East. The remaining eight study intersections would operate at LOS D or better. The traffic volumes, lane configurations, and LOS for the PM peak hour under 2040 No-Build conditions are presented in Figures 1-23 through 1-25.

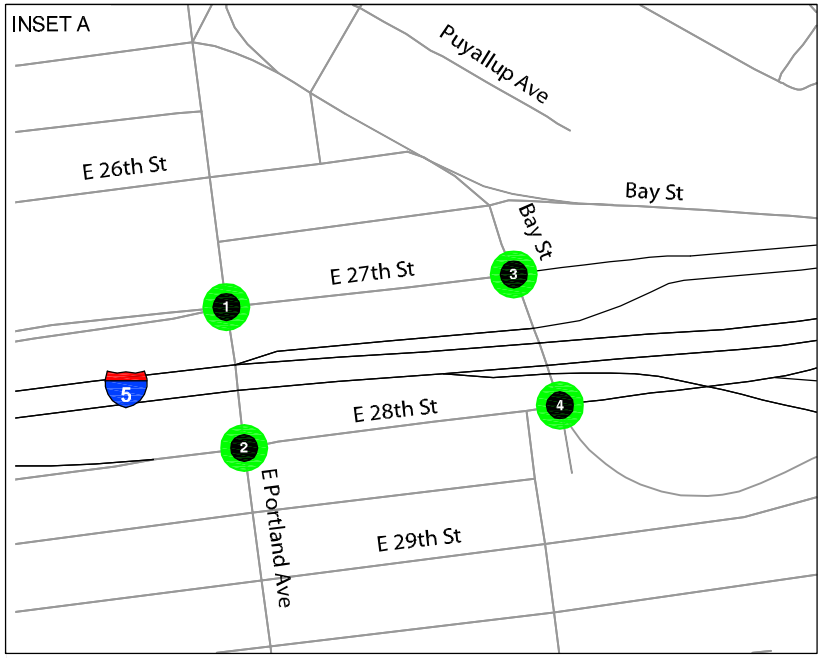
Table 1-19 summarizes the LOS operation and calculated delay for the study intersections during AM and PM peak hours, as observed in the 2040 No-Build analysis.

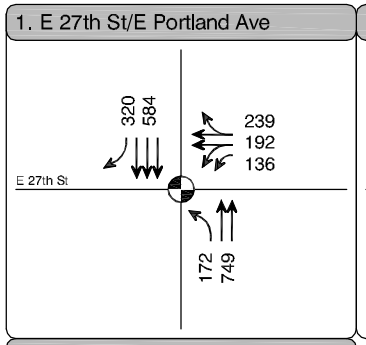
1.6.4 No-Build 2040 Safety (Design Year)

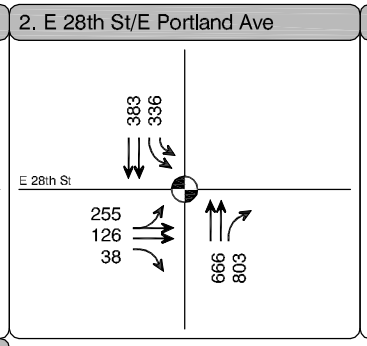
Increases in congestion could result in higher incidences of study area crashes on freeways and intersections. Higher congestion levels could lead to increased levels of rear-end and sideswipe crashes as extreme traffic congestion becomes more common throughout the day. Intersections without capacity improvements may have higher crash rates as drivers become more aggressive and take more risks. Even if crash rates remain the same, the number of crashes per year will likely increase because of the growth in traffic volumes. Tables 1-20 through 1-23 show the crash forecast, including PDO, injury, and fatality, on freeway mainline segments, ramps, local corridors, and intersections.

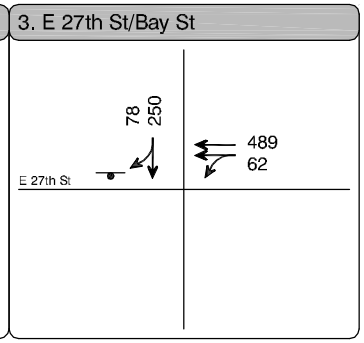
1.6.5 Transportation Demand Management

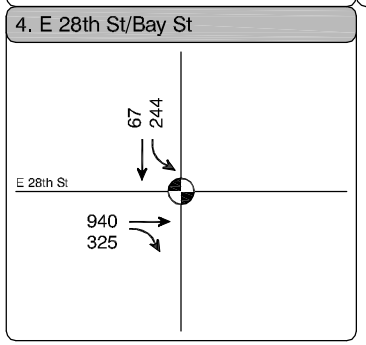
A broad range of transportation demand management (TDM) solutions was investigated to assess whether their application could alleviate the need for the project. The TDM measures examined included programs designed to lower single occupant automobile travel, such as alternative work schedules, restrictions on parking supply, transit and ridesharing subsidies, and targeted marketing activities. The TDM Effectiveness Estimation Methodology (TEEM 2.0) model, a post-processing modeling software, was used to quantify the potential of TDM and land-use strategies to change travel demand within the study area.

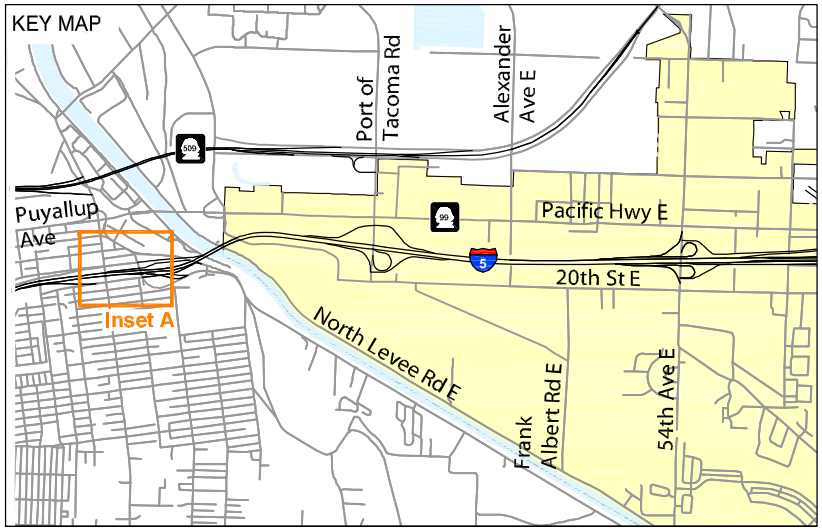












N

NOT TO SCALE

LEGEND

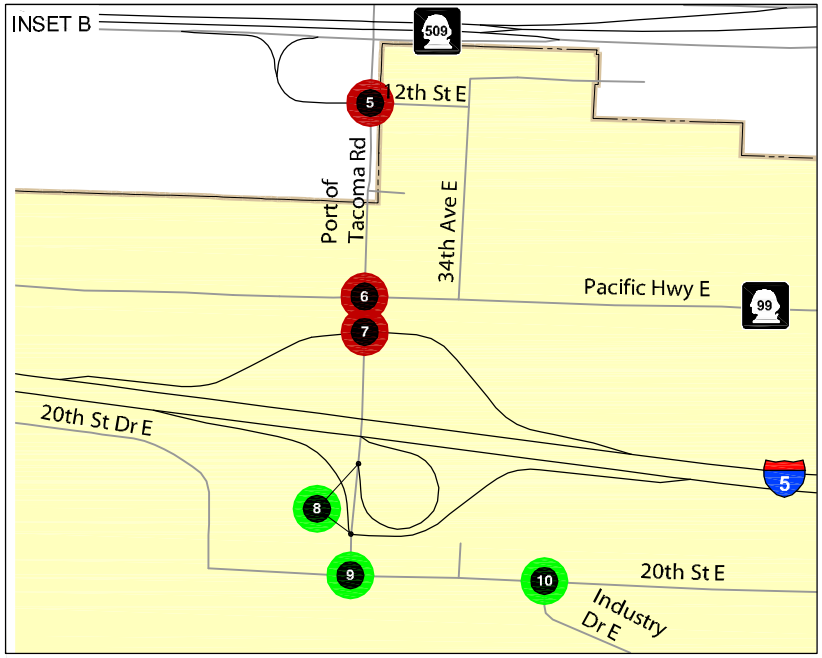
	Turn Lane		Study Intersection		Stop Sign
XX	Peak Hour Traffic Volume		Traffic Signal		City of Fife

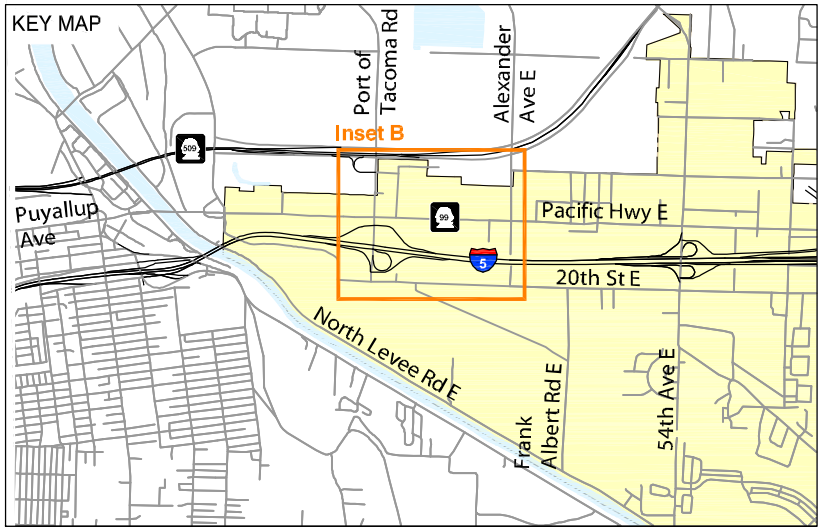
Level of Service

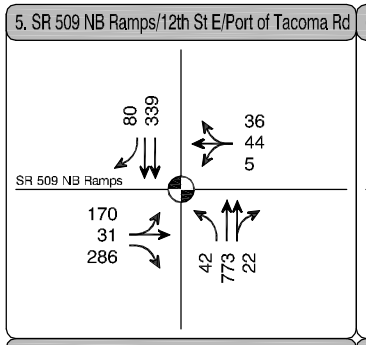
	A - D		E		F

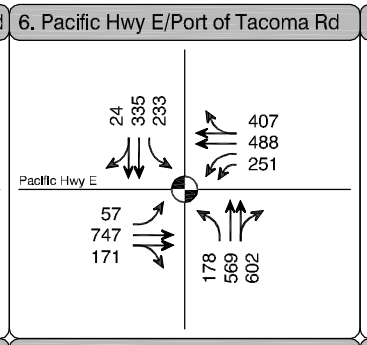
AM PEAK HOUR TRAFFIC VOLUMES AND LANE CONFIGURATIONS - 2040 NO ACTION (INSET A)

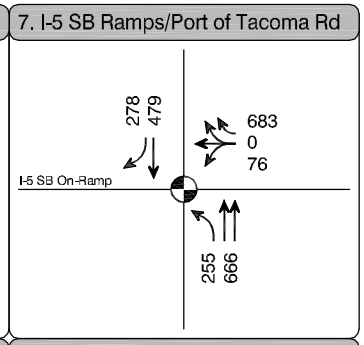
FIGURE 1-20

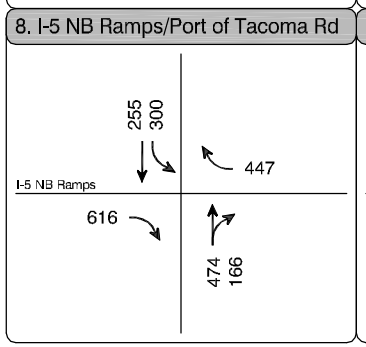


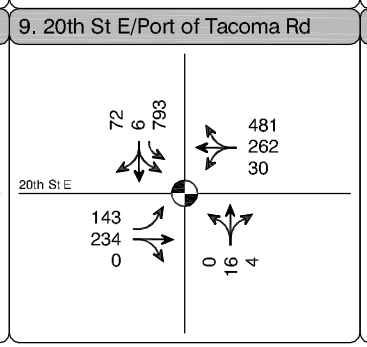


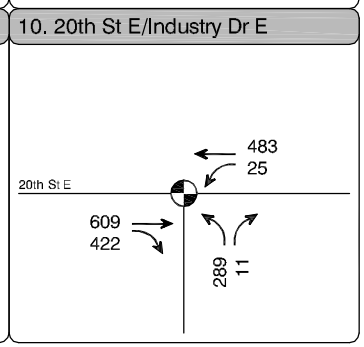












N

NOT TO SCALE

LEGEND

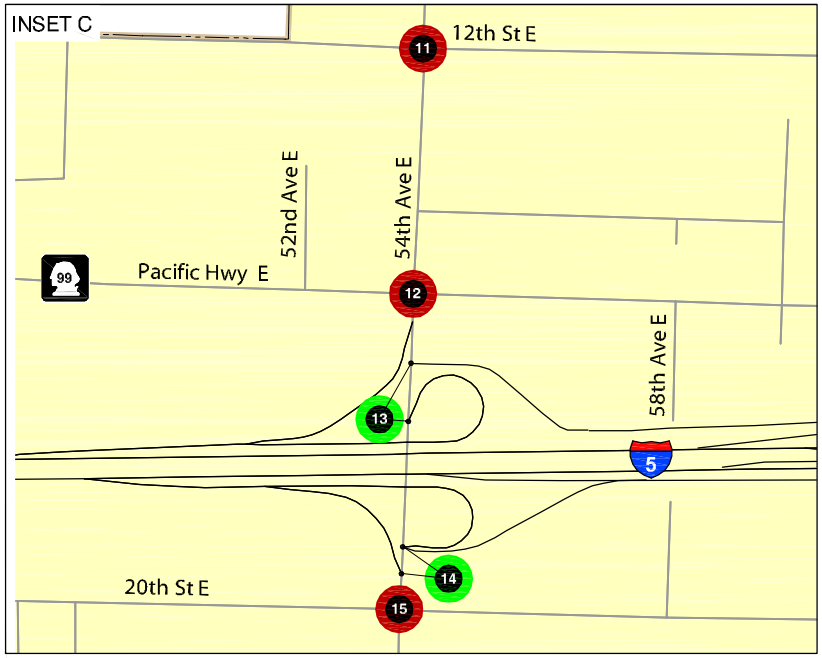
	Turn Lane		Study Intersection		Stop Sign
XX	Peak Hour Traffic Volume		Traffic Signal		City of Fife

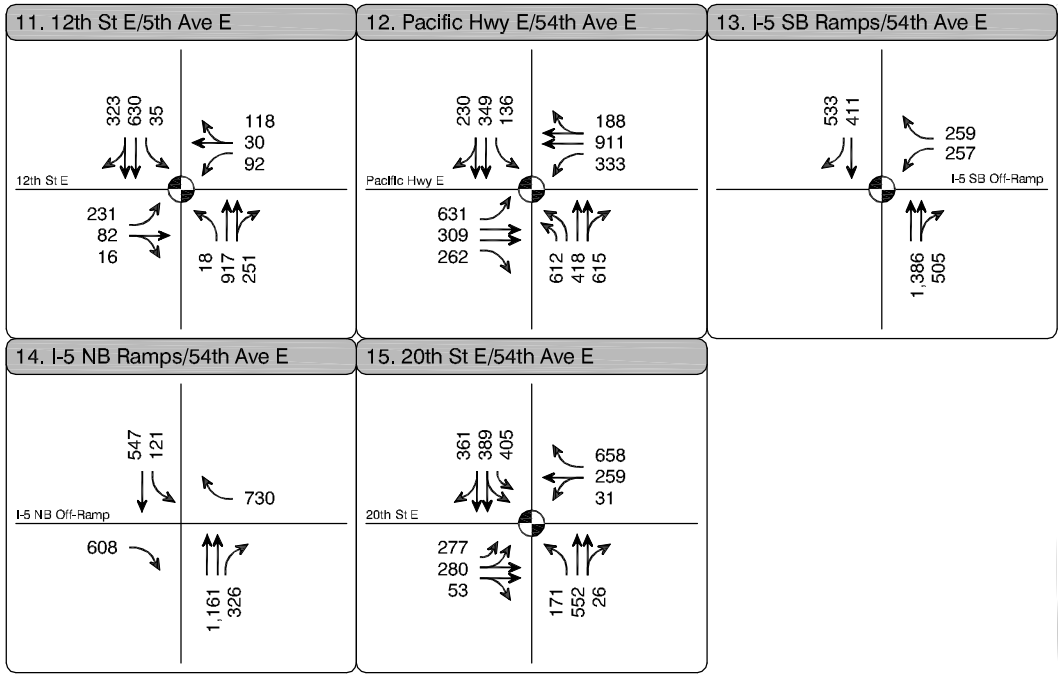
Level of Service

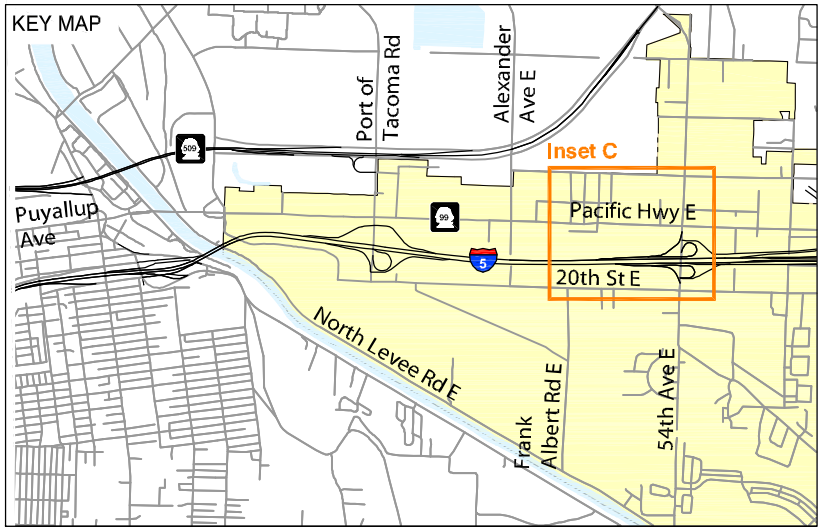
	A - D		E		F

AM PEAK HOUR TRAFFIC VOLUMES AND LANE CONFIGURATIONS - 2040 NO ACTION (INSET B)

FIGURE 1-21







N

NOT TO SCALE

LEGEND

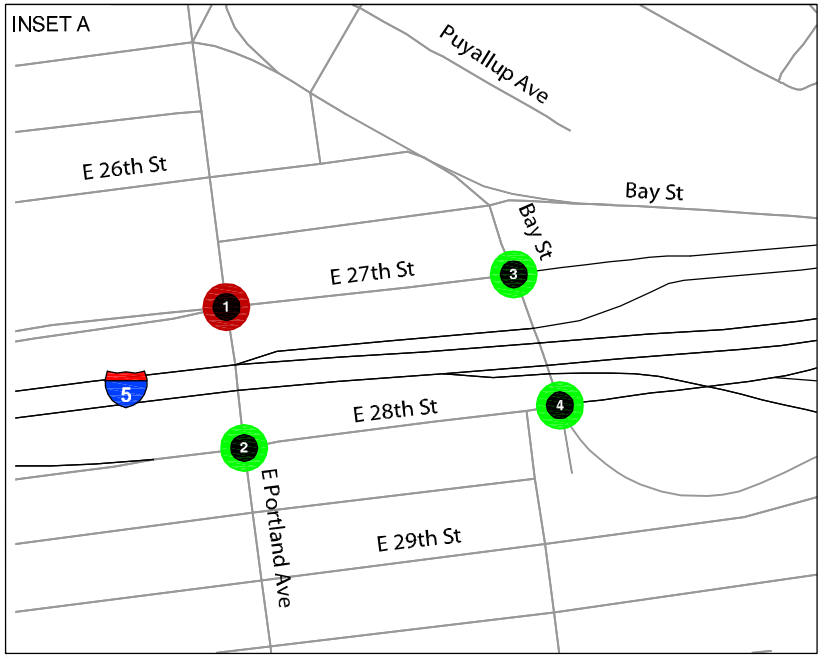
	Turn Lane	1	Study Intersection		Stop Sign
XX	Peak Hour Traffic Volume		Traffic Signal		City of Fife

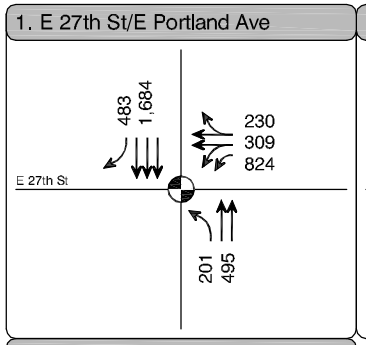
Level of Service

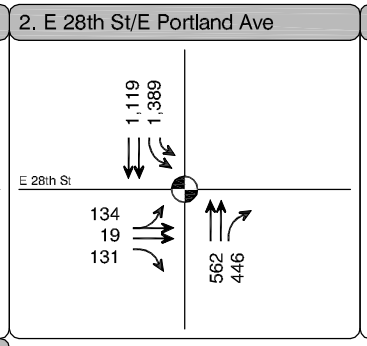
	A - D		E		F

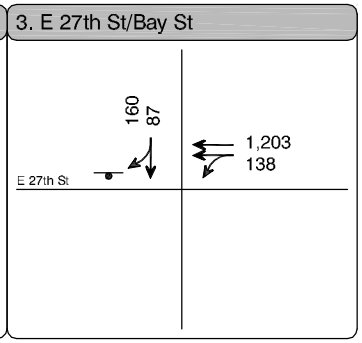
AM PEAK HOUR TRAFFIC VOLUMES AND LANE CONFIGURATIONS - 2040 NO ACTION (INSET C)

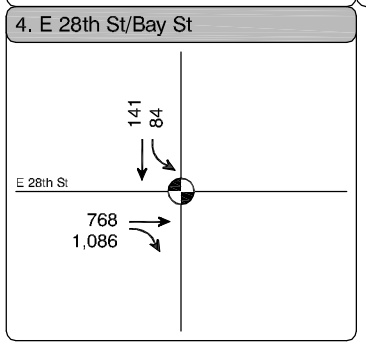
FIGURE 1-22

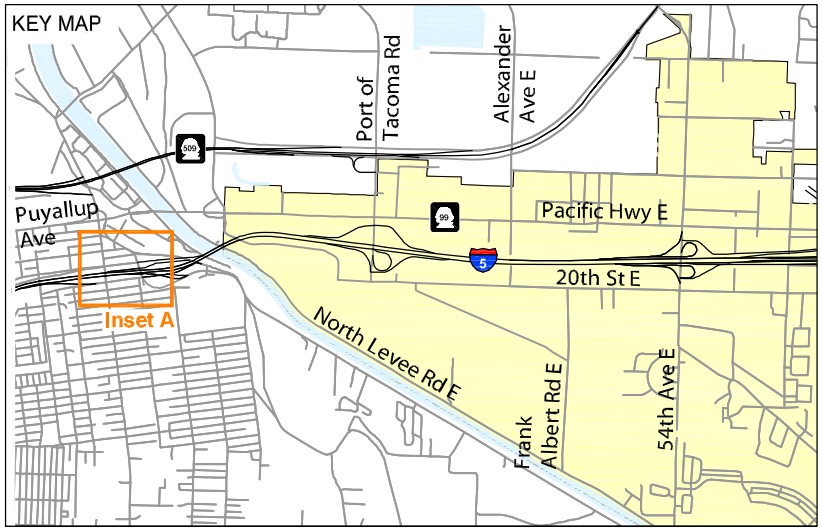












N

NOT TO SCALE

LEGEND

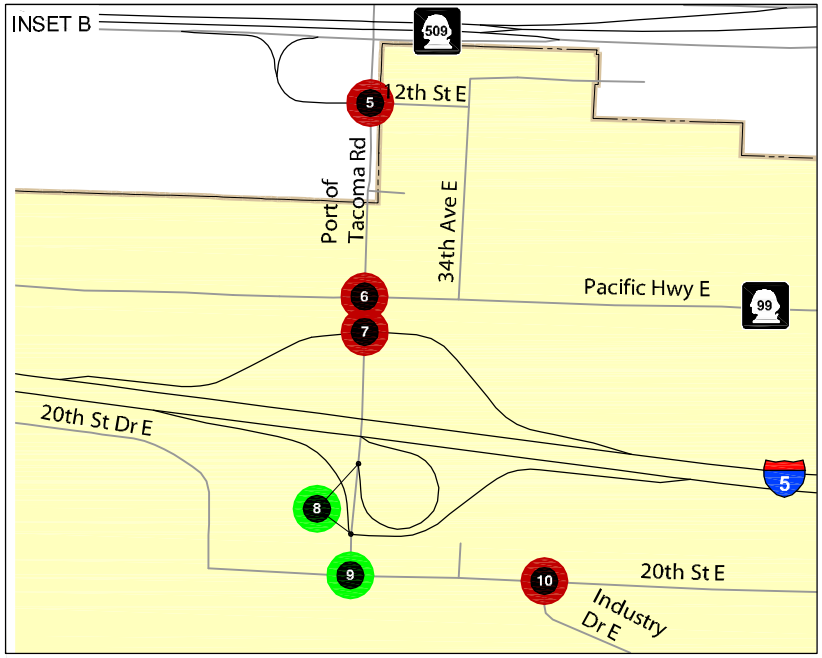
	Turn Lane	1	Study Intersection		Stop Sign
XX	Peak Hour Traffic Volume		Traffic Signal		City of Fife

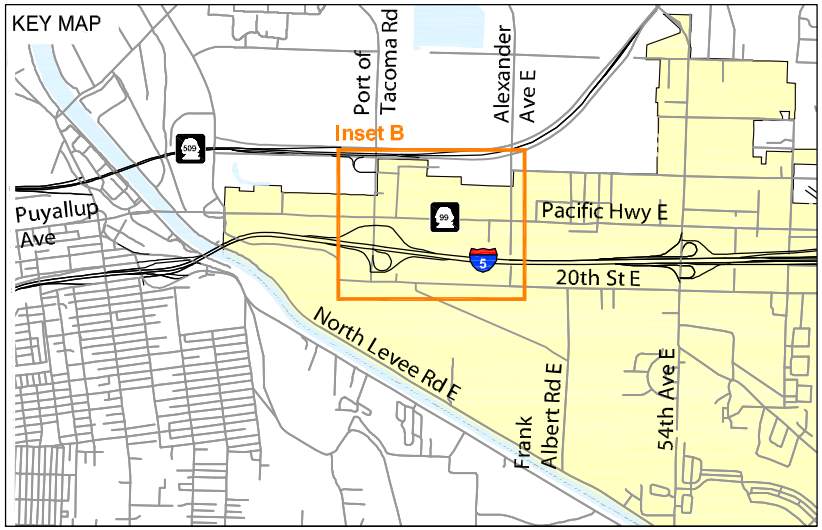
Level of Service

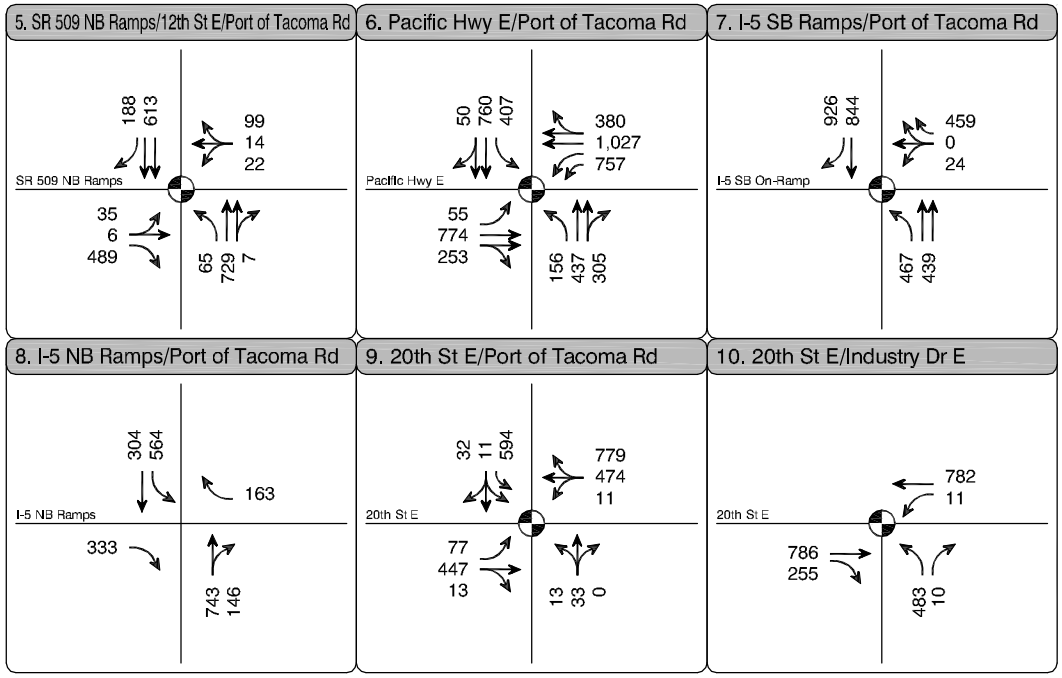
	A - D		E		F

PM PEAK HOUR TRAFFIC VOLUMES AND LANE CONFIGURATIONS - 2040 NO ACTION (INSET A)

FIGURE 1-23







N

NOT TO SCALE

LEGEND

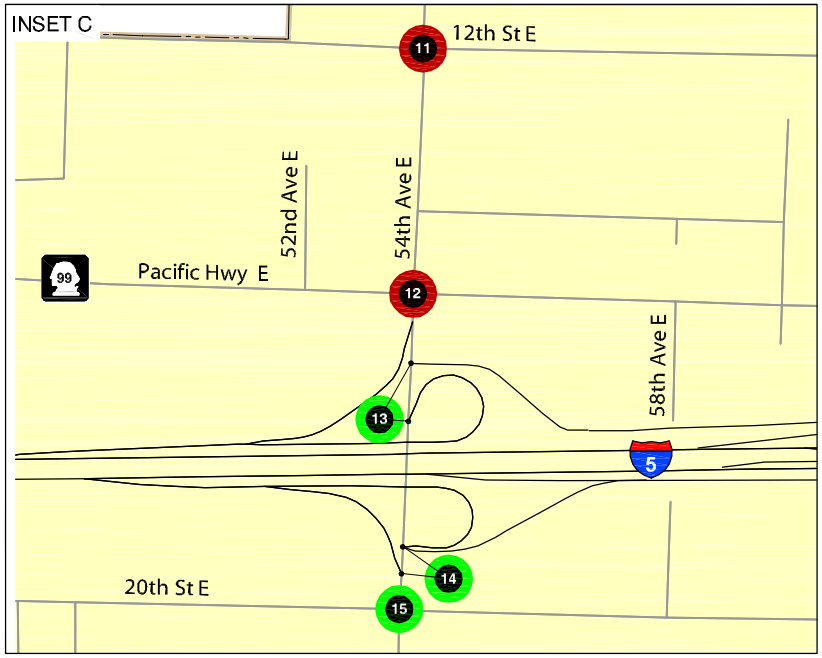
	Turn Lane		Study Intersection		Stop Sign
XX	Peak Hour Traffic Volume		Traffic Signal		City of Fife

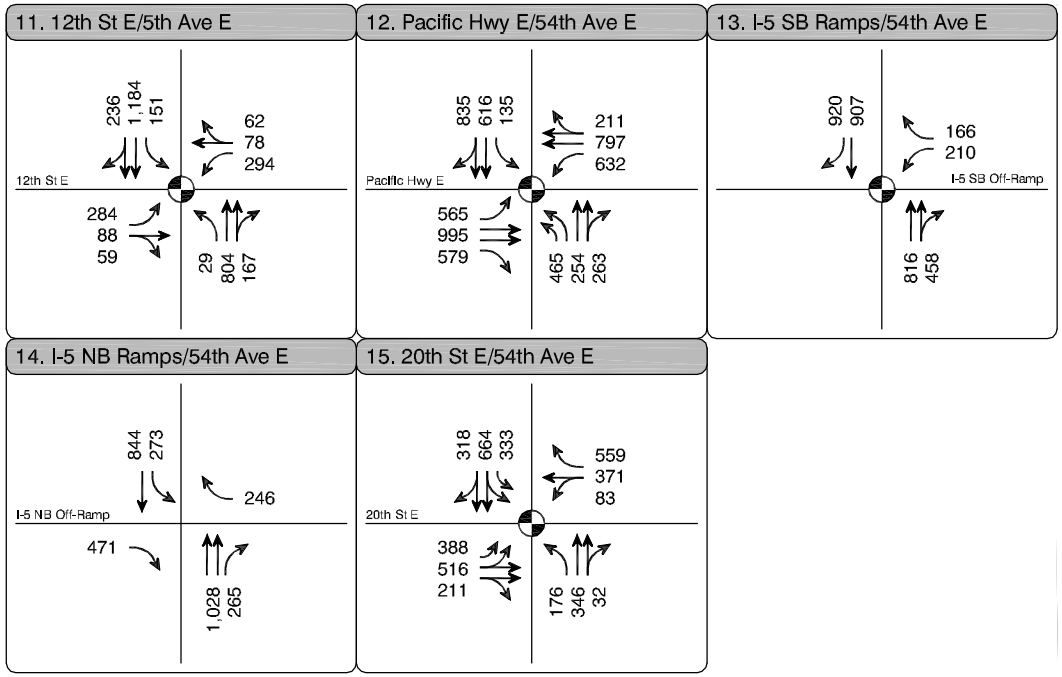
Level of Service

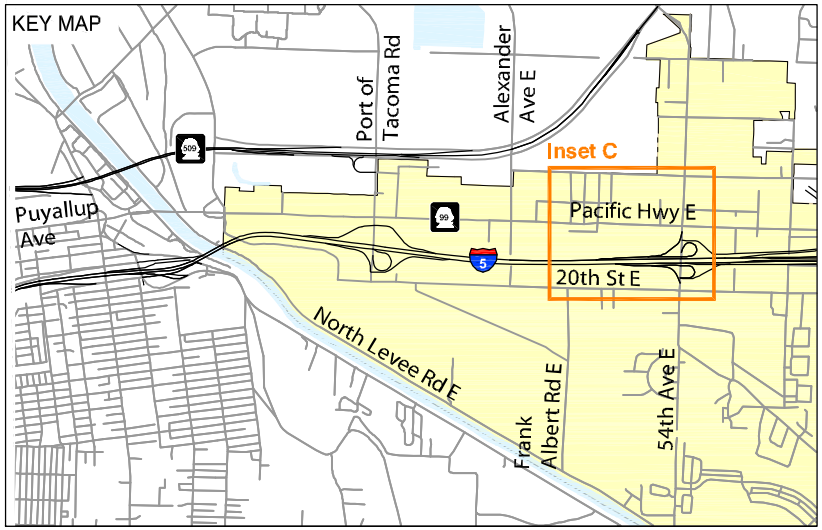
	A - D		E		F

PM PEAK HOUR TRAFFIC VOLUMES AND LANE CONFIGURATIONS - 2040 NO ACTION (INSET B)

FIGURE 1-24







N

NOT TO SCALE

LEGEND

	Turn Lane		Study Intersection		Stop Sign
XX	Peak Hour Traffic Volume		Traffic Signal		City of Fife

Level of Service

	A - D		E		F

PM PEAK HOUR TRAFFIC VOLUMES AND LANE CONFIGURATIONS - 2040 NO ACTION (INSET C)

FIGURE 1-25

Table 1-18. Intersection Levels of Service - 2040 Peak Hour Conditions – No-Build

Intersection		Traffic Control	AM Peak Hour					PM Peak Hour				
			NB	SB	EB	WB	Total	NB	SB	EB	WB	Total
1	E. Portland Ave/E. 27th St	Signal	C/22	B/13		D/43	C/23	C/29	**F/122**		**E/57**	**F/86**
2	E. Portland Ave/E. 28th St	Signal	C/28	B/12	**E/75**		C/34	C/30	B/14	D/39		C/24
3	E. Bay St/E. 27th St	SSSC		B/14		A/2	A/7		A/8		A/2	A/3
4	E. Bay St/E. 28th St	Signal		C/33	A/9		B/13		C/29	B/16		B/17
5	POT Rd/I-509 EB Ramps	Signal	B/17	**F/170**	**F/126**	C/23	**F/91**	B/13	**F/>200**	**F/>200**	A/0	**F/>200**
6	POT Rd/Pacific Hwy	Signal	A/9	**F/>200**	**F/>200**	**E/67**	**F/175**	B/19	**F/>200**	**F/>200**	**F/>200**	**F/>200**
7	POT Rd/ I-5 SB Ramps	Signal	**F/115**	A/1		**F/>200**	**F/>200**	**F/122**	A/1		**F/>200**	**F/144**
8	POT Rd/I-5 NB Ramps	Unct.	A/4	A/10	D/38		B/15	A/4	C/28	A/3		B/12
9	POT Rd/20th St E	Signal	B/15	B/14	B/19	D/35	C/21	C/27	B/15	B/18	**E/56**	D/36
10	Industry Dr. E/20th St E	Signal	**E/70**		B/14	D/48	D/36	**F/>200**		C/21	**F/>200**	**F/165**
17	54th Ave E/12th St E	Signal	B/16	**F/>200**	**F/146**	**E/63**	**F/119**	B/16	**F/>200**	**F/>200**	**F/169**	**F/>200**
18	54th Ave E/Pacific Hwy	Signal	A/4	**F/>200**	**F/>200**	**F/>200**	**F/>200**	D/46	**F/>200**	**F/91**	**F/>200**	**F/184**
19	54th Ave E/I-5 SB Ramps	Signal	D/37	**F/98**		D/35	D/44	C/22	A/5		D/53	B/18
20	54th Ave E/I-5 NB Ramps	Unct.	B/19	D/52	D/54		C/32	A/1	C/27	D/37		B/14
21	54th Ave E/20th St E	Signal	**F/>200**	B/19	**E/78**	**F/>200**	**F/137**	**E/61**	D/35	D/50	**E/65**	D/50

Notes: SSSC = Side-Street Stop-Controlled. Unct. = Uncontrolled >200 = Delay calculated beyond 200 seconds.
Bold indicates unacceptable operation.
Source: Fehr & Peers, 2010.

Table 1-19. Freeway Mainline Crash Forecast (2040 No-Build)

Mainline Segment	ADT	Total (2040 No-Build)				Crash Rate (MVM)	Fatality Rate (100 MVM)
		PDO	Injury	Fatality	Total		
I-5 Northbound							
I-705 on-ramp to E 28th St off-ramp	86,675	221	121	0	342	3.290	0.000
E 28th St off-ramp SR 167 (River Rd) off-ramp	81,513	151	108	0	259	3.456	0.000
SR 167 (River Rd) off-ramp to E 28th St on-ramp	72,840	44	23	1	68	1.266	0.023
E 28th St on-ramp to POT Rd off-ramp to South	84,020	149	64	0	213	1.548	0.000
POT Rd off-ramp to South to POT Rd off-ramp to North	79,270	33	15	0	48	1.583	0.000
POT Rd off-ramp to North to POT Rd on-ramp	76,220	34	19	0	53	0.595	0.000
POT Rd on-ramp to 54th Ave E off-ramp	82,099	42	26	0	68	0.506	0.000
54th Ave E off-ramp to 54th Ave E on-ramp	71,830	65	26	0	91	0.649	0.000
54th Ave E on-ramp to weigh station off-ramp	89,130	264	159	0	423	0.826	0.000
Weigh station off-ramp to Weigh station on-ramp	88,685	109	61	0	170	0.727	0.000
Weigh station on-ramp to SR 18 off-ramp	89,180	67	36	0	103	1.005	0.000
Subtotal		1,179	658	1	1,838		
I-5 Southbound							
SR 18 on-ramp to weigh station off-ramp	95,150	139	82	0	221	1.685	0.000
Weigh station off-ramp to Weigh station on-ramp	94,595	104	57	3	164	0.970	0.017
Weigh station on-ramp to 54th Ave E off-ramp	43,670	207	120	1	327	1.103	0.002
54th Ave E off-ramp to 54th Ave E on-ramp	77,785	105	49	1	156	1.207	0.010
54th Ave E on-ramp to POT Rd off-ramp	89,865	60	31	0	91	0.585	0.000
POT Rd off-ramp to POT Rd on-ramp	83,655	116	53	1	170	1.139	0.008
POT Rd on-ramp to E 27th Street off-ramp	93,285	92	41	0	133	1.508	0.000
E 27th Street off-ramp to SR 167 (River Rd) on-ramp	83,825	81	50	0	131	1.454	0.000
SR 167 (River Rd) on-ramp to E 27th St (Portland Ave) on-ramp	96,030	105	58	0	163	1.089	0.000
E 27th St on-ramp to I-705 off-ramp	102,120	30	25	0	55	1.900	0.000
Subtotal		1,039	566	6	1,611		
Total		2,218	1,224	7	3,449		

Table 1-20. Freeway Ramp Crash Forecast (2040 No-Build)

	Length	ADT	Total (2040 No-Build)				Crash Rate (MVM)	Fatality Rate (100 MVM)
			PDO	Injury	Fatality	Total		
I-5 Northbound								
E 28th St off-ramp	0.28	5,162	20	15	0	35	9.574	0.000
SR 167 off-ramp	0.29	8,673	9	1	0	10	1.578	0.000
E 28th St on-ramp	0.22	11,180	5	4	0	9	1.354	0.000
POT Rd off-ramp to south	0.23	4,745	6	2	0	8	2.905	0.000
POT Rd off-ramp to north	0.29	3,050	10	3	0	14	6.181	0.000
POT Rd on-ramp	0.45	5,879	8	0	0	8	1.221	0.000
54th Ave E off-ramp to south	0.31	5,394	66	46	0	112	26.222	0.000
54th Ave E off-ramp to north	0.24	4,880	40	26	0	66	22.112	0.000
54th Ave E on-ramp	0.5	0	0	0	0	0	1.674	0.000
Subtotal			165	98	0	263		
I-5 Southbound								
54th Ave E off-ramp	0.29	4,460	20	14	0	34	10.280	0.000
54th Ave E on-ramp from south	0.28	4,815	1	1	0	2	0.601	0.000
54th Ave E on-ramp from north	0.41	7,265	11	8	0	19	2.505	0.000
POT Rd off-ramp	0.32	6,211	97	47	0	144	28.404	0.000
POT Rd on-ramp	0.41	9,630	21	7	0	28	2.735	0.000
E 27th St off-ramp	0.28	9,460	23	21	0	44	6.493	0.000
SR 167 on-ramp	0.38	12,205	15	8	0	24	1.993	0.000
E 27th St on-ramp	0.60	6,090	11	3	0	15	1.570	0.000
Subtotal			200	109	0	309		
Total			365	207	0	572		

Table 1-21. Corridor Segment Crash Forecast (2040 No-Build)

Corridor		Length	ADT	2040 No-Build Total				Crash Rate (MVM)	Fatality Rate (100 MVM)
Street	Segment			PDO	Injury	Fatal	Total		
12th St E	Alexander Ave E - 54th Ave E	0.74	6,090	32	2	0	34	2.92	0.00
Pacific Hwy E	POT Rd - 54th Ave E	1.20	32,887	423	142	2	567	5.62	0.02
20th St E	POT Rd - 54th Ave E	1.47	15,690	129	41	0	170	2.88	0.00
POT Rd	12th St E - 20th St E	0.4	17,346	56	18	0	74	4.17	0.00
Alexander Ave E	12th St E - Pacific Hwy E	0.2	10,298	11	2	0	13	2.55	0.00
54th Ave E	12th St E - 20th St E	0.41	23,287	212	50	0	262	10.73	0.00
Other Locations									
Total					863	255	2	1,120	

Table 1-22. Intersection Crash Forecast (2040 No-Build)

Intersection		ADT	2040 No-Build Total				Crash Rate (MEV)	Fatality Rate (100 MEV)
East-West	North-South		PDO	Injury	Fatal	Total		
12th St E	POT Rd	20,490	2	0	0	2	0.03	0.00
12th St E	Alexander Ave E	15,015	0	2	0	2	0.04	0.00
12th St E	54th Ave E	30,921	11	7	0	18	0.22	0.00
Pacific Hwy E	POT Rd	47,134	27	4	0	31	0.26	0.00
Pacific Hwy E	Alexander Ave E	38,182	12	8	0	20	0.21	0.00
Pacific Hwy E	54th Ave E	56,720	69	24	0	93	0.64	0.00
20th St E	POT Rd	22,628	18	2	0	20	0.34	0.00
20th St E	Frank Albert Rd E	17,217	5	3	0	8	0.18	0.00
20th St E	54th Ave E	37,302	29	5	0	34	0.36	0.00
I-5 off-ramp SB	POT Rd	18,355	2	0	0	2	0.04	0.00
I-5 on-ramp SB	POT Rd	21,775	3	0	0	3	0.05	0.00
I-5 off-ramp NB	POT Rd	16,678	0	0	0	0	0.00	0.00
I-5 on-ramp NB	POT Rd	14,762	0	0	0	0	0.00	0.00
I-5 off-ramp SB	54th Ave E	22,068	3	3	0	6	0.08	0.00
I-5 on-ramp SB	54th Ave E	29,688	3	1	0	4	0.05	0.00
I-5 off-ramp NB	54th Ave E	28,182	4	0	0	4	0.05	0.00
I-5 on-ramp NB	54th Ave E	22,833	2	0	0	2	0.04	0.00
Other Locations								
Total				190	59	0	249	

The TEEM program can model the effectiveness of the following 20 TDM strategies either individually or in combination.

- Vanpooling
- Alternative mode subsidy
- Flexpass/residential pass
- Vanshare
- Guaranteed ride home
- Restricted parking supply
- Parking pricing at employment sites
- Telecommuting
- Compressed work week
- Commute trip reduction (CTR)-type programs for smaller employers
- Transportation management associations
- Individualized marketing strategies
- Intensive marketing programs
- Improved bicycle access/facilities
- Improved pedestrian access/facilities
- Shopping trips
- Special events
- Infill and densification
- Increased mixed-use development
- Increased density near transit

The analysis used the TEEM program to test two options focused on TDM strategies. Option 1 increased density near transit and increased mixed-use development in the study area. Option 2 tested a combination of all strategies except for special events to assess a high level of TDM measures. The analysis found an overall 4.9 percent reduction in daily trips and a 2.4 percent reduction in PM peak hour trips within the study area—not beneficial enough for the wide-scale application of TDM strategies to be seen as an effective alternative. Table 1-24 presents the results of the TEEM analysis and the strategies assumed.

Table 1-23. TEEM Model TDM Analysis Results

Measures Used to Evaluate Strategies	Before Applying TDM	Option 1		Option 2	
		After Testing	Percent Change	After Testing	Percent Change
Commute Drive Alone Mode Share					
Employees	50%	48%	-4.5%	39%	-21.9%
Residents	47%	47%	0.0%	46%	-1.4%
Automobile Mode Share for Non-Commute Trips					
Non-Commute	100%	100%	0.0%	100%	0.0%
Daily Vehicle Trips					
Employee Commute Trips	34,739	34,162	-1.7%	30,961	-10.9%
Residents Commute Trips	6,738	6,738	0.0%	6,703	-0.5%
Non-commute Trips	41,248	41,248	0.0%	41,248	0.0%
Daily Vehicle-Miles Traveled					
Employee Commute Trips	597,554	589,976	-1.3%	544,297	-8.9%
Residents Commute Trips	109,197	109,197	0.0%	108,606	-0.5%
Non-commute Trips	653,916	653,916	0.0%	653,916	0.0%
Cost Per Daily VMT Reduced	1,360,667	1,353,090	$4	1,306,818	$461
Cost Per Daily VMT Reduced w/o IM			$4		$461
PM Peak Period Trips[1]					
From the Study Area	20,859	20,702	-0.8%	19,827	-4.9%
To the Study Area	3,131	3,122	-0.3%	3,057	-2.4%
Cost Per PM Peak Trip Reduced	23,990	23,823	$166	22,885	$22,434
Cost Per PM Peak Trip Reduced w/o IM			$166		$22,434

Total Cost:	$27,781		$24,811,413
Total Cost w/o Intensive Marketing:	$27,781		$24,811,413

Note:

1) Includes HBW Attractions, HBO Attractions and HBW Productions

Table 1-24. TEEM Model TDM Analysis Results (continued)

Strategy		Option 1		Option 2
Mode-Shift Support Strategies				
1	Vanpooling	No		Yes
2	Alternative Mode Subsidy	No		Yes
3	FlexPass/Residential Pass	No		Yes
4	Vanshare	No		Yes
5	Guaranteed Ride Home (GRH)	No		Yes
Parking Management Strategies				
6	Restricted Parking Supply	No		Yes
7	Parking Pricing at Employment Sites	No		Yes
Alternative Work Schedules Strategies				
8	Telecommuting	No		Yes
9	Compressed Work Week (CWW)	No		Yes
Programmatic and Policy Support				
10	CTR-Type Program for Small Employers	No		Yes
11	Multi-Employer TMA	No		Yes
12a	Individualized Marketing	No		Yes
12b	Intensive Marketing	No		Yes
Bicycle and Pedestrian Facilities				
13	Increased Bicycle Access	No		Yes
14	Improved Pedestrian Access	No		Yes
Non-Commute Trips				
15	Shopping Trips	No		Yes
16	Special Events	No		No
Land-Use Strategies & Transit Service Strategies				
17	Increased Infill Develop/Densification	No		Yes
18	Increased Mixed-Use Development	No		Yes
19	Increased Density Near Transit	Yes		Yes

2 POLICY POINT 2: REASONABLE ALTERNATIVES

Describe the reasonable alternatives that have been evaluated.

2.1 Summary

Multiple alternatives were developed to improve safety and traffic circulation through the Port of Tacoma Road Interchange with I-5 project. The goal of the analysis was to identify a Proposed Alternative that addresses the projected design year needs, is compatible with the planned construction of other projects within the HSP, and minimizes impacts to the natural and business environment.

A detailed screening process, which evaluated 12 alternatives, identified the Proposed Alternative. The process included the development of alternatives, a three-level screening, a value analysis (VA) study, and traffic modeling. Input from the project's Technical Advisory Committee (TAC) was considered at all levels of the screening and alternative selection process.

Alternative 6 was identified as the Proposed Alternative because the analysis showed it to be the most efficient and cost-effective plan with the least social, economic, and environmental impacts while possessing favorable conditions for phasing.

2.2 Alternatives Developed

Developing alternatives was the first step in the iterative identification and evaluation process. Types of alternatives considered for the remediation of the Port of Tacoma Road interchange with I-5 project included the following.

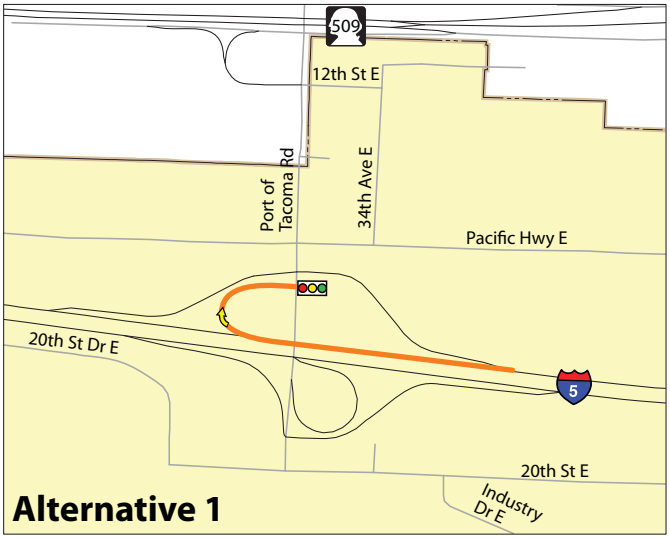
- No-build and limited construction
- Alternatives that "fixed" or revised the existing interchange
- Alternatives that improved the configuration of the local roadway network
- Alternatives that redesigned the interchange (blank slate approach)

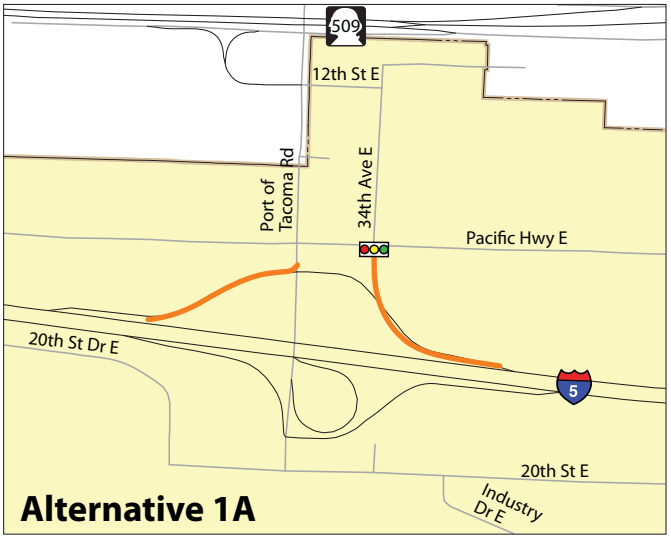
2.2.1 No-Build Alternatives

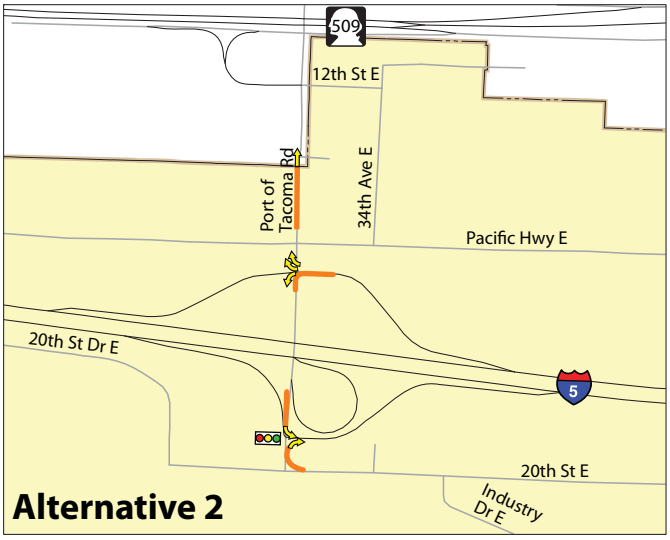
According to FHWA Technical Advisory T 6640.8A, page 15, 20 no-build and/or limited construction alternatives were considered for the Port of Tacoma Road interchange with I-5 project. As discussed in Section 1.6.5, the analysis showed that benefits from the no-build or limited construction alternatives were not substantial enough for them to be considered effective.

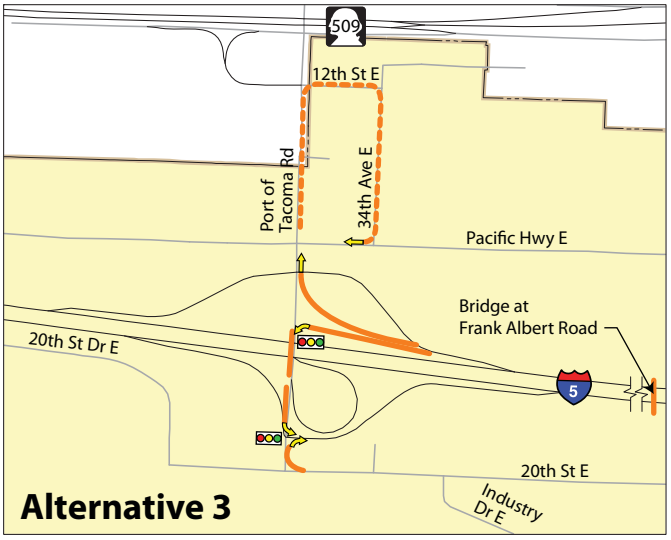
2.2.2 Build Alternatives

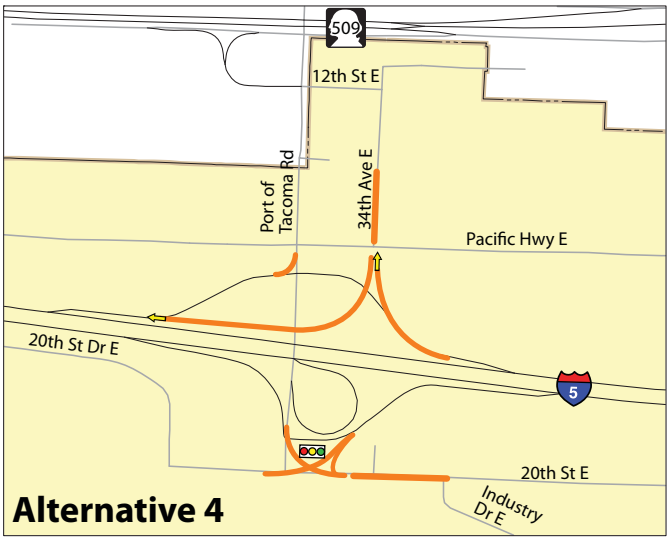
A May 2003 design charrette recommended an interchange revision alternative and a phased approach to reconfiguring the Port of Tacoma Road interchange with I-5. This alternative served as the baseline alternative or "original proposal" for the current work. Figures 2-1 and 2-2 show the 12 build alternatives analyzed in the screening process and they are described below.

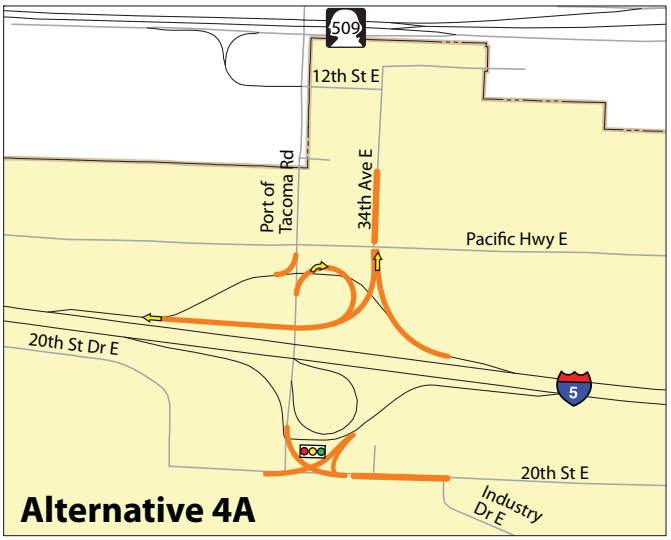






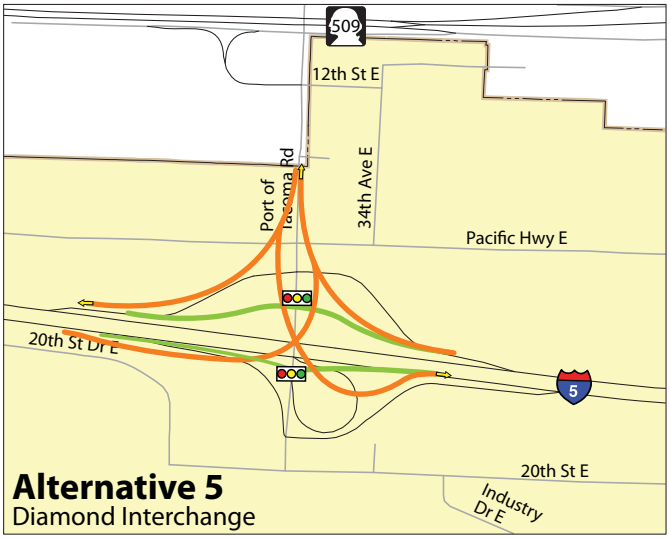


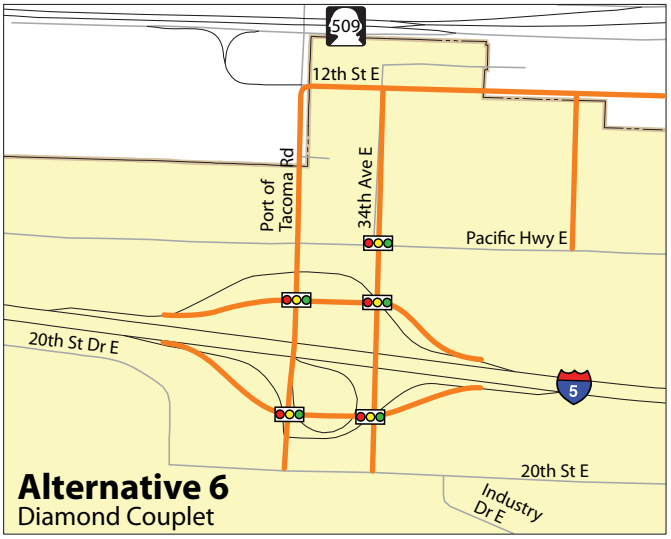


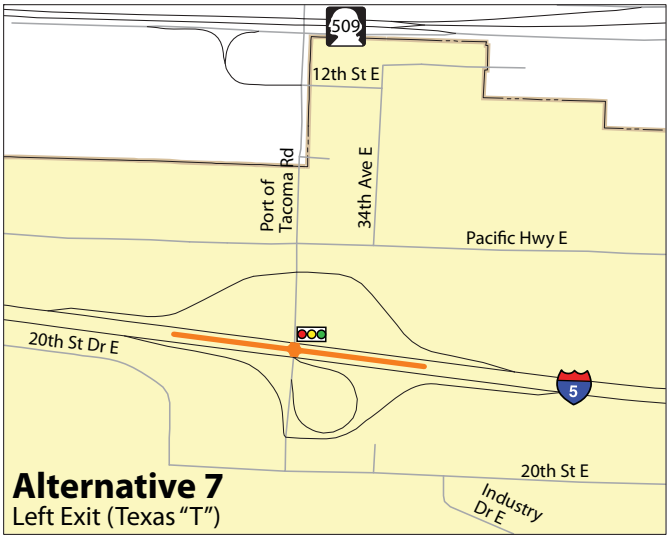


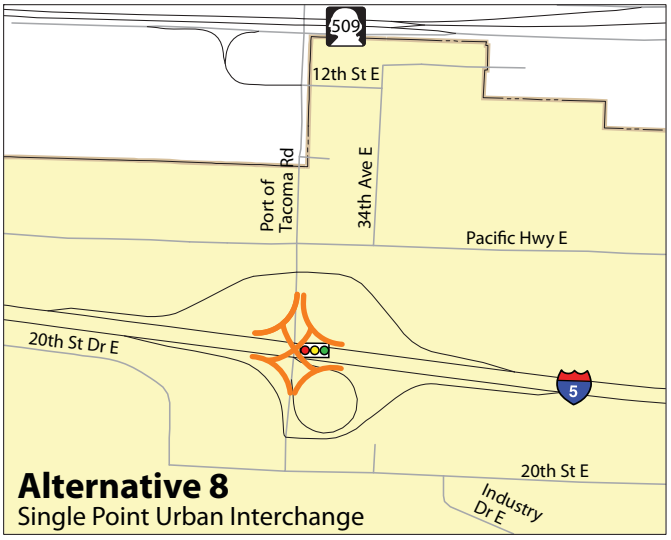
ALTERNATIVES CONSIDERED AND EVALUATED FOR ACCESS POINT REVISION

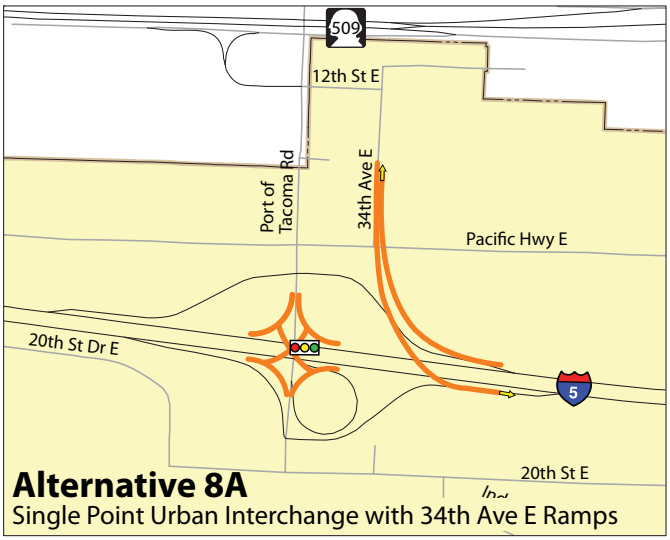
FIGURE 2-1

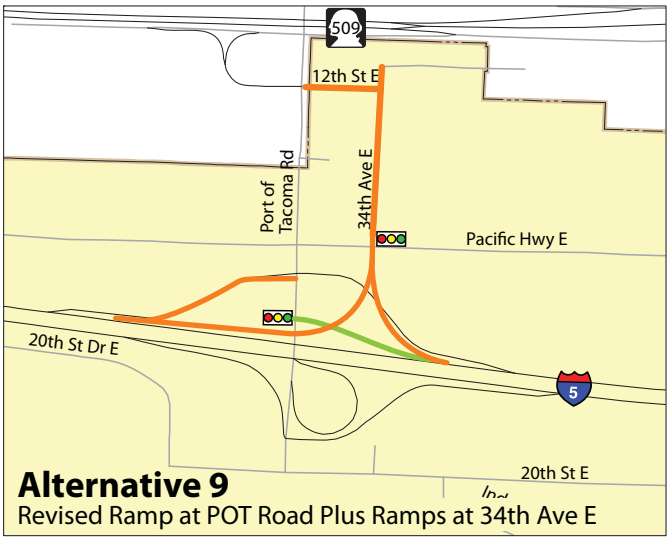












ALTERNATIVES CONSIDERED AND EVALUATED FOR ACCESS POINT REVISION

FIGURE 2-2

2.2.2.1 Alternative 1 - Revised Southbound Off-Ramp

Alternative 1 would revise the existing southbound off-ramp to terminate at Port of Tacoma Road. The existing intersection for the southbound off-ramp would be revised as a new partial loop relocated in the northwest quadrant of the interchange. Southbound off-ramp traffic would have northbound and southbound access to the Port of Tacoma Road via a new traffic signal at the end of the loop. This alternative would create more storage volume and an additional intersection. Vehicles heading northbound on Port of Tacoma Road would still have to make a left turn to access the southbound on-ramp.

2.2.2.2 Alternative 1A - Parclo B with 34th Avenue Off-Ramp

Alternative 1A would revise the southbound off-ramp by connecting it to Pacific Highway East at 34th Avenue East with a traffic signal. This configuration would provide Port-bound vehicles two ways to access Port of Tacoma Road. The I-5 southbound traffic would have access via 34th Avenue East. The I-5 northbound traffic would have access via Port of Tacoma Road.

This alternative would decrease the length of queuing on the southbound off-ramp. Vehicles heading southbound on Port of Tacoma Road would have to make two left turns instead of one.

2.2.2.3 Alternative 2 - Capacity Widening

Alternative 2 would add a left-turn only lane to the existing two lanes on the southbound off-ramp to Port of Tacoma Road. The lane in the center (which now allows both left and right turns) would become a right-turn only lane. This change would provide two right-turn lanes for vehicles heading north on Port of Tacoma Road and a dedicated left-turn lane for vehicles heading south on Port of Tacoma Road. An additional northbound lane, extending from Pacific Highway East north to SR 509, would give vehicles turning right from Pacific Highway East a dedicated lane to continue northbound on Port of Tacoma Road.

Another left-turn lane would be added to Port of Tacoma Road at the northbound on-ramp with a new traffic signal. This would increase the storage capacity for the southbound Port of Tacoma vehicles turning onto the I-5 northbound on-ramp.

A new right-turn only lane would be added from 20th Street East to the northbound on-ramp. This addition would create a dedicated lane for the Port of Tacoma Road northbound traffic from 20th Street East and eliminate delays caused by vehicles turning onto the northbound on-ramp from 20th Street East (see Capacity Widening Drawings 1-4 in Appendix C).

2.2.2.4 Alternative 3 - Reconstructed Port of Tacoma Southbound Off-Ramp

Alternative 3 would revise the existing southbound off-ramp to Port of Tacoma Road with two separate southbound off-ramps, one for each direction on Port of Tacoma Road. The off-ramp for northbound traffic would tie in parallel to Port of Tacoma Road, revising the existing intersection of the southbound off-ramps and Port of Tacoma Road. The off-ramp for traffic heading southbound on Port of Tacoma Road would tie in closer to the bridge and add a new intersection with a traffic signal. Alternative 3 also would add a bridge over I-5, connecting the portions of Frank Albert Road on either side of I-5 and providing an additional route for vehicles to cross I-5 from 20th Street East and Pacific Highway East.

To eliminate vehicles crossing over two lanes of traffic in the very limited distance between the interchange and the Port of Tacoma Road/Pacific Highway East intersection, the left-turn movement from Port of Tacoma Road to Pacific Highway East would be eliminated. Vehicles heading west on Pacific Highway East would have to go straight through the signal, turn right on 12th Street East, turn right again on 34th Avenue East, and make a third right on Pacific Highway East.

As with Alternative 2, Alternative 3 would add an additional left-turn lane to Port of Tacoma Road to the northbound on-ramp and add a new right-turn only lane from 20th Street East to the northbound on-ramp to I-5. The existing bridge would be widened to accommodate this additional left-turn lane and the new southbound off-ramp.

2.2.2.5 Alternative 4 - Ramps at 34th Avenue East with a Revised Intersection at 20th Street East

Alternative 4 would eliminate the existing southbound off-ramp to Port of Tacoma Road and replace it with a new southbound off-ramp that would tie into 34th Avenue East at Pacific Avenue East. From the new off-ramp at 34th Avenue East, vehicles heading to the Port would either go straight through the intersection and turn left on 12th Street East, or turn left on Pacific Highway East to access northbound Port of Tacoma Road. Both 34th Avenue East and 12th Street East would be widened and improved to accommodate the additional traffic attributable to the revised off-ramp. However, vehicles heading south on Port of Tacoma Road from the off-ramps at 34th Avenue East would no longer be able to access Port of Tacoma Road directly. Instead, they would have to make two left turns, one on Pacific Highway East and another on Port of Tacoma Road.

To increase storage capacity, the alternative would add a lane to the southbound on-ramp on Port of Tacoma Road. To improve the efficiency of the intersection of Port of Tacoma Road and the southbound on-ramp, the left-turn movement from northbound Port of Tacoma Road to the southbound on-ramp to I-5 would be eliminated; vehicles would now access the southbound on-ramp via the new ramp at 34th Avenue East.

On the south half of the interchange, the Port of Tacoma Road northbound on-ramp, Port of Tacoma Road, and 20th Street East would be realigned and combined into one intersection with a traffic signal. This would eliminate one intersection and provide better traffic flow. A right-turn only lane from 20th Street East to the northbound on-ramp would be added; to accommodate this right-turn only lane, 20th Street East would be widened (see Ramps at 34th Avenue East with a Revised Intersection at 20th Street East Drawings 1-5 in Appendix C).

2.2.2.6 Alternative 4A - Parclo A/B

In Alternative 4, vehicles would have to make a right turn onto Pacific Highway East from Port of Tacoma Road and another right onto the southbound on-ramp at 34th Avenue East. Alternative 4A includes the same elements as Alternative 4, but would add a loop ramp from Port of Tacoma Road to the new southbound on-ramp extending from 34th Avenue East. This would allow easier access to the southbound on-ramp for vehicles traveling north on Port of Tacoma Road (see Parclo A/B Drawings 1-5 in Appendix C).

2.2.2.7 Alternative 5 - Directional Interchange plus Diamond Interchange

Alternative 5 would provide a directional interchange for trucks from I-5 to Port of Tacoma Road. Additionally, a tight diamond interchange would be provided for local traffic to Port of Tacoma Road. Essentially, the four ramps would parallel Pacific Highway East and I-5. Each ramp would have a traffic signal and allow a right- and a left-turn movement onto Port of Tacoma Road. (A "tight" diamond is used when space is limited and a traditional diamond interchange cannot be used.)

Using directional and diamond interchanges would increase operational efficiency, capacity, and safety. Intersection spacing would no longer be an issue. Trucks and local traffic would be separated and, because traffic signals and left turns would be eliminated, trucks would experience a free flow movement between I-5 and Port of Tacoma Road (see Directional Interchange plus Diamond Interchange Drawings 1-5 in Appendix C).

2.2.2.8 Alternative 6 - Diamond Interchange with Couplet

Alternative 6 would modify the existing interchange into a split diamond interchange or diamond interchange with a couplet. This interchange would provide access to both 34th Avenue East and Port of Tacoma Road from both northbound and southbound on-ramps.

Vehicles exiting the southbound ramp would approach 34th Avenue East and could either turn right on 34th Avenue East or continue straight to Port of Tacoma Road. Left turns onto 34th Avenue East would be prohibited because 34th Avenue East would become a one-way northbound street from 20th Street East to 12th Street East. Eliminating this left turn would increase the efficiency of the intersection because it would reduce the number of approach legs. Vehicles continuing straight through the signal would encounter another signal at Port of Tacoma Road and could either continue straight to the southbound on-ramp or turn left on Port of Tacoma Road. Port of Tacoma Road would become a one-way southbound street from 12th Street East to 20th Street East.

Vehicles exiting the northbound off-ramp would approach a traffic signal at Port of Tacoma Road and go straight to 34th Avenue East or turn right on Port of Tacoma Road. At 34th Avenue East, there would be another traffic signal and vehicles could either continue straight to the northbound on-ramp or turn left on 34th Avenue East.

Additional local road improvements would include widening 34th Avenue East with a bridge over I-5, widening 20th Street East between Port of Tacoma Road and 34th Avenue East, and widening 34th Avenue East between Pacific Highway East and 12th Street East (see Diamond Interchange with Couplet Drawings 1-5 in Appendix C).

2.2.2.9 Alternative 7 - Left Exit

Alternative 7 assumes the existing interchange configuration would remain in place and a truck-only left-turn exit would be added in both directions from I-5 to Port of Tacoma Road. Although the left-turn exit would provide additional queuing storage for trucks, it would not eliminate the closely spaced intersections and actually would add an intersection at the bridge structure.

2.2.2.10 Alternative 8 - Single Point Urban Interchange

A single point urban interchange (SPUI) is a modified diamond with the ramp terminals on the crossroad combined into a single at-grade intersection. This single intersection accommodates all interchange and through movements. When compared to a diamond interchange, a SPUI would take up less ROW than a traditional diamond interchange. Intersection spacing would not be a problem and there would be only one signalized intersection as opposed to two (see SPUI Drawing 1 in Appendix C).

2.2.2.11 Alternative 8A - Single Point Urban Interchange with 34th Avenue Ramps

Alternative 8A would incorporate the SPUI from Alternative 8 and add additional on and off-ramps at 34th Avenue East. The ramps at 34th Avenue East would allow additional access to Port of Tacoma Road without adding an intersection. Traffic would either turn left on Pacific Highway East or go straight through the signal on 34th Avenue East and turn left on 12th Street East.

2.2.2.12 Alternative 9 – Revised Ramp at Port of Tacoma Road plus Ramps at 34th Avenue East

This alternative, the preferred configuration from the 2003 design charrette, was reevaluated as part of the IJR. To eliminate the closely spaced intersection of the southbound off-ramp and Port of Tacoma Road, the existing southbound off-ramp to Port of Tacoma Road and left turn from Port of Tacoma Road to the southbound on-ramp will be eliminated. New southbound on- and off-ramps would connect to 34th Avenue East with a traffic signal at Pacific Highway East and provide access to Port of Tacoma Road via 12th Street East. An additional southbound off-ramp would connect to Port of Tacoma Road closer to the bridge structure with a traffic signal and provide additional north or southbound access to Port of Tacoma Road.

2.3 Alternative Screening

A three-tiered screening process analyzed the benefits and viability of each alternative. Screening criteria were developed to address issues raised in the project's purpose and need statement and to measure each alternative's ability to successfully go through the environmental documenting process. The Level I screening identified and eliminated the fatally flawed alternatives. The Level II screening evaluated the remaining alternatives on geometrics and environmental issues. Finally, the Level III screening considered the alternative's ability to serve projected traffic volumes obtained from the PSRC travel demand forecasting. Table 2-1 describes each rejected alternative and the reasons for its rejection.

The three-tiered screening process identified two alternatives – Alternatives 6 and 8 – as viable alternatives to improve the interchange and meet the stated project objectives. Screening results were validated through WSDOT's Value Matrix Analysis process, which concluded that Alternatives 6 and 8 provided the greatest benefit to cost ratio of all the alternatives evaluated in the Level III screening process.

At the request of the TAC, the operational attributes of Alternatives 6 and 8 were analyzed through detailed VISSIM modeling. Its results showed that both Alternatives 6 and 8 provided desired operational improvements for the interchange, but Alternative 6 provided slightly greater improvements over Alternative 8. The two alternatives were reevaluated through a

refinement of the Value Matrix Analysis, which showed that, compared with Alternative 8, Alternative 6 could be constructed in phases and would require a limited amount of ROW to widen Port of Tacoma Road and SR 99. With the inclusion of these two factors, Alternative 6 had the highest benefit to cost ratio.

Table 2-1. Alternative Screening Results Summary

No.	Alternative Name	Description	Screening Level Rejected	Reason for Rejection
1	1	Revised southbound I-5 off -ramp	Level I	Doesn't reduce number of intersection points
2	1B	Parclo B with southbound I-5 off-ramp to 34th Ave E	Level I	SB I-5 off-ramp decreased lane storage and potential added left turn at POT Rd
3	2	Capacity widening	VISSIM Traffic Modeling	Didn't meet expected operational improvements
4	3	Reconstructed POT Southbound Off Ramp	Level I -Refinement	Concept refined and incorporated to a similar alternative
5	4	Ramps at 34th Ave E with a Revised Intersection at 20th Street E	WSDOT's value matrix	Lower scoring in WSDOT's value matrix
6	4A	Parclo A/B	WSDOT's values matrix	Lower scoring in WSDOT's value matrix
7	5	Directional Interchange Plus Diamond Interchange	Level 2(a)	Exceeded maximum allowable ramp grades
8	6	Diamond Interchange with couplet	Proposed Alternative	
9	7	Left exit	Level I	Didn't address closely spaced intersections and added a new one.
10	8	SPUI	VISSIM traffic modeling	Challenging phasing and constructability
11	8A	SPUI with 34th Ave E ramps	Level I - Refinement	Concept refined and incorporated to a similar alternative
12	9	Revised Ramp at POT Rd plus Ramps at 34th Ave E	Level I - Refinement	Concept refined and incorporated to a similar alternative

2.3.1 Recommended Alternative

The recommended alternative, Alternative 6 – Diamond Couplet Interchange, proposes the reconfiguration of the existing One-Quad Parclo B interchange to a split diamond configuration with the Port of Tacoma Road and 34th Avenue East operating as a one-way couplet. This alternative was endorsed by the TAC on 20 January 2010 (see Appendix D). The other attributes of the alternative include the following.

- Can be constructed in multiple phases
- Can be constructed under traffic
- Requires no widening of Port of Tacoma Road
- Requires minimal widening of SR 99 (eastbound right-turn pocket at Port of Tacoma Road intersection)
- Entails least length of queuing of all alternatives
- Increases spacing between the intersections of Port of Tacoma Road with I-5 and SR 99
- Is consistent with Purpose and Need statement developed by project stakeholders because of signalization and increased capacity for vehicles traveling southbound on Port of Tacoma Road to northbound I-5
- Is consistent with needs identified in Policy Point 1
- Is consistent with design standards of Policy Point 4

3 POLICY POINT 3: OPERATIONAL AND COLLISION ANALYSIS

How will the Proposed Alternative affect safety and traffic operations now and for the next 30 years?

3.1 Summary

The analysis of the Proposed Alternative evaluated the proposal's effect on the operation and safety of the surface streets and freeway systems. The analysis is consistent with the procedures and methods outlined in Policy Point 1 and documented in Appendix A.

The operational analysis shows that the Proposed Alternative would improve traffic operations and reduce potential crashes within the study area in the design year. The operations of the I-5 mainline and the intersection LOS would improve with the Proposed Alternative. The findings indicate that the Proposed Alternative would reduce the number of conflict points for potential crashes by simplifying the geometrics and phasing at the interchange.

The Proposed Alternative will be fully constructed by 2020 to address the operational and safety needs of the interchange. The project will likely be constructed in phases prior to 2020 to allow for funding and to provide interim benefits.

3.1.1 2020 Year of Opening Condition

3.1.1.1 AM Peak Hour

In the AM peak hour, I-5 northbound and southbound operations are expected to improve with the completion of the Proposed Alternative. The I-5 southbound mainline is expected to operate at LOS D or better, with the exception of two segments, the basic segment between Bay Street and East 27th Street/Portland Avenue and the weave segment between East 27th Street/Portland Avenue and I-705. This represents a slight improvement over one segment that operates at LOS E in the No-Build Alternative. For the northbound mainline, eight segments are expected to continue to operate at LOS E, where 12 segments are expected to operate at LOS E in the No-Build Alternative. Four segments at the Port of Tacoma Road interchange would improve to operate at LOS D, which is related to the benefits of the Proposed Alternative.

- Arterial roadways, such as Port of Tacoma Road, would improve based on increased capacity and the benefits related to the one-way operation of intersections through the corridor.

3.1.1.2 PM Peak Hour

In the PM peak hour, I-5 northbound and southbound operations are expected to improve with the completion of the Proposed Alternative. I-5 southbound operations are expected to operate at LOS D or better, with the exception of two segments, the diverge segment at the off-ramp to 54th Avenue East and the merge segment on-ramp from Port of Tacoma Road/34th Avenue East. Northbound freeway segments are expected to continue to operate at LOS D or better, except for the diverge segment at the off-ramp to East 28th Street/Portland Avenue and the merge segment at the on-ramp from truck scale. The operation at the basic segment between Port of Tacoma Road northbound on/off-ramps would improve to LOS D.

- Arterial roadways, such as Port of Tacoma Road, would improve based on increased capacity and the benefits related to the one-way operation of intersections through the corridor.

3.1.2 2040 Design Year Condition

3.1.2.1 AM Peak Hour

I-5 northbound and southbound freeway operations are expected to improve slightly compared to the No-Build condition. The completion of the Proposed Alternative would improve Port of Tacoma Road and its interchange with I-5.

The mainline segments on northbound I-5 would operate slightly better than 2040 No-Build conditions with 22 segments operating at LOS E or F compared to 24 segments in the No-Build condition.

The mainline segments on southbound I-5 would operate better than 2040 No-Build conditions with nine segments operating at E compared to 18 segments with LOS E or F in the No-Build conditions in the AM peak hour.

- Arterial roadways, such as Port of Tacoma Road, would improve based on increased capacity and the benefits related to the one-way operation of intersections through the corridor.

3.1.2.2 PM Peak Hour

I-5 northbound and southbound mainline operations would show minimal changes with the completion of the Proposed Alternative.

In the PM peak hour, out of 26 segments in the northbound direction, 17 segments would operate at LOS E or F in the Proposed Alternative, compared to 22 segments operating at LOS E or F in the No-Build conditions.

In the southbound direction, 14 segments would operate at LOS E or F, compared to 15 segments in the No-Build conditions.

- Arterial roadways, such as Port of Tacoma Road, would improve based on increased capacity and the benefits related to the one-way operation of intersections through the corridor.

3.2 Analysis Methods and Assumptions

Appendix A discusses the methodology for developing traffic forecasts and many of the assumptions underlying this operations analysis. Appendix B contains the operational analysis methods and assumptions technical memorandum, which reviews the microsimulation assumptions used for the evaluation of the interchange alternatives.

3.2.1 Travel Demand Forecasting

The analysis used an enhanced version of the PSRC regional transportation model to develop forecasts of future travel demand. The enhanced model used a finer land-use zone structure and a more detailed transportation network to better reflect the I-5 corridor and the local streets within the study area. Forecasts were developed for 2020 and 2040 based on PSRC data for those years.

The 2020 and 2040 forecasts differ on the assumed completion of the SR 167 connection. This connection provides a strong operational benefit to the study area. The 2020 year of opening does not include the benefit of the SR 167 extension because the completion of the project by 2020 is unlikely because of funding and the lead time required for construction. Without the SR 167 extension, congestion levels are forecasted to be so severe that there would be little or only minor differentiation between the No-Build and Proposed alternatives. Appendix A explains the future year traffic volume forecasting methodology.

3.2.2 Operational and Safety Analysis Methods and Assumptions

Appendix B explains the operational analysis methodology. The microsimulation model (VISSIM) examines intersection performance by correlating the effect of intersection volumes, roadway geometrics, and signal timing/phasing for a detail review of roadway operations. The software reports a number of evaluation metrics, including travel time, delay, and intersection LOS.

3.2.3 Potential Crash Forecast Methodology

The standard methodology for forecasting future crashes is to find an interchange location with a similar geometry and to apply that crash rate to the forecasted volume. For the No-Build analysis, as volumes increase, the crash rate is likely to increase. Even if the crash rate remains the same, the total number of crashes would increase with growth in traffic on area freeways, ramps, and at intersections. Moreover, actual crash rates are affected by a number of factors, such as weather, driver behavior, and vehicle condition.

The Proposed Alternative would create four intersections made up of two one-way approaches. Each of these intersections would have simple geometry and phasing, with only five conflict points and two signal phases per intersection. In comparison, the No-Build Alternative has 11 conflict points and 5 signal phases for the southbound ramps' intersection and 6 conflict points for the northbound ramps. Generally, an intersection with fewer conflict points and simpler signal phasing will have fewer crashes. Therefore, the Proposed Alternative would be expected to have a lower crash rate overall than the No-Build Alternative.

3.3 Year of Opening Conditions (2020)

The Proposed Alternative's year of opening is assumed to be 2020. The analysis assumes the completion of the entire interchange project by 2020. However, funding and construction schedules may result in phasing the project. This section describes the operation of freeways and intersections at the year of opening and a safety analysis comparing the Proposed Alternative to the No-Build Alternative. Both alternatives assume the additional improvements

to freeways, interchanges, arterials, or ramps within the study area identified in local and regional planning documents. The completion of the SR 167 Interchange and Extension project is not assumed in 2020. The complete list of assumed improvements is found in Table 1-1.

3.3.1 Year of Opening (2020) Freeway Operations

The freeway mainline, merge and diverge points, and weaving segments were analyzed for the Proposed and No-Build alternatives in the year of opening. Table 3-1 summarizes the I-5 mainline operations for the 2020 Proposed Alternative. Figures 3-1 and 3-2 present the results of freeway segment LOS and lane configuration for the 2020 Proposed Alternative.

In the AM peak hour, 4 of the I-5 northbound and 1 of the I-5 southbound mainline segments would improve to LOS D or better with the Proposed Alternative. However, 8 of the 19 mainline segments of the I-5 northbound direction would continue to operate at LOS E or F under the 2020 Proposed Alternative. Of the 5 merge/diverge/weave segments in the northbound direction, four would operate at LOS E. In the southbound direction, 1 mainline segment and 1 merge/diverge/weave segment would operate at LOS E.

In the PM peak hour, I-5 southbound operations would improve to operate at LOS D or better, with the exception of 2 segments, the diverge segment at the off-ramp to 54th Avenue East and the merge segment on-ramp from Port of Tacoma Road/34th Avenue East. Northbound freeway segments are expected to continue to operate at LOS D or better, except for the diverge segment at the off-ramp to East 28th Street/Portland Avenue and the merge segment at the on-ramp from the truck scale. The operation at the basic mainline segment between the Port of Tacoma Road northbound on-/off-ramp would improve to LOS D.

3.3.2 Year of Opening (2020) Intersection Operations

The intersection analysis for the year of opening was based on the HCM2000 methods for unsignalized and signalized intersections. Using the forecasted volumes for 2020, the analysis evaluated study area intersections to calculate the performance of intersection operations during the AM and PM peak hours. The analysis includes the intersections formed by the Proposed Alternative. Table 3-2 presents the results of intersection analysis in 2020 for the Proposed Alternative.

The Proposed Alternative changes the operation of intersections on Port of Tacoma Road, creating a one-way couplet with southbound traffic traveling on Port of Tacoma Road and northbound traffic on 34th Avenue East.

Table 3-1. 2020 Proposed Alternative I-5 Mainline Freeway Operations Summary

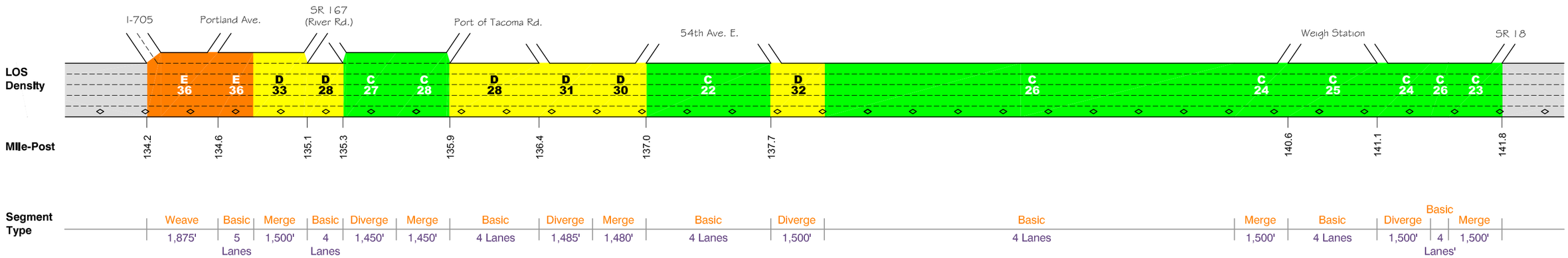
	Type	AM Peak Hour		PM Peak Hour	
		LOS	Density	LOS	Density
I-5 Northbound					
I-5 NB on-ramp from I-705	Merge	C	28	D	35
I-5 NB off-ramp to E 28th Street/Portland Avenue	Diverge	C	27	**E**	**36**
I-5 NB off-ramp to E Bay Street	Diverge	D	31	D	34
I-5 NB between E Bay Street off/on-ramps	Basic	D	32	D	28
I-5 NB on-ramp from E 28th Street	Merge	D	30	C	25
I-5 NB between E 28th Street. On-ramp and Port of Tacoma Road off-ramp	Basic	D	31	D	26
I-5 NB off-ramp to Port of Tacoma Road/34th Ave	Diverge	D	31	C	26
I-5 NB between Port of Tacoma Road NB off/on-ramps	Basic	D	33	D	29
I-5 NB on-ramp from Port of Tacoma Road/34th Ave	Merge	D	30	C	28
I-5 NB between Port of Tacoma Road and 54th Avenue E	Basic	**E**	**35**	D	32
I-5 NB off-ramp to 54th Avenue E	Diverge	**E**	**36**	D	33
I-5 NB between 54th Avenue E on/off ramps	Basic	D	29	D	26
I-5 NB on-ramp from 54th Avenue E	Merge	**E**	**35**	D	32
I-5 NB between 54th Avenue E on ramp and truck scales off ramp	Basic	**E**	**35**	D	32
I-5 NB off-ramp to truck scales	Diverge	**E**	**35**	D	33
I-5 NB between truck scales off/on-ramps	Basic	**E**	**37**	D	34
I-5 NB on-ramp from truck scales	Merge	**E**	**41**	**E**	**40**
I-5 NB between truck scales and SR 18	Basic	**E**	**37**	D	35
I-5 NB off-ramp to SR 18	Diverge	D	31	D	31

Note: Average volumes based on 13 VISSIM runs
***Bold** indicates unacceptable operation.*
Source: Fehr & Peers, 2010.

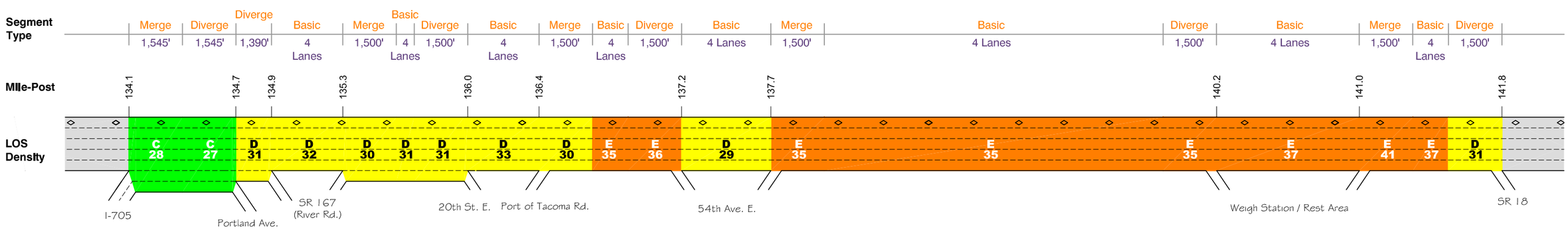
I-5 Southbound					
I-5 SB on-ramp from SR 18	Merge	C	23	C	26
I-5 SB between SR 18 and truck scales	Basic	C	26	D	31
I-5 SB off-ramp to truck scales	Diverge	C	24	C	28
I-5 SB between truck scales off/on-ramps	Basic	C	25	D	30
I-5 SB on-ramp from truck scales	Merge	C	24	C	28
I-5 SB between truck scales on ramp and 54th Avenue E off ramp	Basic	C	26	D	31
I-5 SB off ramp to 54th Ave E	Diverge	D	32	**E**	**38**
I-5 SB between 54th Avenue E on/off ramps	Basic	C	22	D	28
I-5 SB on-ramp from 54th Avenue E	Merge	D	30	D	33
I-5 SB off-ramp to Port of Tacoma Road/34th Ave	Diverge	D	31	D	34
I-5 SB between Port of Tacoma Road off/on-ramps	Basic	D	28	D	32
I-5 SB on-ramp from Port of Tacoma Road/34th Ave	Merge	C	28	**E**	**36**
I-5 SB off-ramp to Bay Street	Diverge	C	27	D	34
I-5 SB between Bay Street on/off ramps	Basic	D	28	D	34
I-5 SB on-ramp from Bay Street	Merge	D	33	D	30
I-5 SB between Bay Street and E 27th Street/Portland Avenue	Basic	**E**	**36**	D	33
I-5 SB weave between E 27th Street/Portland Avenue and I-705	Weave	**E**	**36**	D	35

Note: Average volumes based on 13 VISSIM runs.
***Bold** indicates unacceptable operation.*
Source: Fehr & Peers, 2010.

Interstate 5: State Route 18 to Interstate 705 (Southbound)



Interstate 5: Interstate 705 to State Route 18 (Northbound)



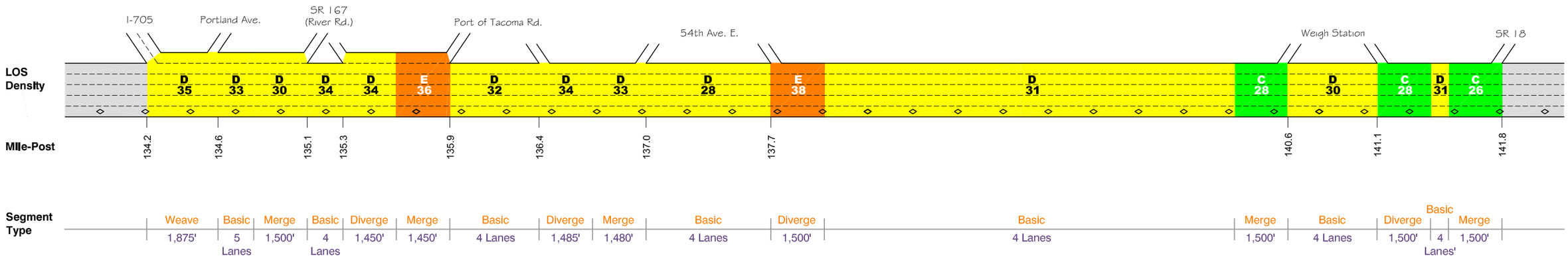
LEGEND

		Level of Service
6.0	Mile-Post	A - C
◊	HOV Bypass Lane	D
D — 32.8	Level of Service / Density (Vehicles / Lane Mile)	E
		F

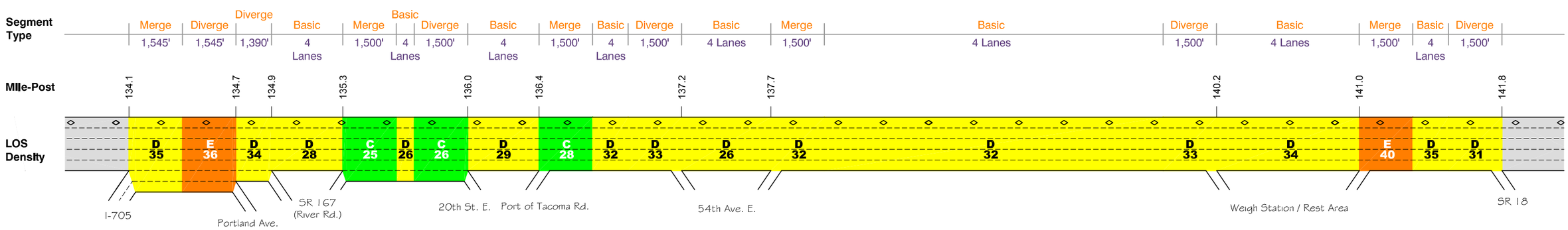
AM PEAK HOUR LANE CONFIGURATIONS AND LEVEL OF SERVICE - 2020 ALTERNATIVE 6

FIGURE 3-1

Interstate 5: State Route 18 to Interstate 705 (Southbound)



Interstate 5: Interstate 705 to State Route 18 (Northbound)



LEGEND

		Level of Service
6.0	Mile-Post	A - C
◊	HOV Bypass Lane	D
D — 32.8	Level of Service / Density (Vehicles / Lane Mile)	E
		F

PM PEAK HOUR LANE CONFIGURATIONS AND LEVEL OF SERVICE - 2020 ALTERNATIVE 6

FIGURE 3-2

Table 3-2. Intersection Levels of Service - 2020 Peak Hour Conditions – Proposed Alternative

Intersection		Traffic Control	AM Peak Hour					PM Peak Hour				
			NB	SB	EB	WB	Total	NB	SB	EB	WB	Total
1	E Portland Ave/E 27th St	Signal	C/21	B/15		E/63	C/29	C/34	F/127		F/82	F/99
2	E Portland Ave/E 28th St	Signal	D/36	B/16	D/51		D/36	C/26	B/17	C/32		C/22
3	E Bay St/E 27th St	SSSC		A/10		A/2	A/5		C/15		A/4	A/6
4	E Bay St/E 28th St	Signal		B/15	A/7		A/9		C/23	B/12		B/13
5	POT Rd/SR-509 NB Ramps-12th Ave	Signal		A/10	C/24	B/18	B/18		A/8	B/17	B/17	B/13
6	POT Rd/Pacific Hwy	Signal		C/31	B/20	B/11	C/22		C/35	D/47	B/17	C/27
7	POT Rd/I-5 SB Ramps	Signal		A/1		C/32	B/12		A/4		C/33	B/11
8	POT Rd/I-5 NB Ramps	Signal		A/6	C/30		C/23		A/7	C/23		B/17
9	POT Rd/20th St	Signal	A/8	A/8	D/44	D/36	B/18	A/9	A/8	D/38	D/40	C/21
10	Industry Dr/20th St	Signal	D/44		A/5	A/6	B/13	D/43		A/2	A/8	B/11
17	54th Ave/12th St	Signal	B/15	B/12	D/48	D/42	B/19	B/18	E/80	F/>200	E/56	E/78
18	54th Ave/Pacific Hwy	Signal	C/27	F/103	E/56	E/56	D/54	C/26	F/188	F/>200	E/58	F/>200
19	54th Ave/I-5 SB Ramps	Signal	B/19	A/2		D/51	C/23	D/42	D/36		D/52	D/43
20	54th Ave/I-5 NB Ramps	Signal	A/2	D/36	C/24		B/15	A/3	E/76	B/16		C/31
21	54th Ave/20th St	Signal	E/60	C/27	D/45	D/44	D/43	F/>200	F */	F/146	D/39	F/96
22	34th Ave/Pacific Hwy	Signal	B/14		C/24	D/36	C/24	E/59		F/110	C/22	D/41
23	34th Ave/I-5 SB Ramps	Signal	A/7			D/46	B/12	A/6			D/46	B/12
24	34th Ave/I-5 NB Ramps	Signal	B/12		C/27		C/21	A/4		D/41		B/16
25	34th Ave/20th St	Signal			A/2	A/3	A/2			B/19	A/9	B/14

Notes:
SSSC = side-street stop-controlled.
Source: Fehr & Peers, 2010.

In the AM peak hour, all intersections would operate overall at LOS D or better under the Proposed Alternative. While overall intersection operations would be LOS D or better, some intersection approaches would experience greater delays. For example, the westbound, eastbound, and southbound approaches to the 54th Avenue East/Pacific Highway East intersection and the northbound approach to the 54th Avenue East/20th Street intersection would operate at LOS E or F. Figures 3-3 through 3-6 show the volume, geometry, and LOS for the study intersections during the AM peak hour.

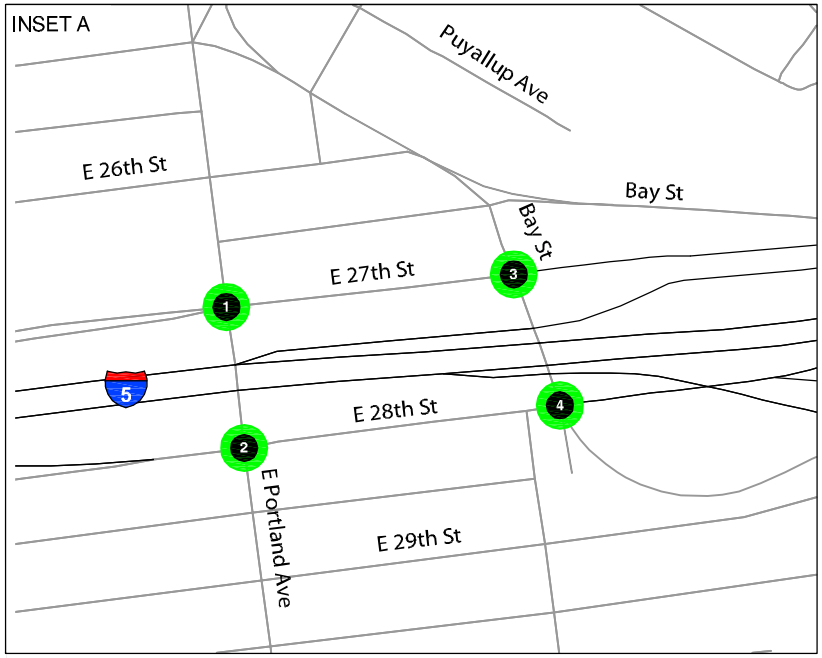
During the PM peak hour, four intersections would continue to operate at LOS E or F in the Proposed Alternative. They include three intersections along 54th Avenue E: (1) East 12th Street, (2) Pacific Highway East and East 20th Street, and (3) East Portland Avenue and East 27th Street. Figures 3-7 through 3-10 present the volume, geometry, and LOS conditions during the PM peak hour.

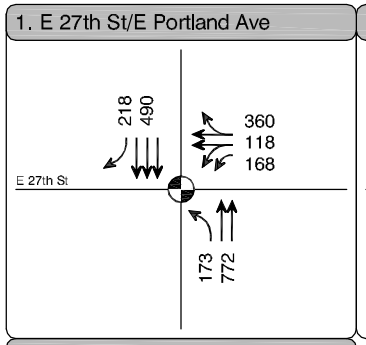
3.3.3 Year of Opening (2020) Safety

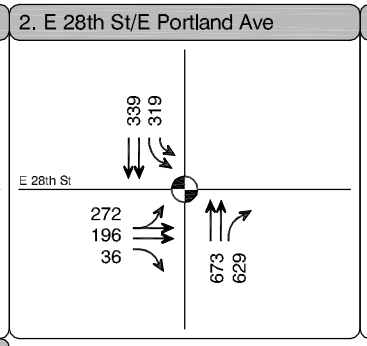
The standard methodology for forecasting future crashes is to find an interchange location with a similar geometry and apply that crash rate to the forecasted volume. The Proposed Alternative is somewhat unusual, with its configuration of two intersecting one-way couplets forming the interchange, and although a similar configuration is employed at the I-90/North Argonne Road in Spokane, Washington; given the limited number of trucks employing this interchange as well as the substantially lower ADTs, this interchange was not deemed to be a suitable comparison. The Proposed Alternative would create four intersections made up of two one-way approaches. Each intersection would have simple geometry and phasing, with only five conflict points and two signal phases per intersection. In comparison, the No-Build Alternative has 11 conflict points and 5 signal phases for the southbound ramps' intersection and 6 conflict points for the northbound ramps. Generally, an intersection with fewer conflict points and simpler signal phasing will have lower crash rates. Therefore, the Proposed Alternative would be expected to have a lower crash rate overall than the No-Build Alternative.

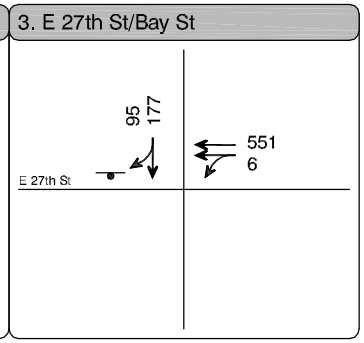
3.4 Design Year Operations (2040)

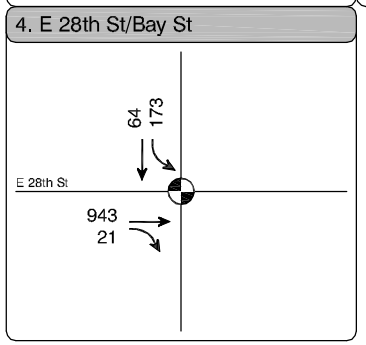
The design year is assumed to be 2040, representing the completion and full operation of the facility. This section describes the operation of freeways and intersections in the design year and a safety analysis comparing the Proposed Alternative to the No-Build Alternative. Both alternatives assume the additional improvements to freeways, interchanges, arterials, and ramps within the study area identified in local and regional planning documents. While the completion of the SR 167 interchange and extension project is not assumed in 2020, it is included in 2040. Table 1-1 lists assumed improvements.

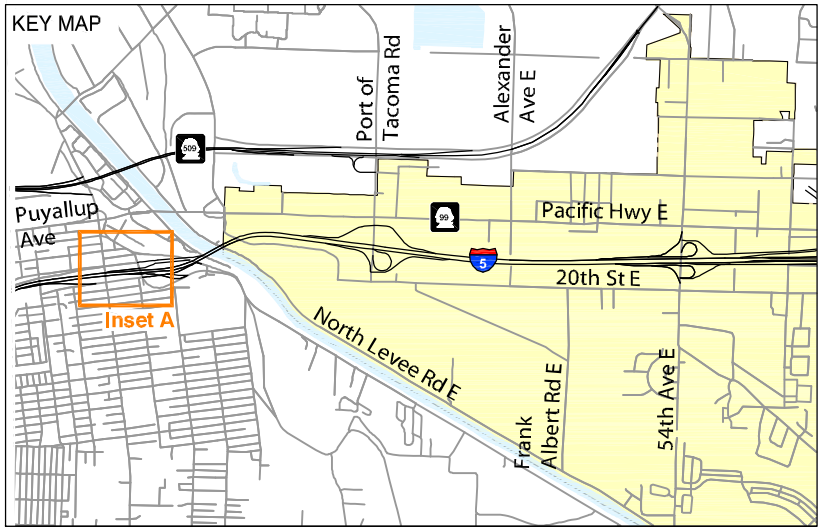












N

NOT TO SCALE

LEGEND

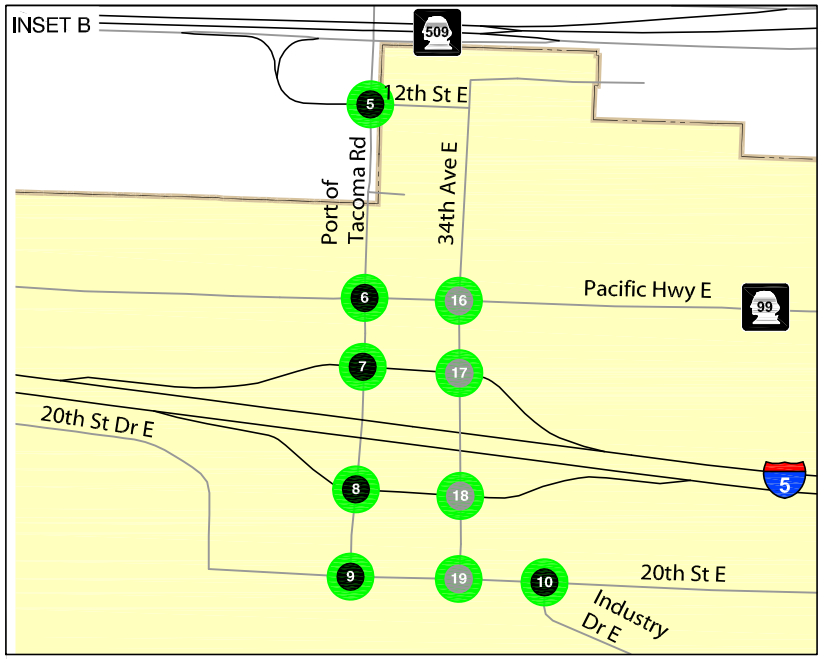
	Turn Lane	1	Study Intersection		Stop Sign
XX	Peak Hour Traffic Volume		Traffic Signal		City of Fife

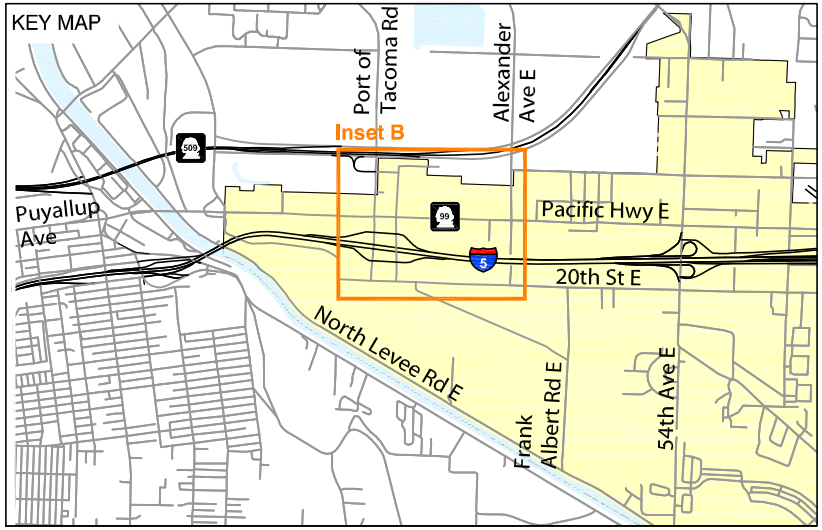
Level of Service

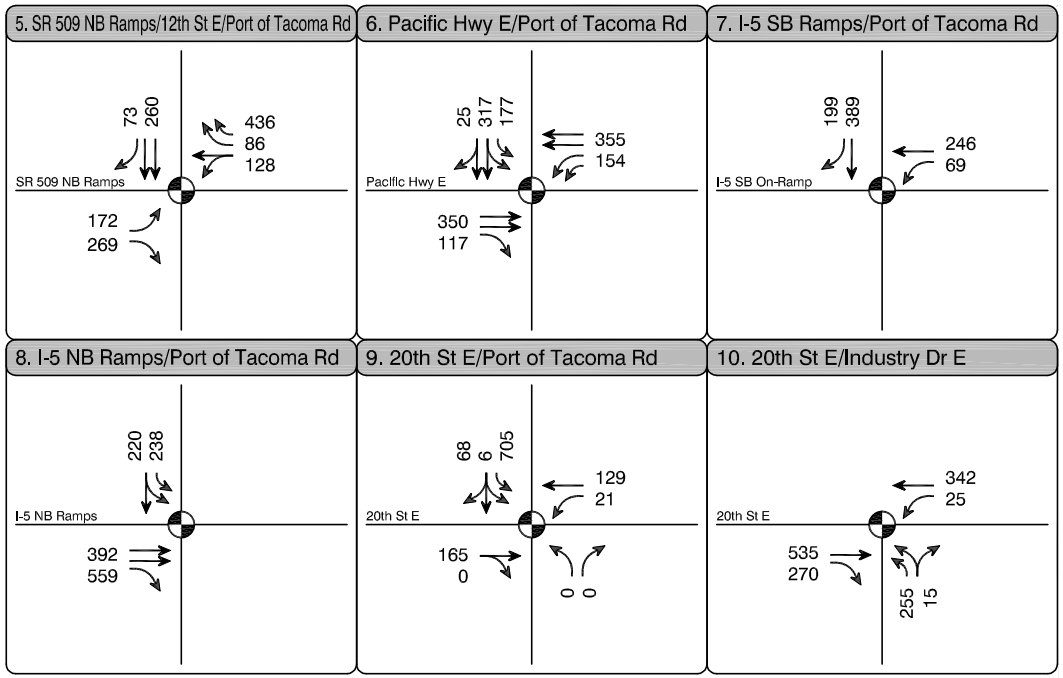
A - D	E	F

AM PEAK HOUR TRAFFIC VOLUMES AND LANE CONFIGURATIONS - 2020 PROPOSED ALTERNATIVE (INSET A)

FIGURE 3-3







N

NOT TO SCALE

LEGEND

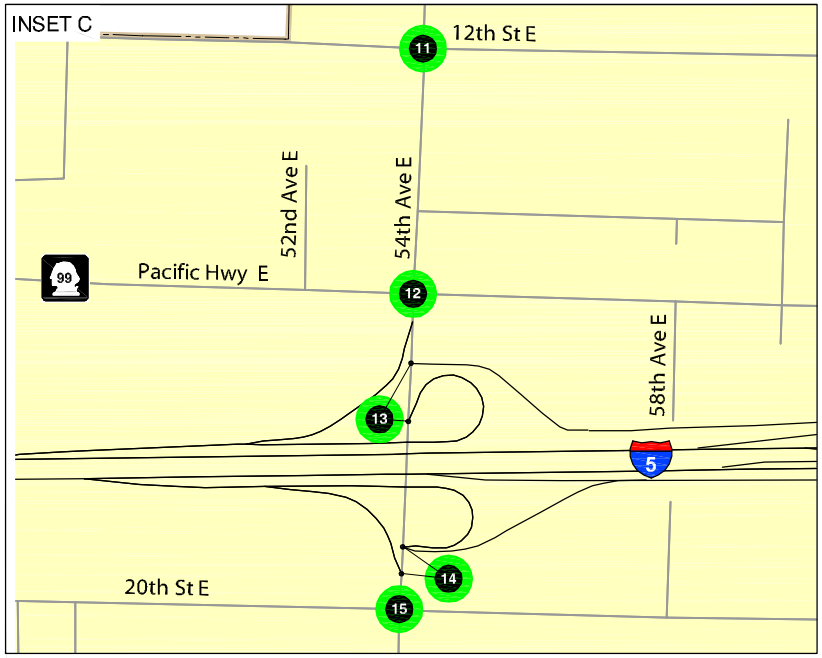
- Turn Lane
- XX Peak Hour Traffic Volume
- Study Intersection (Grey: See Figure 3-6)
- Traffic Signal
- Stop Sign
- City of Fife

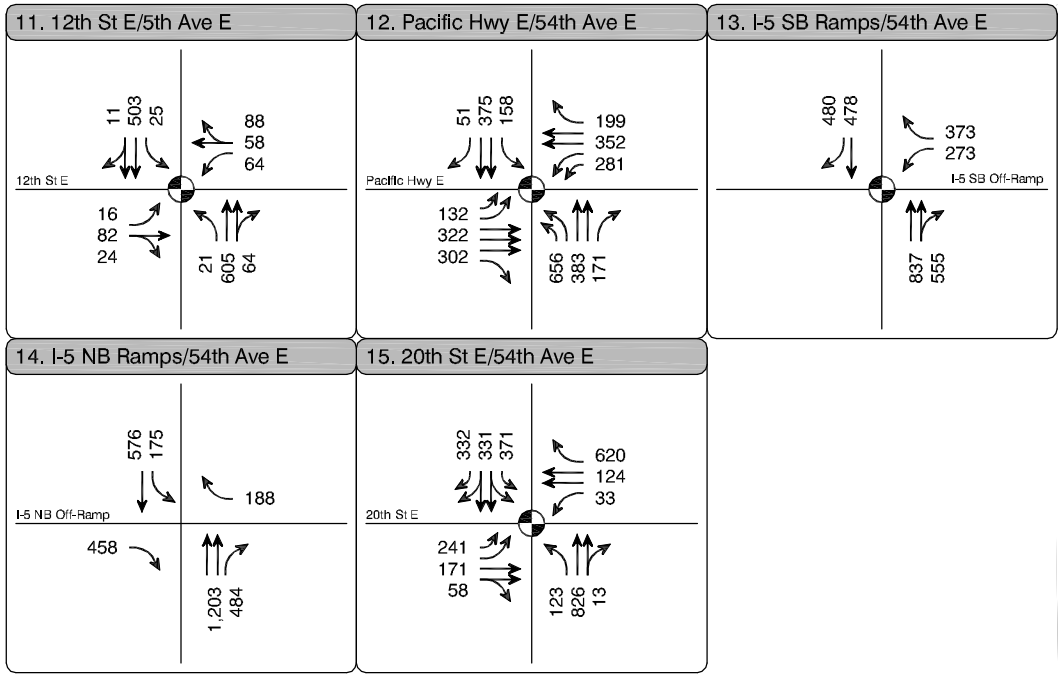
Level of Service

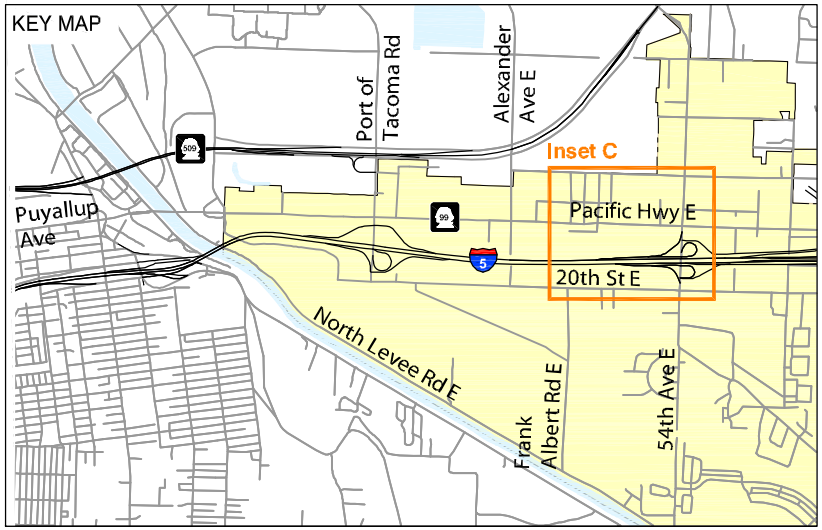
- A - D
- E
- F

AM PEAK HOUR TRAFFIC VOLUMES AND LANE CONFIGURATIONS - 2020 PROPOSED ALTERNATIVE (INSET B)

FIGURE 3-4







N

NOT TO SCALE

LEGEND

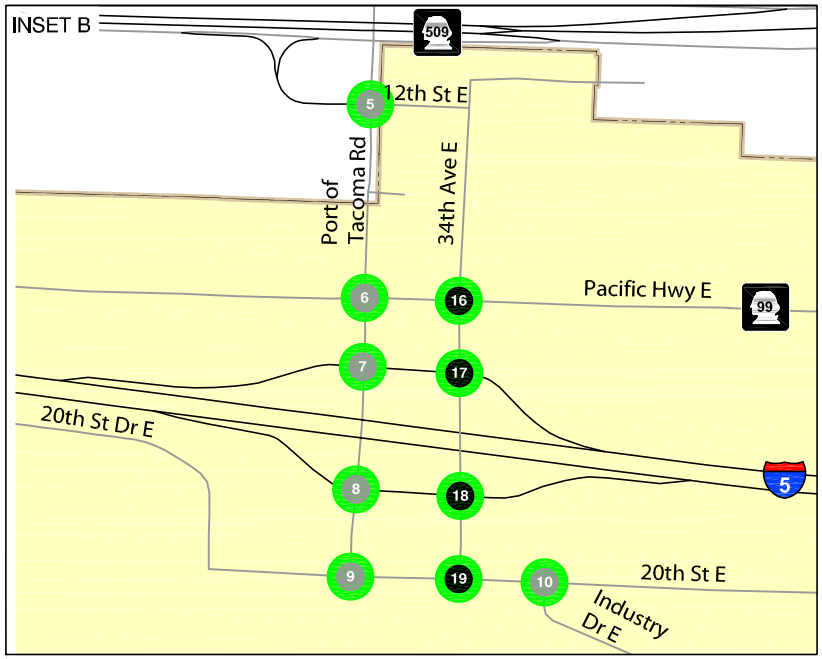
- Turn Lane
- XX Peak Hour Traffic Volume
- Study Intersection
- Traffic Signal
- Stop Sign
- City of Fife

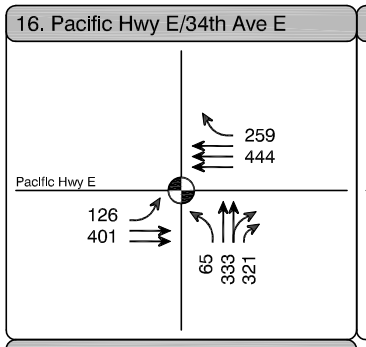
Level of Service

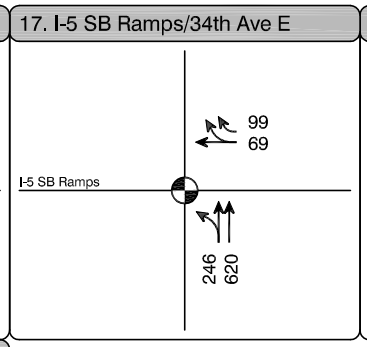
- A - D
- E
- F

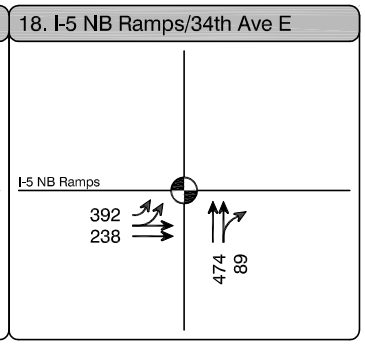
AM PEAK HOUR TRAFFIC VOLUMES AND LANE CONFIGURATIONS - 2020 PROPOSED ALTERNATIVE (INSET C)

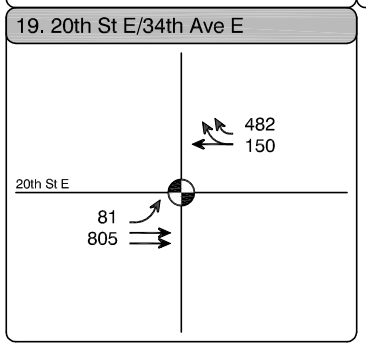
FIGURE 3-5

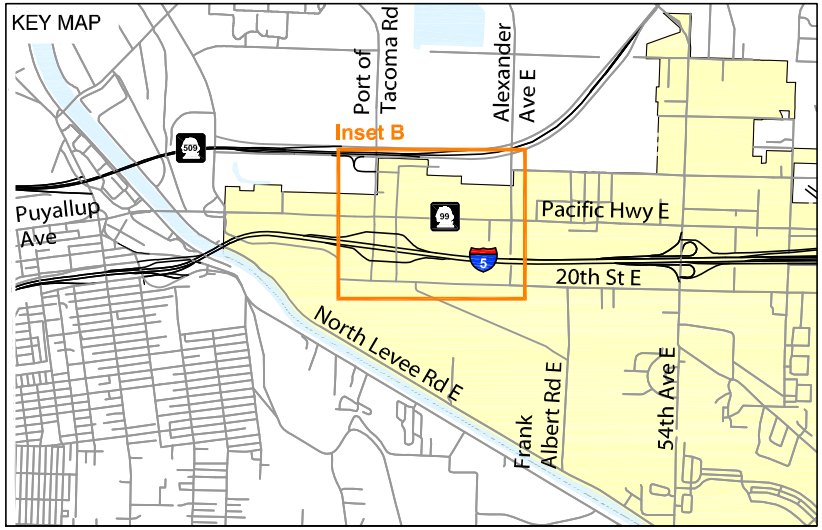












N

NOT TO SCALE

LEGEND

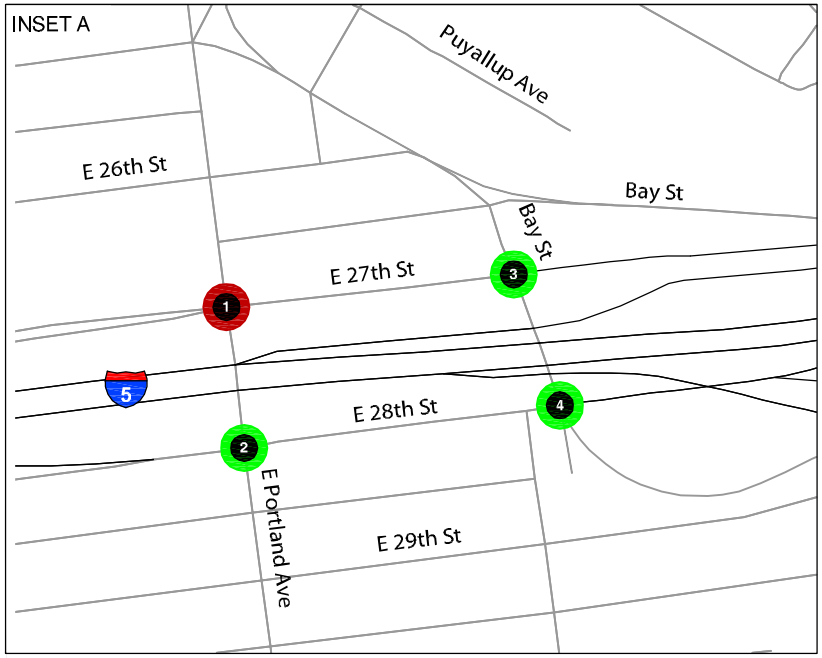
- Turn Lane
- XX Peak Hour Traffic Volume
- Study Intersection (Grey: See Figure 3-4)
- Traffic Signal
- Stop Sign
- City of Fife

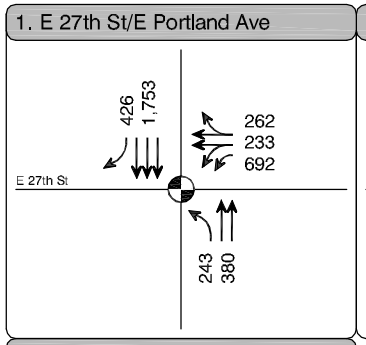
Level of Service

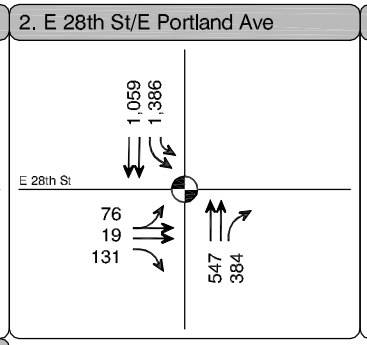
- A - D
- E
- F

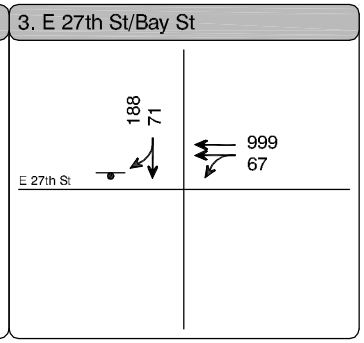
AM PEAK HOUR TRAFFIC VOLUMES AND LANE CONFIGURATIONS - 2020 PROPOSED ALTERNATIVE (INSET B)

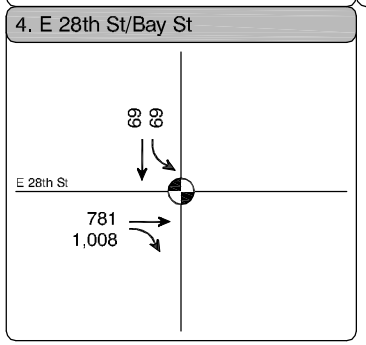
FIGURE 3-6

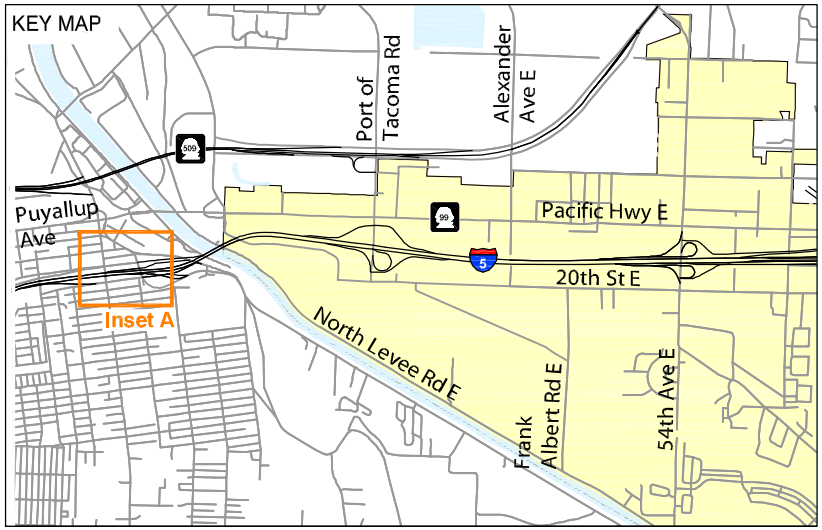












N

NOT TO SCALE

LEGEND

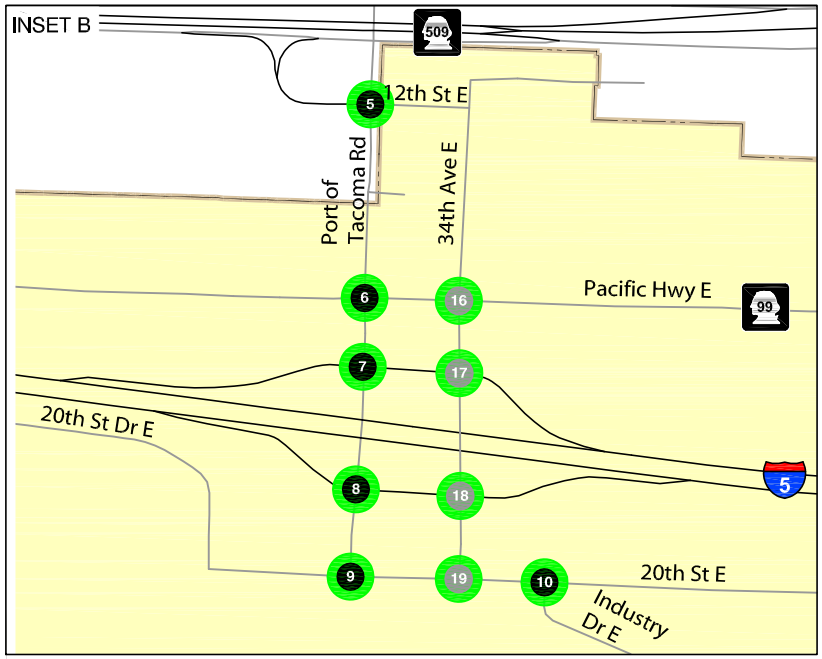
	Turn Lane		Study Intersection		Stop Sign
XX	Peak Hour Traffic Volume		Traffic Signal		City of Fife

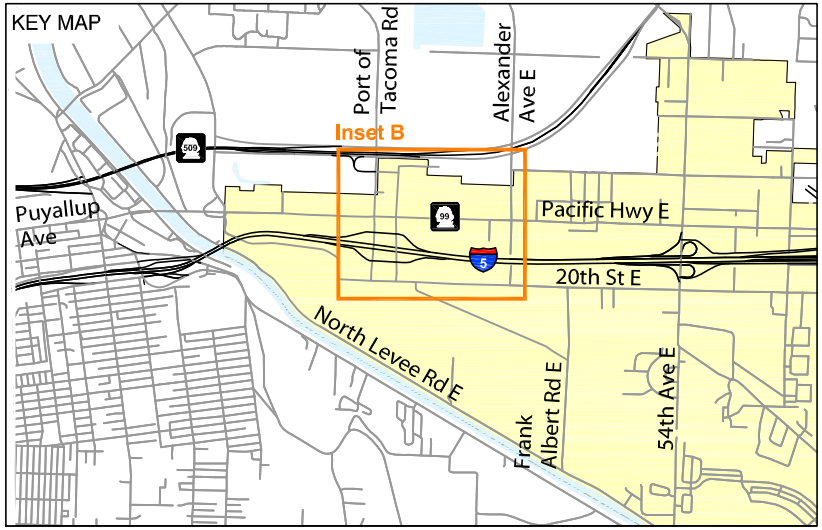
Level of Service

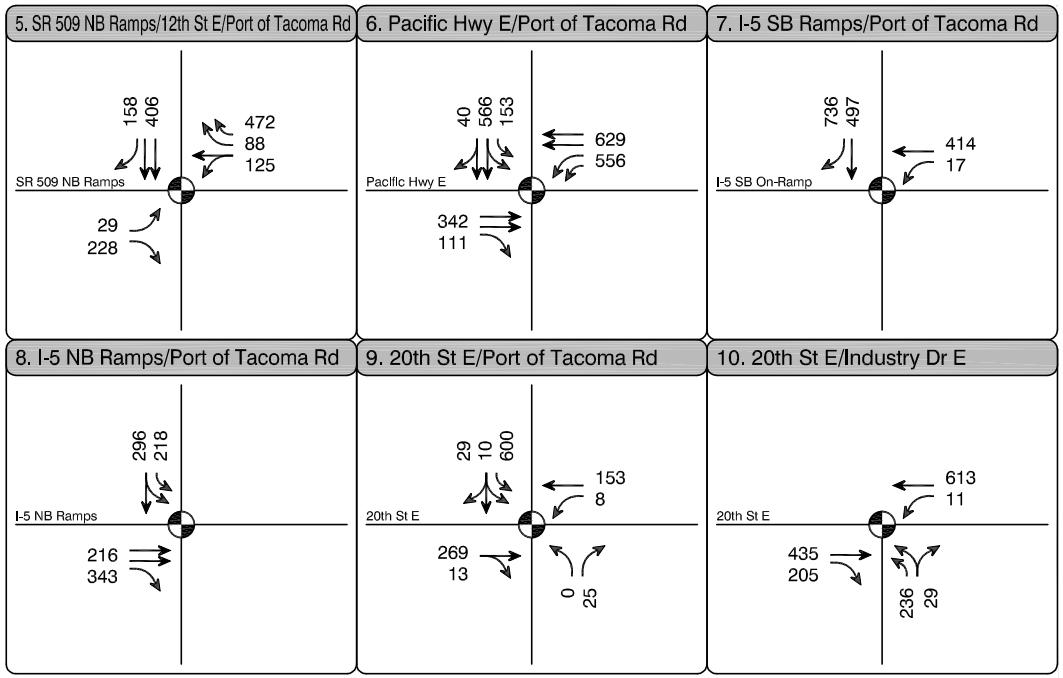
A - D	E	F

PM PEAK HOUR TRAFFIC VOLUMES AND LANE CONFIGURATIONS - 2020 PROPOSED ALTERNATIVE (INSET A)

FIGURE 3-7







N

NOT TO SCALE

LEGEND

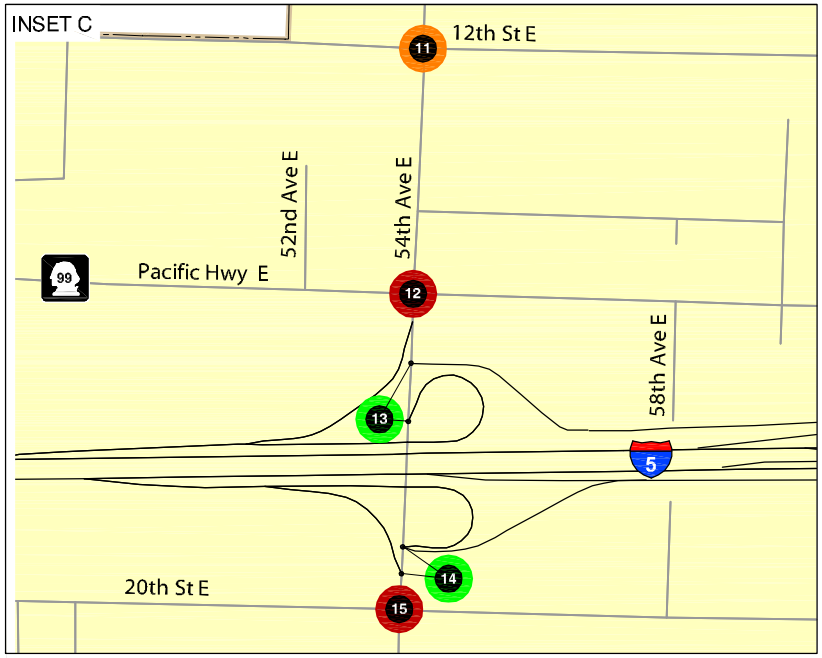
- Turn Lane
- XX Peak Hour Traffic Volume
- Study Intersection (Grey: See Figure 3-10)
- Traffic Signal
- Stop Sign
- City of Fife

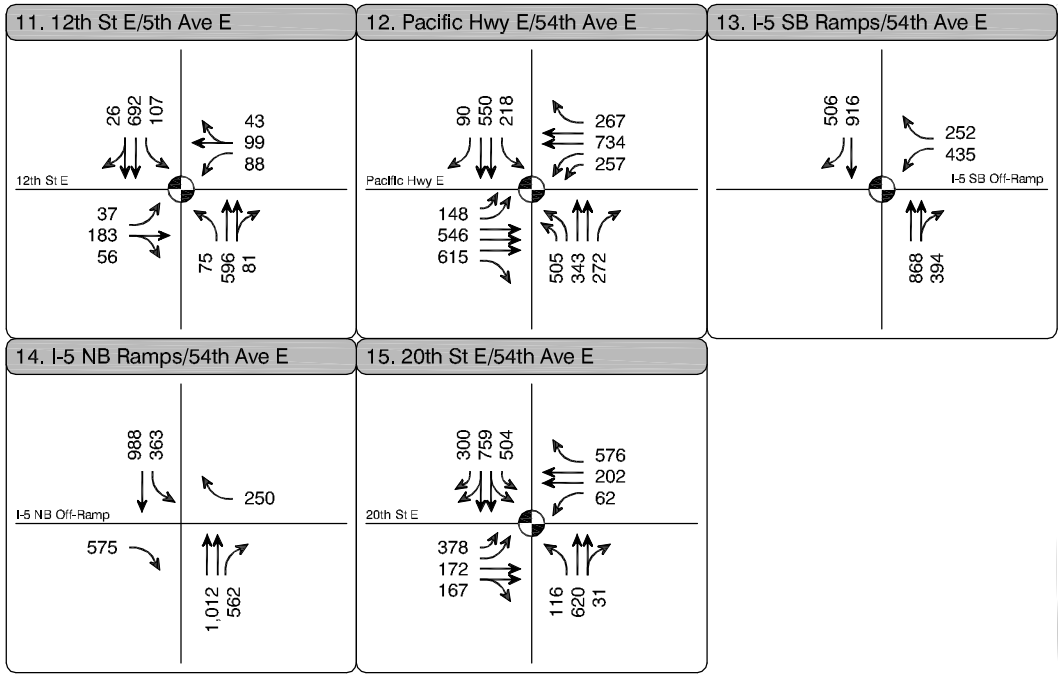
Level of Service

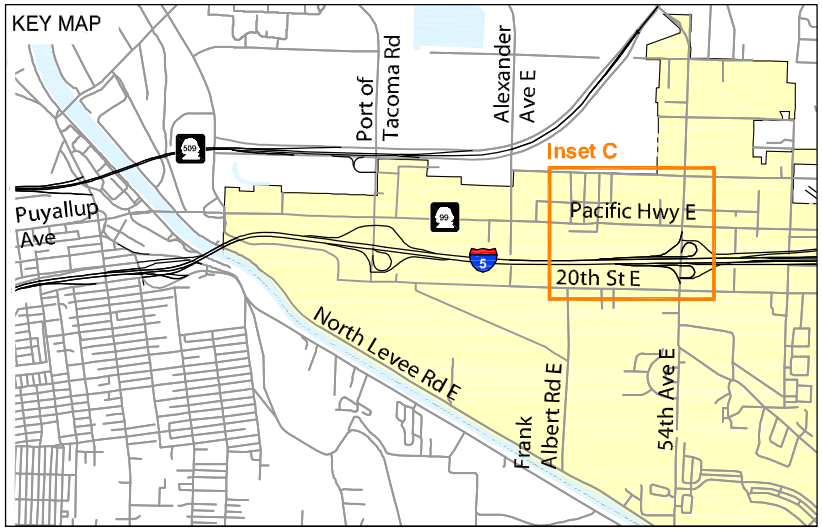
- A - D
- E
- F

PM PEAK HOUR TRAFFIC VOLUMES AND LANE CONFIGURATIONS - 2020 PROPOSED ALTERNATIVE (INSET B)

FIGURE 3-8







N

NOT TO SCALE

LEGEND

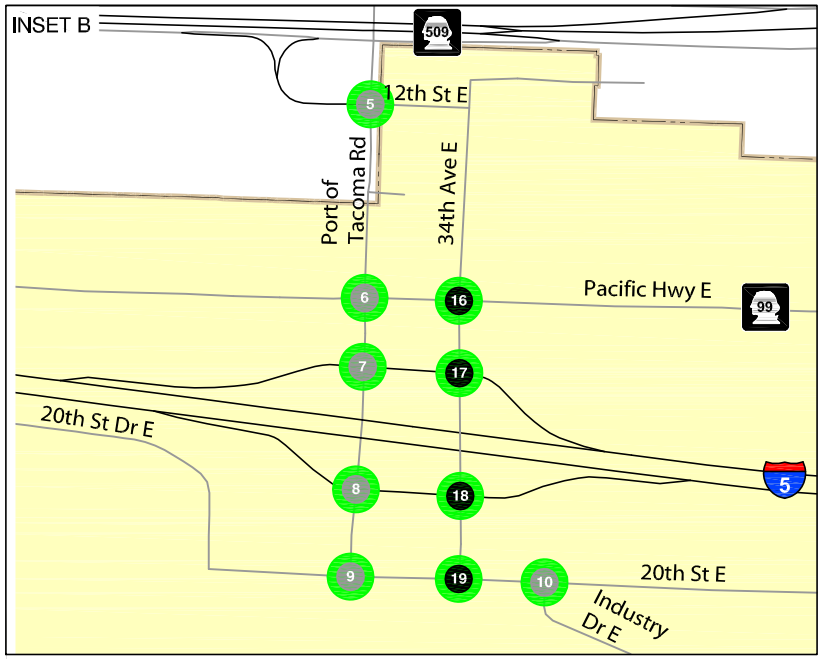
	Turn Lane		Study Intersection		Stop Sign
XX	Peak Hour Traffic Volume		Traffic Signal		City of Fife

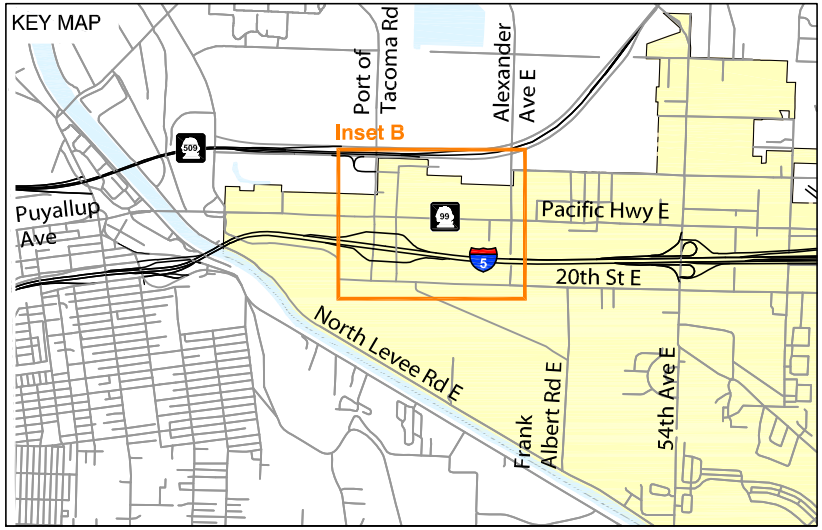
Level of Service

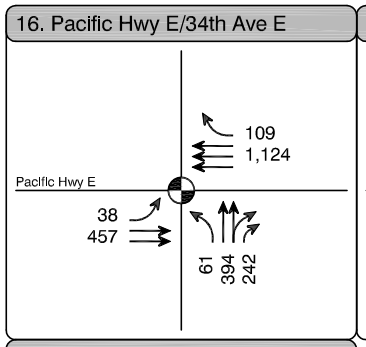
	A - D		E		F

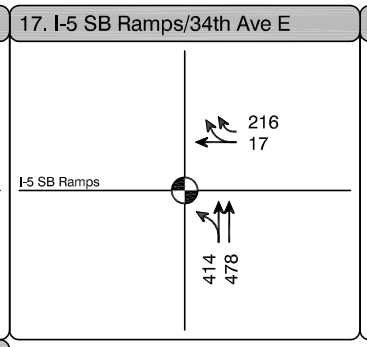
PM PEAK HOUR TRAFFIC VOLUMES AND LANE CONFIGURATIONS - 2020 PROPOSED ALTERNATIVE (INSET C)

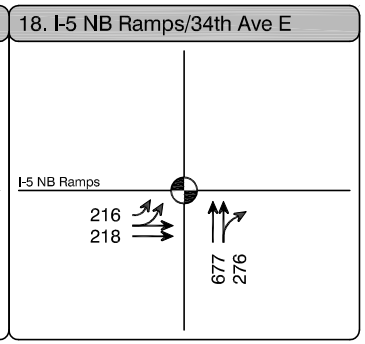
FIGURE 3-9

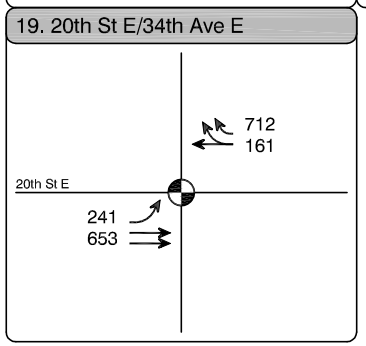












N

NOT TO SCALE

LEGEND

- Turn Lane
- XX Peak Hour Traffic Volume
- Study Intersection (Grey: See Figure 3-8)
- Traffic Signal
- Stop Sign
- City of Fife

Level of Service

- A - D
- E
- F

PM PEAK HOUR TRAFFIC VOLUMES AND LANE CONFIGURATIONS - 2020 PROPOSED ALTERNATIVE (INSET B)

FIGURE 3-10

3.4.1 Design Year (2040) Freeway Operations

The analysis evaluated freeway basic, merge, diverge, and weaving mainline segments for the Proposed Alternative in the design year. Table 3-3 summarizes the I-5 mainline operations for the 2040 Proposed Alternative. Figure 3-11 shows the results for 2040 conditions for freeway operations in the AM peak hour and Figure 3-12 shows the PM peak hour results.

In the 2040 design year, most of the I-5 segments in the northbound direction would operate at LOS E or F during the AM peak hour. Of the 26 freeway segments in the northbound direction, 17 would operate at LOS F and 5 would operate at LOS E during the AM peak hour under the 2040 Proposed Alternative. Of the 15 merge/diverge/weave segments in the northbound direction, all but 3 would operate at LOS E or LOS F.

During the PM peak hour, all but nine I-5 mainline segments would operate at LOS E or F. Six segments would operate at LOS F and 11 would operate at LOS E under the 2040 Proposed Alternative. A comparison to the 2040 No-Build analysis reveals only slight improvement with the Proposed Alternative. Because the objective of this project is improving the Port of Tacoma Road with I-5 interchange, it is not surprising that freeway mainline operations are not expected to improve with the project.

In the southbound direction, four basic segments and five merge/diverge/weave segments would operate at LOS E during the AM peak hour for the 2040 Proposed Alternative. None of the southbound freeway segments would operate at LOS F—a significant improvement compared to the No-Build conditions, in which 18 segments operate at LOS E or F. During the PM peak hour, seven basic segments and seven merge/diverge/weave segments would operate at LOS E or F with the 2040 Proposed Alternative, compared to the improvement of only one segment from LOS E to LOS D with the 2040 No-Build alternative.

3.4.2 Design Year (2040) Intersection Operations

The intersection analysis for the design year was based on the HCM2000 methods for unsignalized and signalized intersections. Using the forecasted volumes for 2040, the analysis evaluated the study area intersections to calculate the performance of intersection operations during the AM and PM peak hours. The analysis includes four additional intersections along the 34th Avenue East corridor formed by the Proposed Alternative.

The Proposed Alternative changes the operation of intersections on Port of Tacoma Road, creating a one-way couplet with southbound traffic traveling on Port of Tacoma Road and northbound traffic on 34th Avenue East. The Proposed Alternative includes the planned improvements to the transportation system identified in Table 1-1.

The travel forecasting model was run to estimate the 2040 traffic volumes associated with the Proposed Alternative. Figures 3-13 through 3-20 present the AM and PM peak hour volumes by movement for each intersection.

Table 3-3. 2040 Proposed Alternative I-5 Mainline Freeway Operations

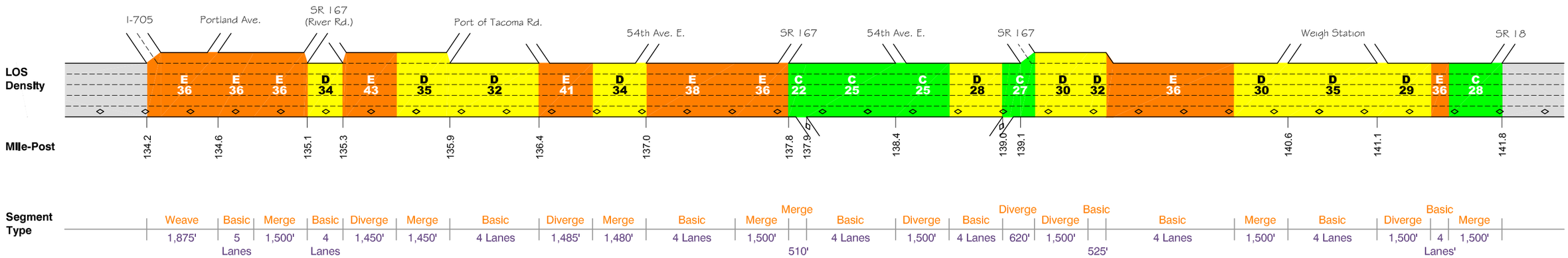
	Type	AM Peak Hour		PM Peak Hour	
		LOS	Density	LOS	Density
I-5 Northbound					
I-5 NB on-ramp from I-705	Merge	D	33	D	34
I-5 NB off-ramp to E 28th Street/Portland Ave	Diverge	E	**38**	E	**36**
I-5 NB off-ramp to E Bay Street	Diverge	E	**41**	E	**37**
I-5 NB between E Bay Street off/on-ramps	Basic	E	**42**	E	**35**
I-5 NB on-ramp from E 28th Street	Merge	E	**41**	D	30
I-5 NB between E 28th Street. On-ramp and POT Rd off-ramp	Basic	F	**45**	D	31
I-5 NB off-ramp to POT Rd/34th Ave	Diverge	F	**48**	D	35
I-5 NB between POT Rd NB off/on-ramps	Basic	F	**50**	E	**36**
I-5 NB on-ramp from POT Rd/34th Ave	Merge	F	**68**	E	**39**
I-5 NB between POT Rd and 54th Ave E	Basic	F	**58**	E	**41**
I-5 NB off-ramp to 54th Ave E	Diverge	F	**57**	F	**51**
I-5 NB off-ramp to SR 167	Diverge	D	32	E	**37**
I-5 NB off-ramp to SR 167 HOV	Diverge	C	23	C	23
I-5 NB between SR 167 HOV and 54th Ave E on-ramps	Basic	D	31	D	27
I-5 NB on-ramp from 54th Ave E	Merge	F	**46**	D	34
I-5 NB between 54th Ave E and SR 167 HOV	Basic	F	**56**	E	**40**
I-5 NB on-ramp from SR 167 HOV	Merge	F	**58**	D	32
I-5 NB between SR 167 HOV and SR 167	Basic	F	**61**	F	**46**
I-5 NB on-ramp from SR 167	Merge	F	**56**	D	34
I-5 NB between SR 167 and lane section ends	Basic	F	**78**	E	**40**
I-5 NB between SR 167 and truck scales off-ramp	Basic	F	**72**	F	**46**
I-5 NB off-ramp to truck scales	Diverge	F	**73**	F	**44**
I-5 NB between truck scales off/on-ramps	Basic	F	**54**	F	**48**
I-5 NB on-ramp from truck scales	Merge	F	**55**	F	**51**
I-5 NB between truck scales and SR 18	Basic	F	**50**	E	**44**
I-5 NB off-ramp to SR 18	Diverge	E	**40**	E	**38**
Notes: Average volumes based on 13 VISSIM runs. **Bold** indicates unacceptable operation. 1. Modeled traffic volume expressed as a percent of observed traffic volume. For example: 100% indicates an exact replication of field Source: Fehr & Peers, 2010.					
I-5 Southbound					
I-5 SB on-ramp from SR 18	Merge	C	28	F	**70**
I-5 SB between SR 18 and truck scales	Basic	E	**36**	F	**85**
I-5 SB off-ramp to truck scales	Diverge	D	29	F	**87**
I-5 SB between truck scales off/on-ramps	Basic	D	35	F	**87**
I-5 SB on-ramp from truck scales	Merge	D	30	F	**96**

Table 3-3. 2040 Proposed Alternative I-5 Mainline Freeway Operations

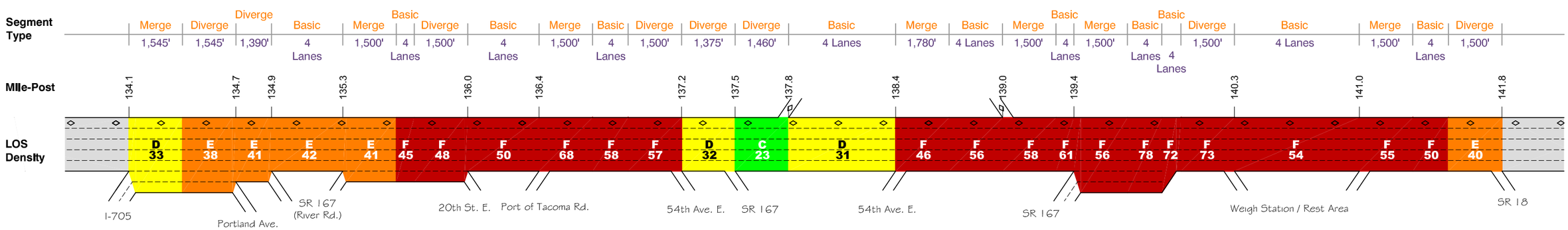
	Type	AM Peak Hour		PM Peak Hour	
		LOS	Density	LOS	Density
I-5 SB between truck scales and SR 167	Basic	**E**	**36**	**F**	**75**
I-5 SB between truck scales and SR 167	Basic	D	32	D	34
I-5 SB off-ramp to SR 167	Diverge	D	30	D	29
I-5 SB off-ramp to SR 167 HOV	Diverge	C	27	D	30
I-5 SB between SR 167 HOV end and 54th Ave E	Basic	D	28	D	28
I-5 SB off-ramp to 54th Ave E	Diverge	C	25	B	19
I-5 SB between 54th Ave E and SR 167 HOV	Basic	C	25	D	26
I-5 SB on-ramp from SR 167 HOV	Merge	C	22	C	24
I-5 SB on-ramp from SR 167	Merge	**E**	**36**	C	26
I-5 SB between SR 167 and 54th Ave E	Basic	**E**	**38**	**E**	**37**
I-5 SB on-ramp from 54th Ave E	Merge	D	34	D	34
I-5 SB off-ramp to POT Rd/34th Ave	Diverge	**E**	**41**	E	36
I-5 SB between POT Rd off/on-ramps	Basic	D	32	**E**	**36**
I-5 SB on-ramp from POT Rd/34th Ave	Merge	D	35	**E**	**40**
I-5 SB off-ramp to Bay Street	Diverge	**E**	**43**	**F**	**43**
I-5 SB between Bay Street on/off ramps	Basic	D	34	**E**	**39**
I-5 SB on-ramp from Bay Street	Merge	**E**	**36**	D	34
I-5 SB between Bay Street and E 27th Street/Portland Ave	Basic	**E**	**36**	**E**	**35**
I-5 SB weave between E 27th Street/Portland Ave and I-705	Weave	**E**	**36**	**E**	**37**

Notes: Average volumes based on 13 VISSIM runs.
Bold indicates unacceptable operation.
Source: Fehr & Peers, 2010.

Interstate 5: State Route 18 to Interstate 705 (Southbound)



Interstate 5: Interstate 705 to State Route 18 (Northbound)



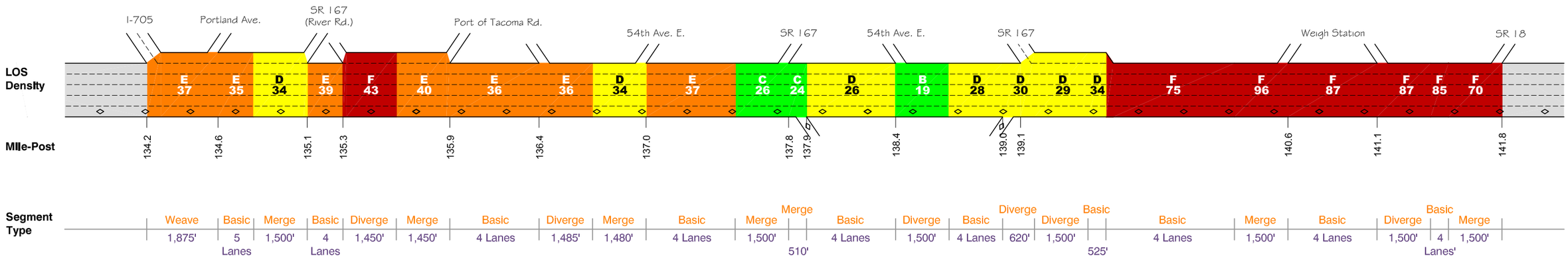
LEGEND

		Level of Service
6.0	Mile-Post	A - C
◊	HOV Bypass Lane	D
D — 32.8	Level of Service — Density (Vehicles / Lane Mile)	E
		F

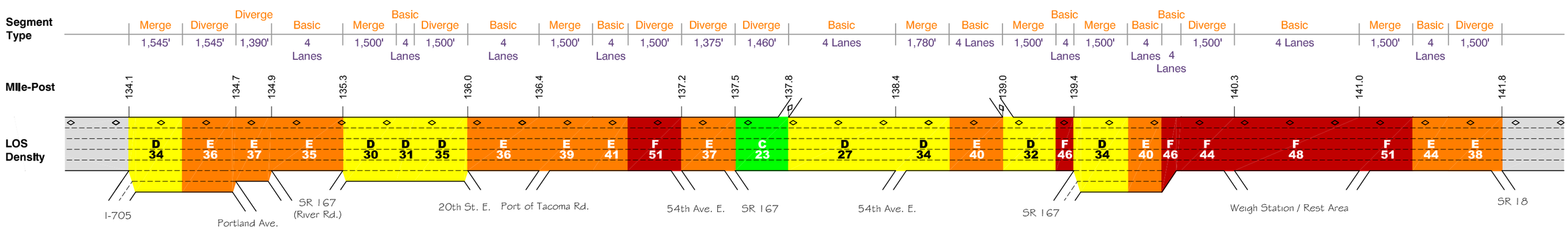
AM PEAK HOUR LANE CONFIGURATIONS AND LEVEL OF SERVICE - 2040 ALTERNATIVE 6

FIGURE 3-11

Interstate 5: State Route 18 to Interstate 705 (Southbound)



Interstate 5: Interstate 705 to State Route 18 (Northbound)

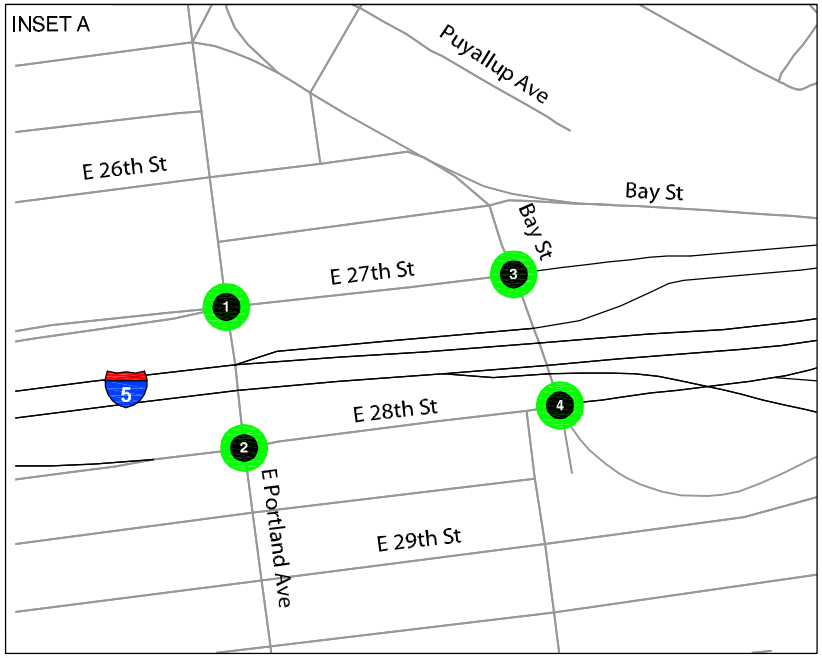


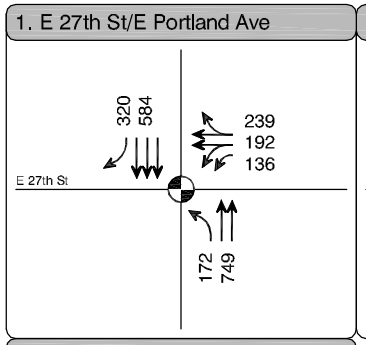
LEGEND

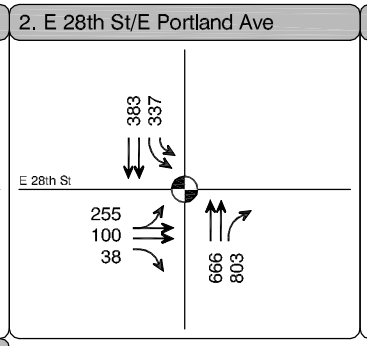
		Level of Service
6.0	Mile-Post	A - C
◊	HOV Bypass Lane	D
D — 32.8	Level of Service / Density (Vehicles / Lane Mile)	E
		F

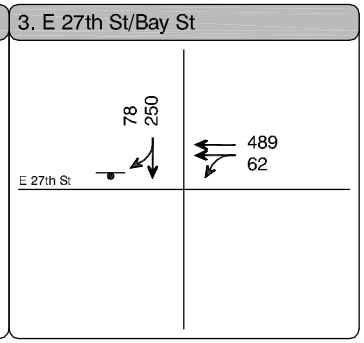
PM PEAK HOUR LANE CONFIGURATIONS AND LEVEL OF SERVICE - 2040 ALTERNATIVE 6

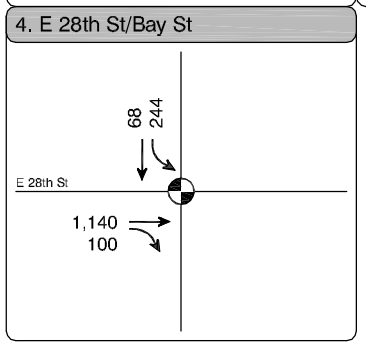
FIGURE 3-12

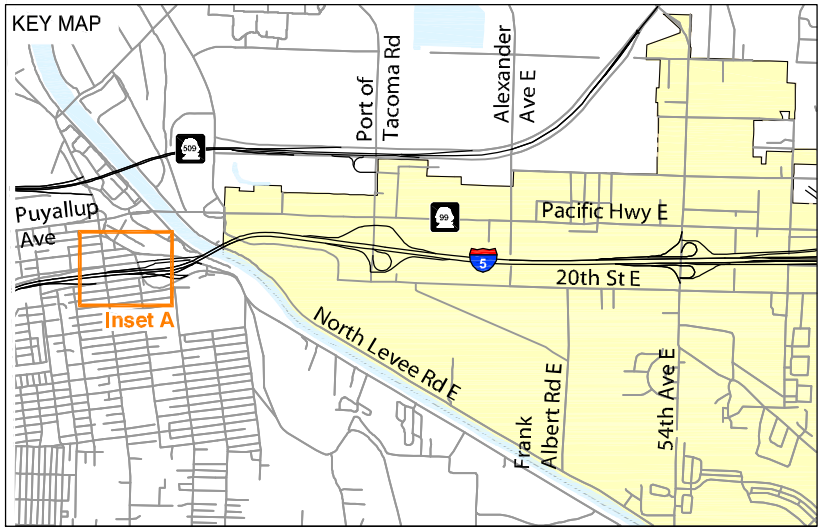












N

NOT TO SCALE

LEGEND

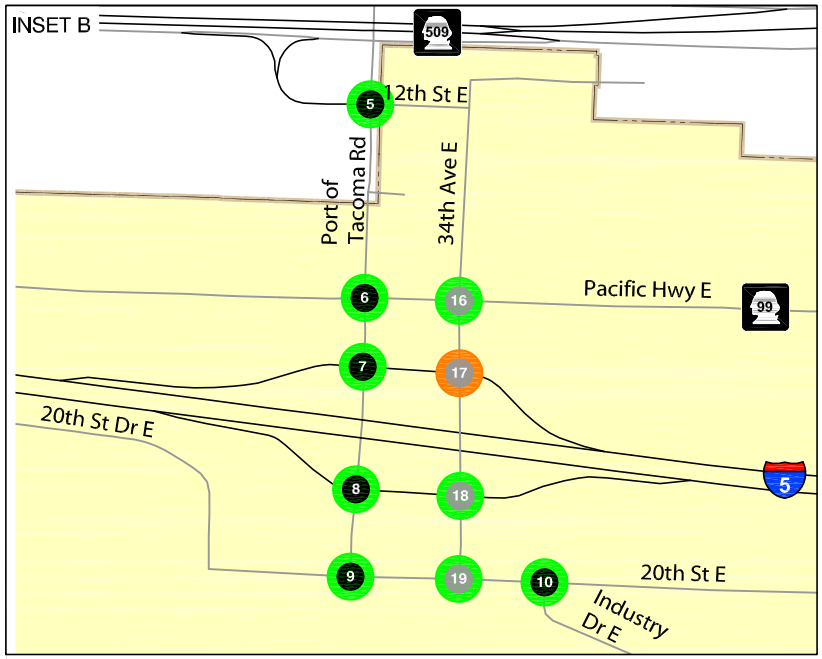
	Turn Lane		Study Intersection		Stop Sign
XX	Peak Hour Traffic Volume		Traffic Signal		City of Fife

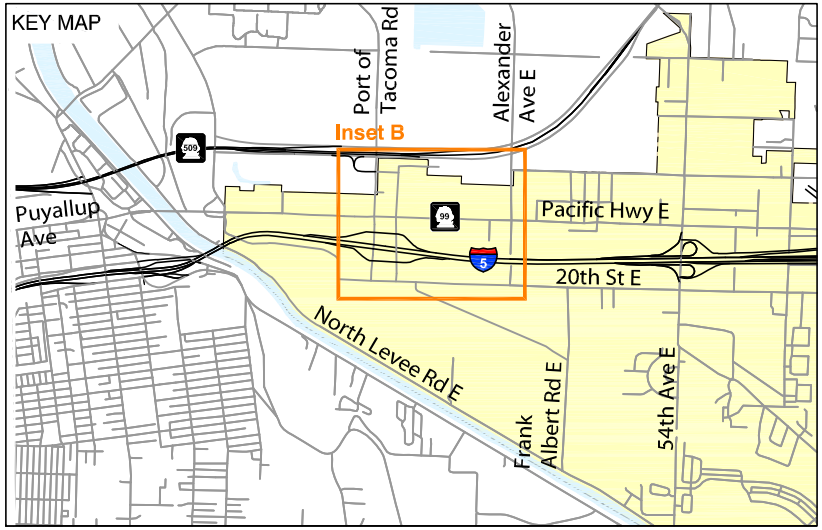
Level of Service

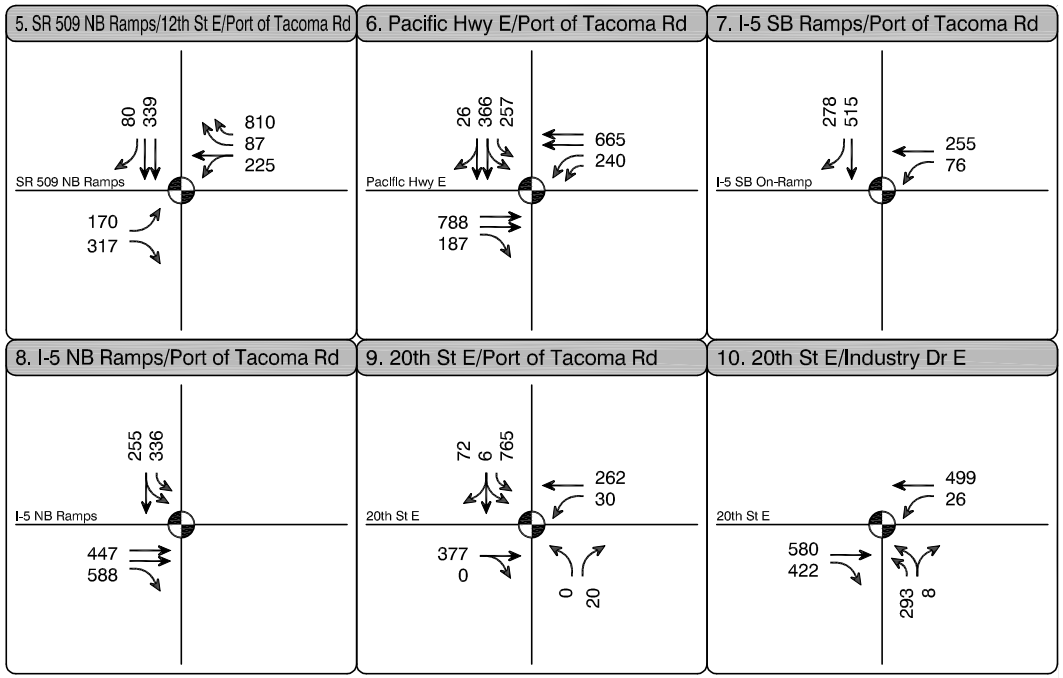
	A - D		E		F

AM PEAK HOUR TRAFFIC VOLUMES AND LANE CONFIGURATIONS - 2040 PROPOSED ALTERNATIVE (INSET A)

FIGURE 3-13







N

NOT TO SCALE

LEGEND

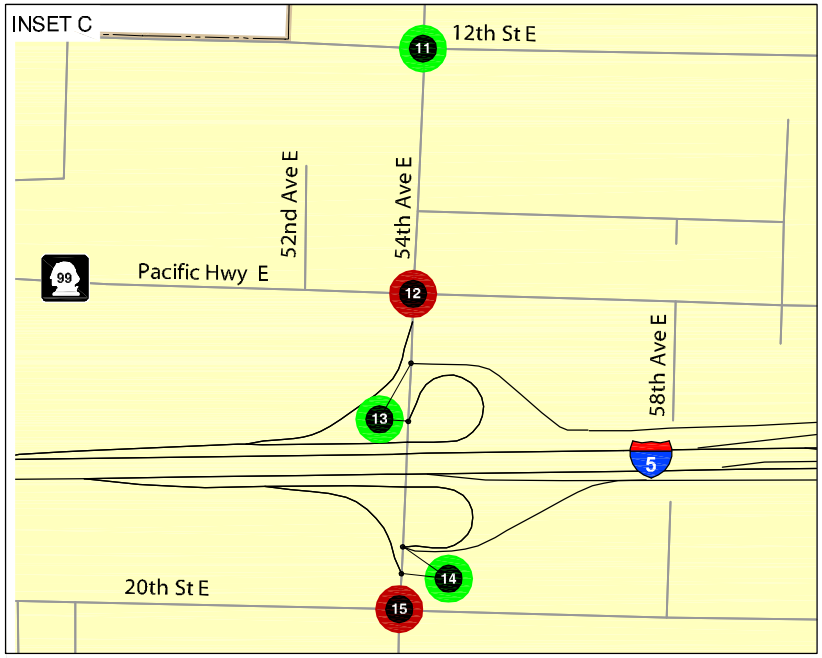
- Turn Lane
- XX Peak Hour Traffic Volume
- Study Intersection (Grey: See Figure 3-16)
- Traffic Signal
- Stop Sign
- City of Fife

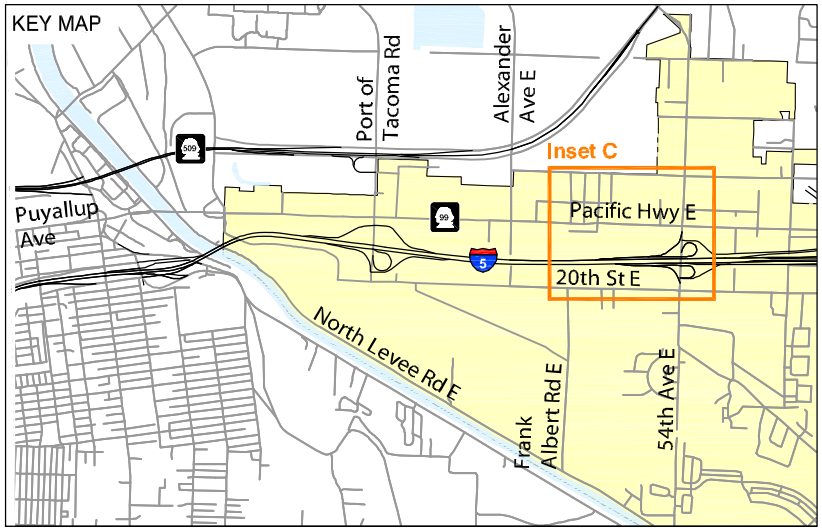
Level of Service

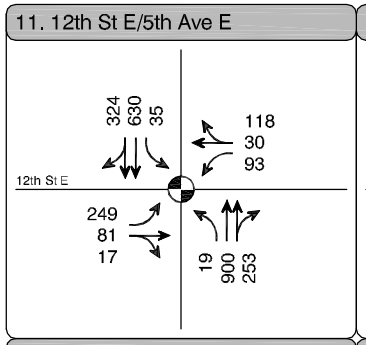
- A - D
- E
- F

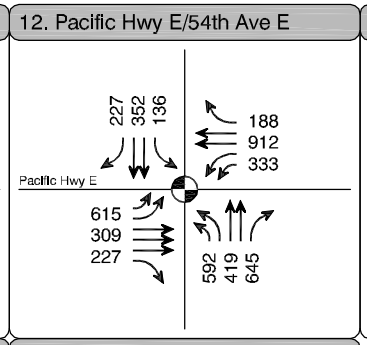
AM PEAK HOUR TRAFFIC VOLUMES AND LANE CONFIGURATIONS - 2040 PROPOSED ALTERNATIVE (INSET B)

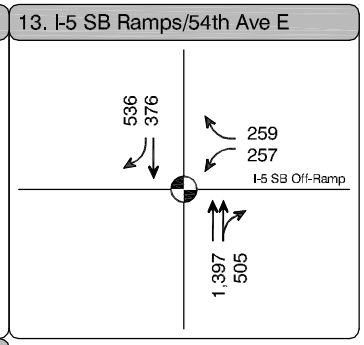
FIGURE 3-14

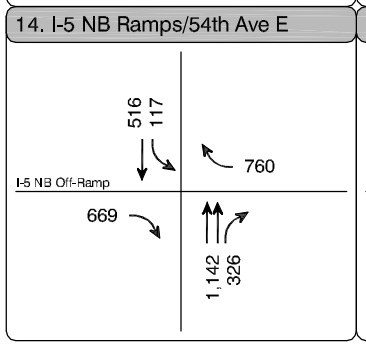


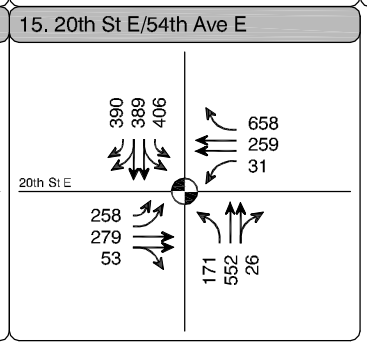












N

NOT TO SCALE

LEGEND

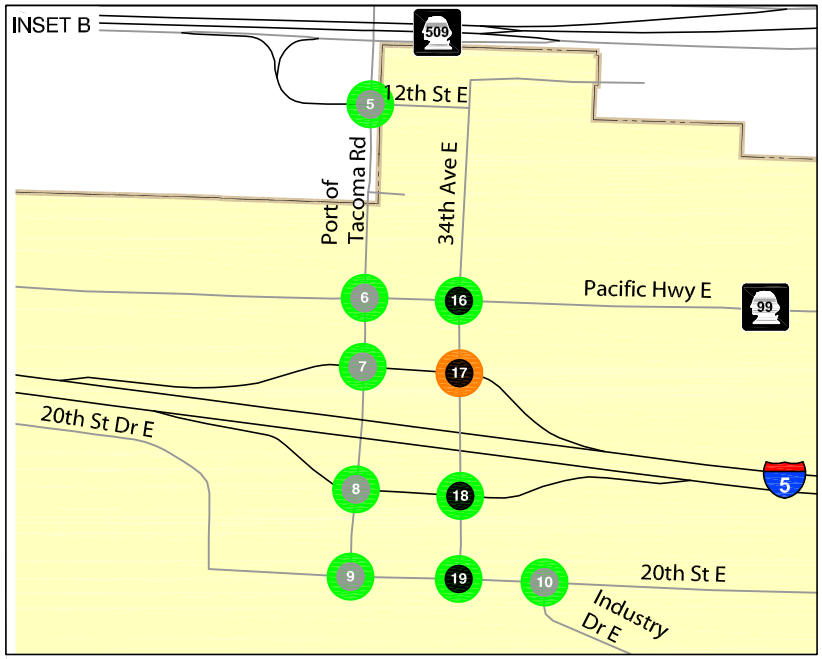
- Turn Lane
- XX Peak Hour Traffic Volume
- Study Intersection
- Traffic Signal
- Stop Sign
- City of Fife

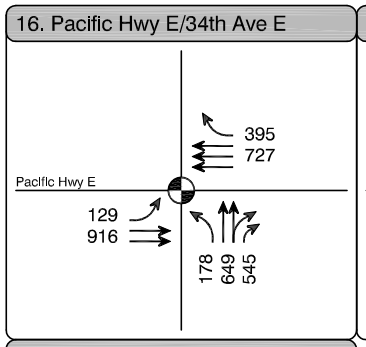
Level of Service

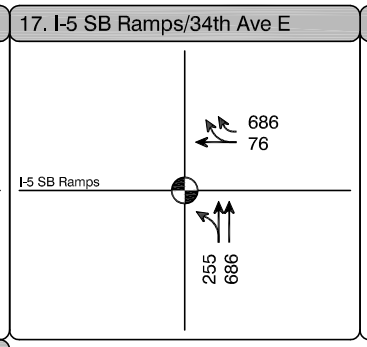
- A - D
- E
- F

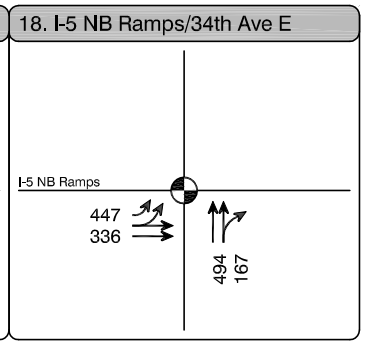
AM PEAK HOUR TRAFFIC VOLUMES AND LANE CONFIGURATIONS - 2040 PROPOSED ALTERNATIVE (INSET C)

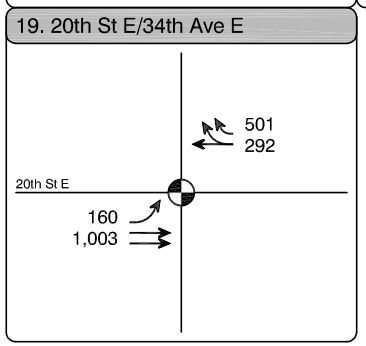
FIGURE 3-15

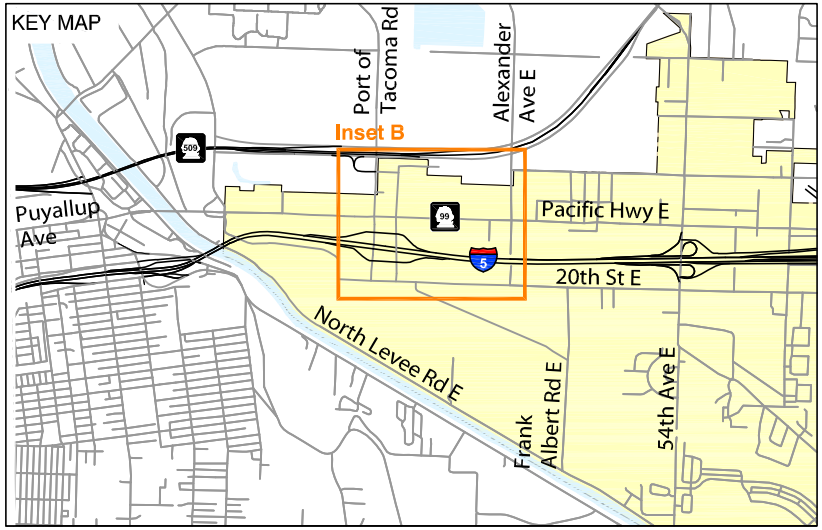












N

NOT TO SCALE

LEGEND

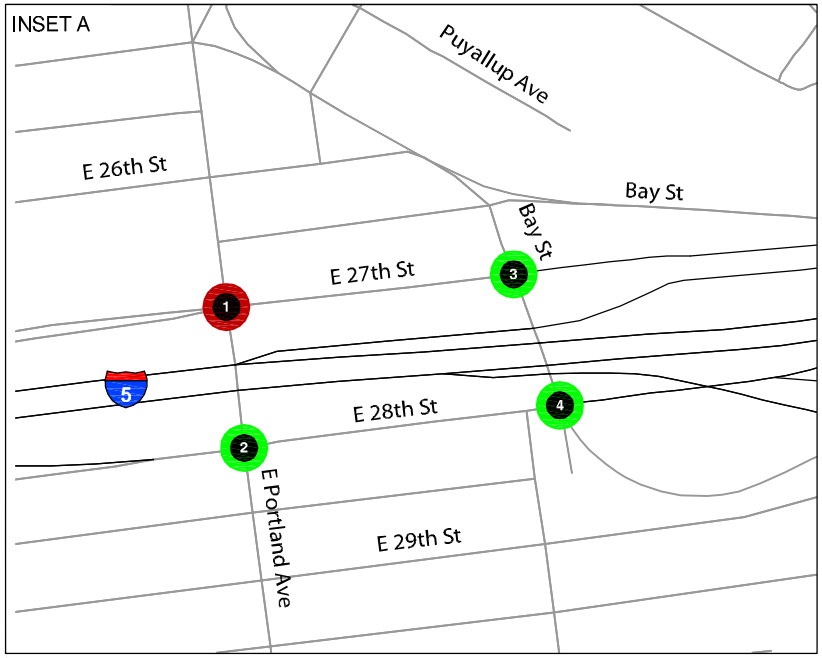
- Turn Lane
- XX Peak Hour Traffic Volume
- Study Intersection (Grey: See Figure 3-14)
- Traffic Signal
- Stop Sign
- City of Fife

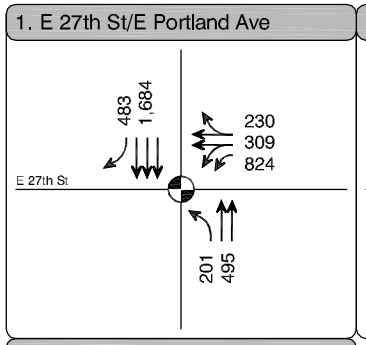
Level of Service

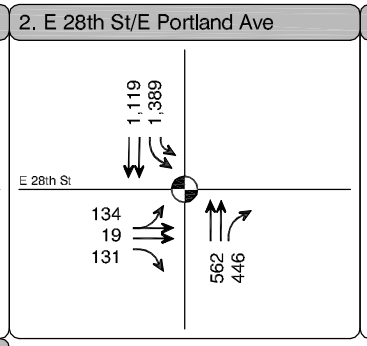
- A - D
- E
- F

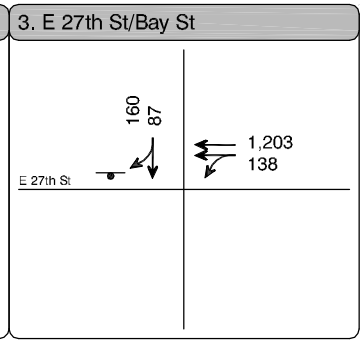
AM PEAK HOUR TRAFFIC VOLUMES AND LANE CONFIGURATIONS - 2040 PROPOSED ALTERNATIVE (INSET B)

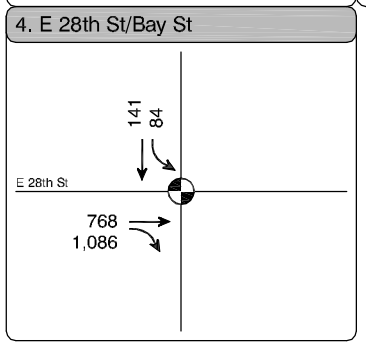
FIGURE 3-16

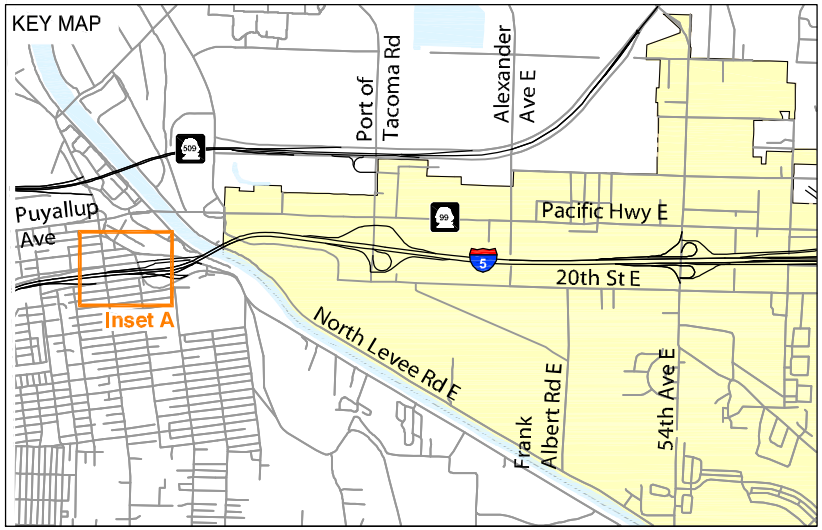












N

NOT TO SCALE

LEGEND

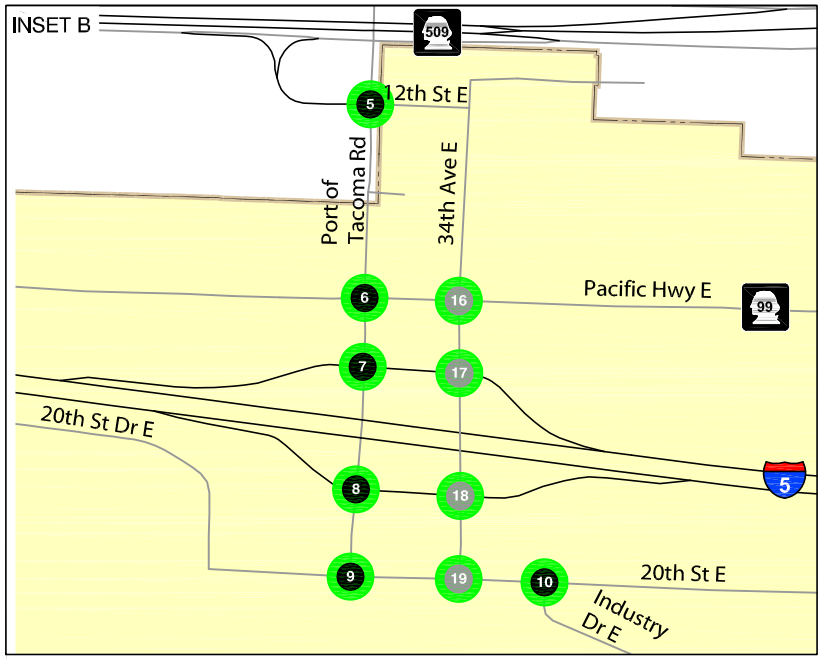
	Turn Lane	1	Study Intersection		Stop Sign
XX	Peak Hour Traffic Volume		Traffic Signal		City of Fife

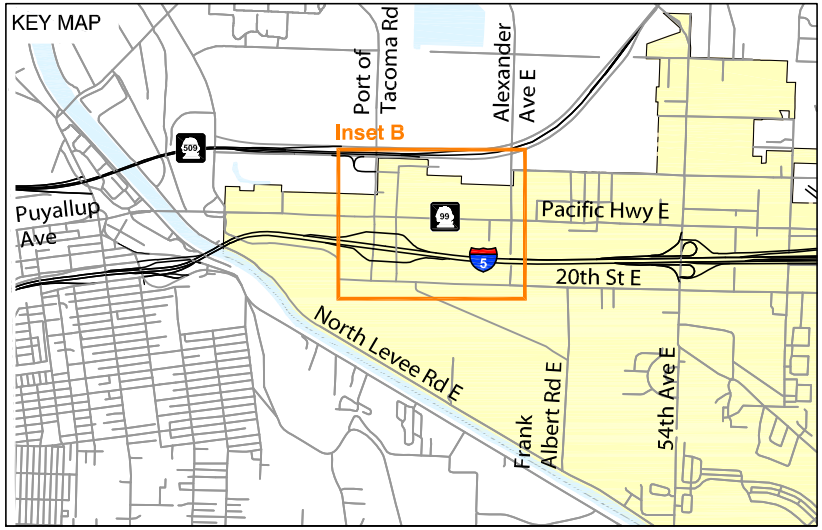
Level of Service

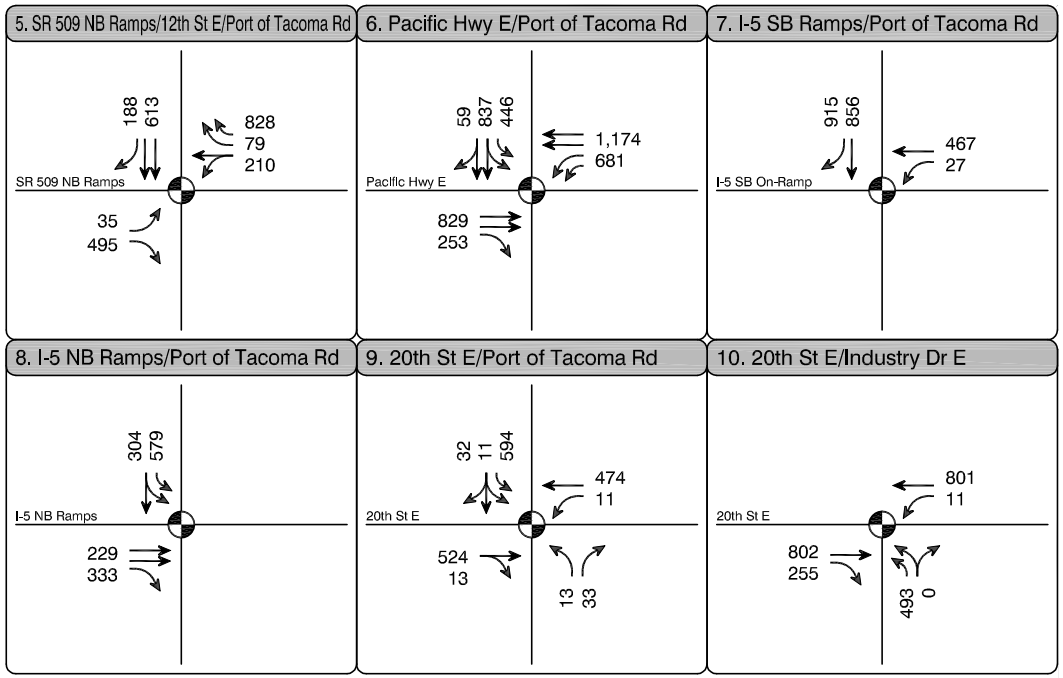
A - D	E	F

PM PEAK HOUR TRAFFIC VOLUMES AND LANE CONFIGURATIONS - 2040 PROPOSED ALTERNATIVE (INSET A)

FIGURE 3-17







N

NOT TO SCALE

LEGEND

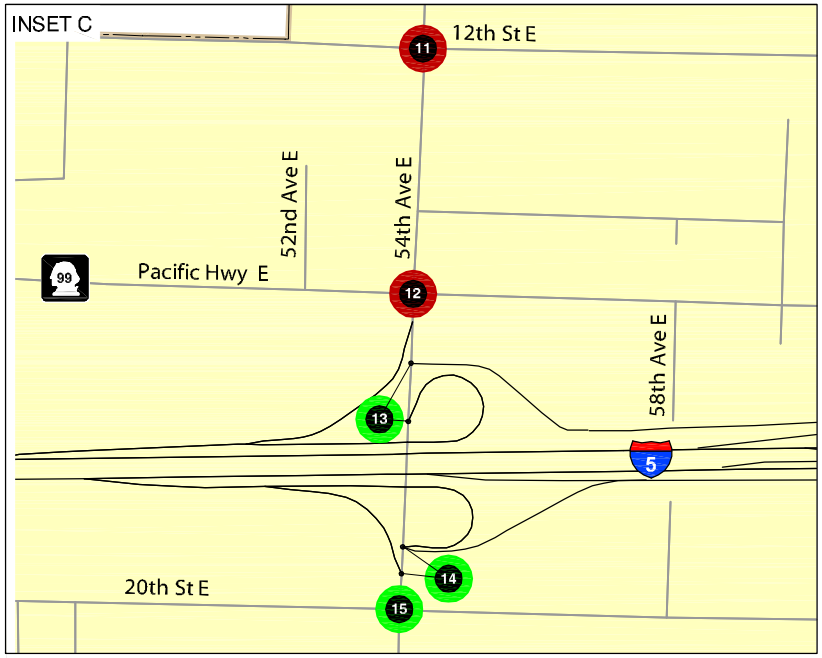
- Turn Lane
- XX Peak Hour Traffic Volume
- Study Intersection (Grey: See Figure 3-20)
- Traffic Signal
- Stop Sign
- City of Fife

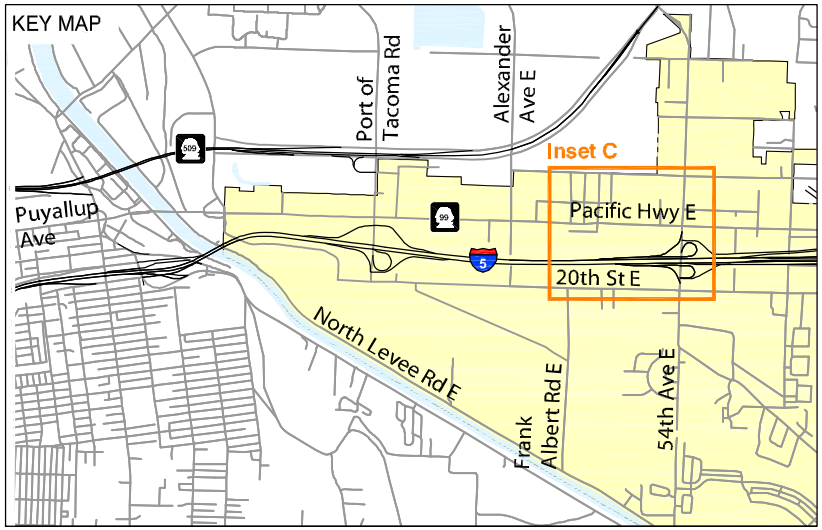
Level of Service

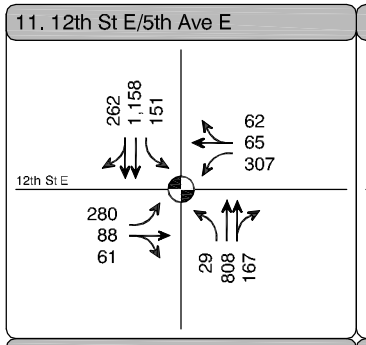
- A - D
- E
- F

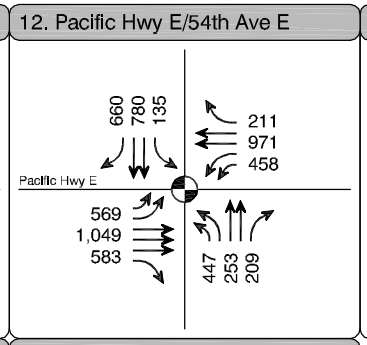
PM PEAK HOUR TRAFFIC VOLUMES AND LANE CONFIGURATIONS - 2040 PROPOSED ALTERNATIVE (INSET B)

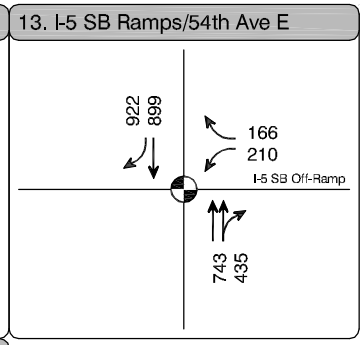
FIGURE 3-18

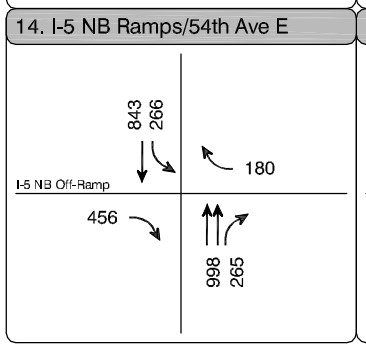


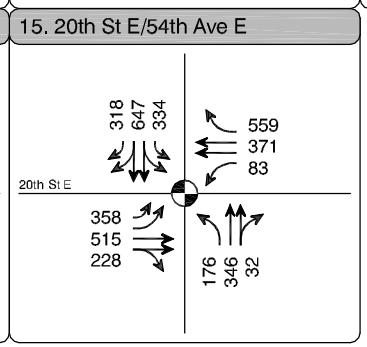












N

NOT TO SCALE

LEGEND

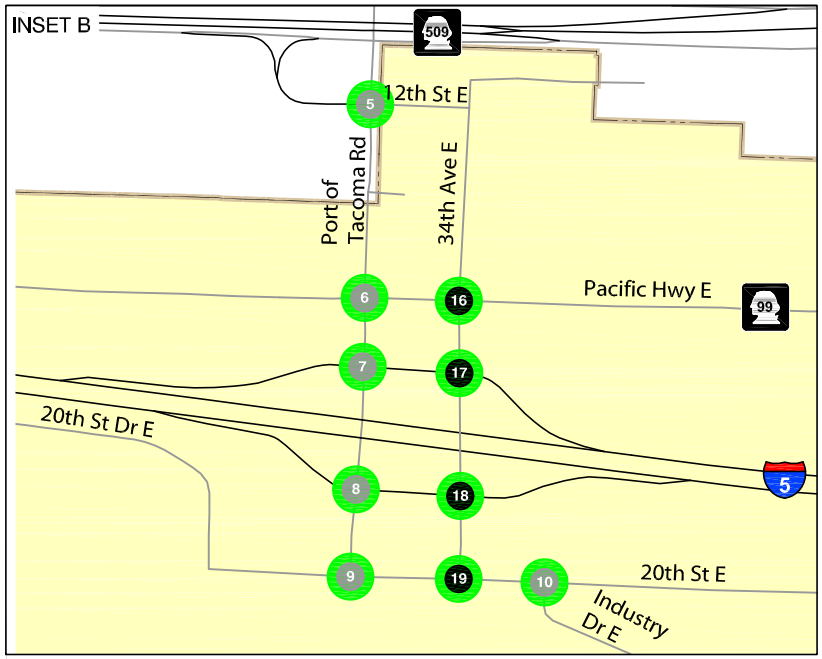
	Turn Lane		Study Intersection		Stop Sign
XX	Peak Hour Traffic Volume		Traffic Signal		City of Fife

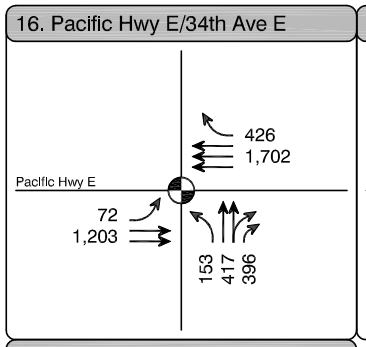
Level of Service

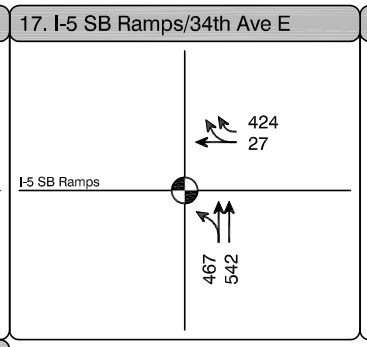
	A - D		E		F

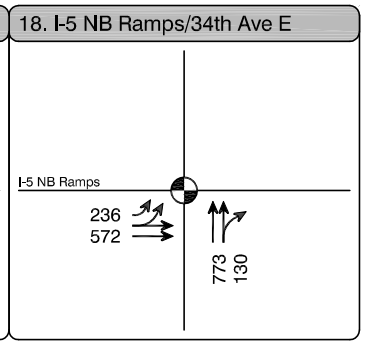
PM PEAK HOUR TRAFFIC VOLUMES AND LANE CONFIGURATIONS - 2040 PROPOSED ALTERNATIVE (INSET C)

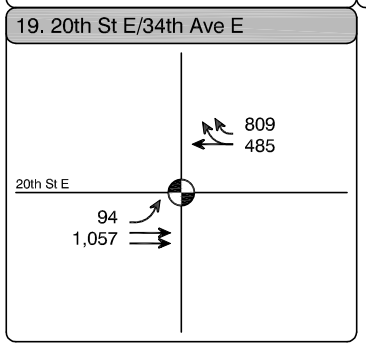
FIGURE 3-19

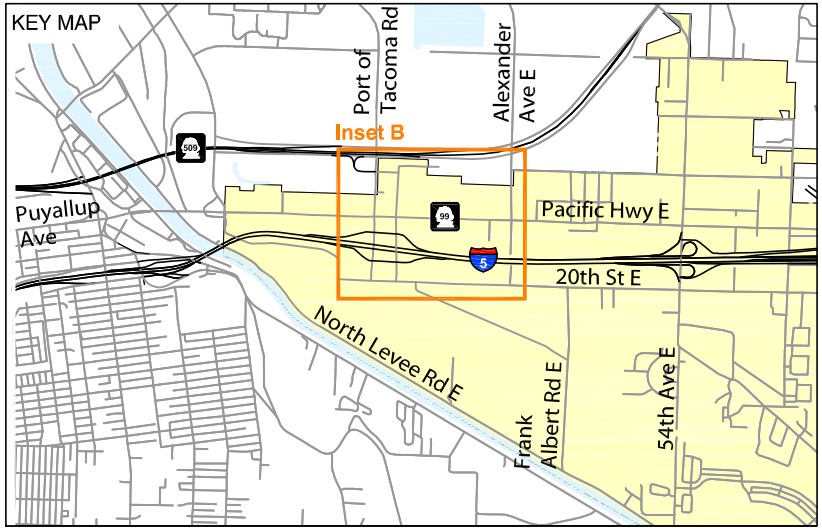












N

NOT TO SCALE

LEGEND

- Turn Lane
- XX Peak Hour Traffic Volume
- Study Intersection (Grey: See Figure 3-18)
- Traffic Signal
- Stop Sign
- City of Fife

Level of Service

- A - D
- E
- F

PM PEAK HOUR TRAFFIC VOLUMES AND LANE CONFIGURATIONS - 2040 PROPOSED ALTERNATIVE (INSET B)

FIGURE 3-20

As compared to the No-Build Alternative, the Proposed Alternative, by creating a north-south couplet with 34th Avenue East, would improve peak hour LOS operations at all Port of Tacoma Road intersections by simplifying signal phasing and increasing directional capacity. For example, the intersection of Port of Tacoma Road/Pacific Highway East would change from an eight-phase to a four-phase signal under the Proposed Alternative. Table 3-4 summarizes the intersection control delay and LOS conditions for the AM and PM peak hours for the 2040 Proposed Alternative. The LOS is reported by individual approach and for the overall intersection.

During the AM peak hour, the Proposed Alternative would improve the operation of the Port of Tacoma Road interchange. Only the 34th Avenue East/I-5 southbound ramps intersection would operate at LOS E during the AM peak hour, with all other interchange intersections operating at LOS D or better. The intersections of 54th Avenue East/Pacific Highway East and 54th Avenue East/20th Street East would operate at LOS F due to westbound congestion related to morning commute patterns and traffic volumes. All other study area intersections would operate overall at LOS D or better during the AM peak hour.

During the PM peak hour, the Proposed Alternative would improve operations by simplifying signal phasing and increasing directional capacity at Port of Tacoma Road intersections. For example, the intersection of Port of Tacoma Road/Pacific Highway East would change from an eight-phase to a four-phase signal, improving from LOS F under the 2040 No-Build Alternative to LOS D with the Proposed Alternative. The Portland Avenue and 54th Avenue East interchanges would continue to have intersections that operate at LOS F during the 2040 PM peak hour. The signal at East Portland Avenue/East 27th Street would operate at LOS F overall with failing approaches for the eastbound and southbound movements. Two intersections on 54th Avenue East, at Pacific Highway East and at 12th Street East, would operate at LOS F with long delays during the evening commute. All other intersections would operate with the Proposed Alternative at LOS D or better overall during the PM peak hour.

3.4.3 Design Year (2040) Safety

The standard methodology for forecasting future crashes is to find an interchange location with a similar geometry and apply that crash rate to the forecasted volume. The Proposed Alternative is somewhat unusual, with its configuration of two intersecting one-way couplets forming the interchange, and a suitable comparison could not be found within the state.

The Proposed Alternative would create four intersections made up of two one-way approaches. Each intersection would have simple geometry and phasing, with only five conflict points and two signal phases per intersection. In comparison, the No-Build Alternative has 11 conflict points and five signal phases for the southbound ramps intersection and six conflict points for the northbound ramps. Generally, an intersection with fewer conflict points and simpler signal phasing will have fewer crashes, and the Proposed Alternative would be expected to have a lower crash rate overall than the No-Build Alternative.

Table 3-4. Intersection Levels of Service - 2040 Peak Hour Conditions – Proposed Alternative

Intersection		Traffic Control	AM Peak Hour					PM Peak Hour				
			NB	SB	EB	WB	Total	NB	SB	EB	WB	Total
1	E. Portland Ave/E. 27th St	Signal	C/22	B/14		**E/56**	C/27	C/25	**F/137**		**E/65**	**F/95**
2	E. Portland Ave/E. 28th St	Signal	C/20	B/18	D/42		C/24	C/23	B/13	C/31		B/17
3	E. Bay St/E. 27th St	SSSC		B/13		A/2	A/7		A/9		A/3	A/5
4	E. Bay St/E. 28th St	Signal		B/17	A/8		A/10		C/29	B/15		B/17
5	POT Rd/I-509 EB Ramps	Signal		B/15	C/25	C/25	C/23		C/26	D/38	C/31	C/31
6	POT Rd/Pacific Hwy	Signal		C/34	C/26	B/10	C/24		**F/82**	C/30	B/17	D/42
7	POT Rd/I-5 SB Ramps	Signal		A/2		D/48	B/16		A/6		D/46	B/15
8	POT Rd/I-5 NB Ramps	Signal		B/15	**E/61**		D/48		A/8	C/27		B/16
9	POT Rd/20th St E	Signal	A/9	B/12	D/40	C/33	C/23	C/32	B/12	D/36	C/31	C/26
10	Industry Dr. E/20th St E	Signal	D/41		A/6	A/7	B/14	D/41		A/7	B/14	B/16
17	54th Ave E/12th St E	Signal	B/16	D/42	**F/116**	D/45	D/42	B/15	**F/196**	**F/>200**	**F/133**	**F/191**
18	54th Ave E/Pacific Hwy	Signal	**F* /**	**E/64**	D/39	**F/>200**	**F/122**	D/35	**F/88**	**F/81**	**F/>200**	**F/108**
19	54th Ave E/I-5 SB Ramps	Signal	D/51	B/17		C/31	D/38	A/9	A/3		D/41	A/9
20	54th Ave E/I-5 NB Ramps	None	C/26	**F/90**	B/15		D/38	A/1	C/15	C/20		A/9
21	54th Ave E/20th St E	Signal	**F/>200**	B/14	**E/64**	**F/>200**	**F/151**	D/53	C/21	D/53	C/34	D/39
22	34th Ave/Pacific Hwy	Signal	C/30		C/20	D/36	C/28	D/36		B/18	C/32	C/29
23	34th Ave/I-5 SB Ramps	Signal	**E/55**			**E/69**	**E/62**	A/5			D/42	B/17
24	34th Ave/I-5 NB Ramps	Signal	D/39		**E/64**		D/53	A/8		D/44		C/25
25	34th Ave/20th St	Signal			A/4	A/5	A/4			A/4	A/9	A/7

Notes: SSSC = Side-Street Stop-Controlled.
Unct. = Uncontrolled
Bold indicates unacceptable operation.
Source: Fehr & Peers, 2010.

4 POLICY POINT 4: ACCESS CONNECTIONS AND DESIGN

Will the Proposed Alternative provide fully directional interchanges connected to public streets or roads, spaced appropriately, and designed to full design level geometric control criteria?

4.1 Summary

The Proposed Alternative provides fully directional access between I-5 and other public roads via interchange ramps and one-way arterials. The design of the Proposed Alternative accommodates spacing requirements and constraints and meets current geometric standards.

4.2 Directionality

The Proposed Alternative features the reconstruction of an existing One Quad Parclo B interchange at I-5 and Port of Tacoma Road into a diamond couplet interchange. Connections to and from I-5 will be realigned to provide directional traffic movements to a new one-way couplet arterial system between 12th Street East to 20th Street East. Port of Tacoma Road will become one-way southbound, while an extension of 34th Avenue East will serve the one-way northbound movement.

4.3 Access Connections to Public Roads

Proposed interchange connections are to public highways and roads. Modifications and additions to the Port of Tacoma Road interchange with I-5 will provide connections to Port of Tacoma Road and 34th Avenue East, eventually providing access to Pacific Highway East, SR 509, 12th Street East, 20th Street East, and many local businesses.

The Proposed Alternative provides a new access point to the extension of 34th Avenue East (northbound arterial) that will connect I-5 with Pacific Highway East. This arterial will now serve as the main entrance to the Port and access to surrounding businesses.

4.4 Design Standards

The design of the proposed access revision follows the procedures outlined in the WSDOT DM, and has been developed to meet or exceed current full design levels. Interchange and ramp spacing is consistent with design standards, based on DM Chapter 1360, Exhibits 1360-2 (Interchange Spacing) and 1360-3 (Minimum Ramp Connection Spacing). Table 4-1 describes milepost locations and relative spacing between the Proposed Alternative and the most immediate interchanges and ramps.

Table 4-1. Interchange Spacing

Proposed Alternative POT Road Interchange with I-5	Milepost (MP)[1] SRMP (ARM)	Interchange Spacing [2 (miles)]	Ramp Spacing [2, 5 (miles)]
SR 167 Interchange with I-5	135.03 (135.07)	1.08 [3]	0.51 (+/-2718 ft)
SR 99 Interchange with I-5	137.45 (137.51)	1.27 [4]	0.90 (+/-4752 ft)

1 - WSDOT – State Highway Log, Planning Report 2009, Olympic Region
2 - All length measurements are calculated using the accumulated route MP (ARM) value
3 - Distance measured from SR 167 underpass to POT Road overpass (MP 136.09 - ARM 136.15)
4 - Distance measured from proposed 34th Ave E (MP 136.18 - ARM 136.24) to SR 99 overpass
5 - Shortest length measured between on-/off-ramps along either northbound or southbound I-5

The following design assumptions were made to establish the interchange geometry.

- I-5 (mainline) design speed of 70 mph, based on posted speed of 60 mph and DM Chapter 1140, Figure 1140-1 for Freeways
- Freeway ramp design speed between 25 and 60 mph, based on DM Chapter 1360, Figure 1360-4, for 70 mph mainline design speed
- Maximum ramp and arterial grades are less than or equal to 7 percent for 25 to 30 mph ramp design speed and less than or equal to 6 percent for 35 to 40 mph ramp design speed based on DM Chapter 1360, Figure 1360-5
- Mainline lane widths are 12 feet with 10-foot right shoulder and 10-foot left shoulder, based on DM Chapter 1140, Exhibit 1140-5 for interstate with six lanes or more
- Ramp width for one-lane ramps of 15-foot traveled way with 8-foot right shoulder and 4-foot left shoulder, and for two-lane ramps of 25-foot traveled way with 8-foot right shoulder and 4-foot left shoulder. For any additional lanes, 12-foot traveled way width. DM Chapter 1360, Exhibit 1360-6

Table 4-2 shows the number of lanes and traffic movements for the Proposed Alternative.

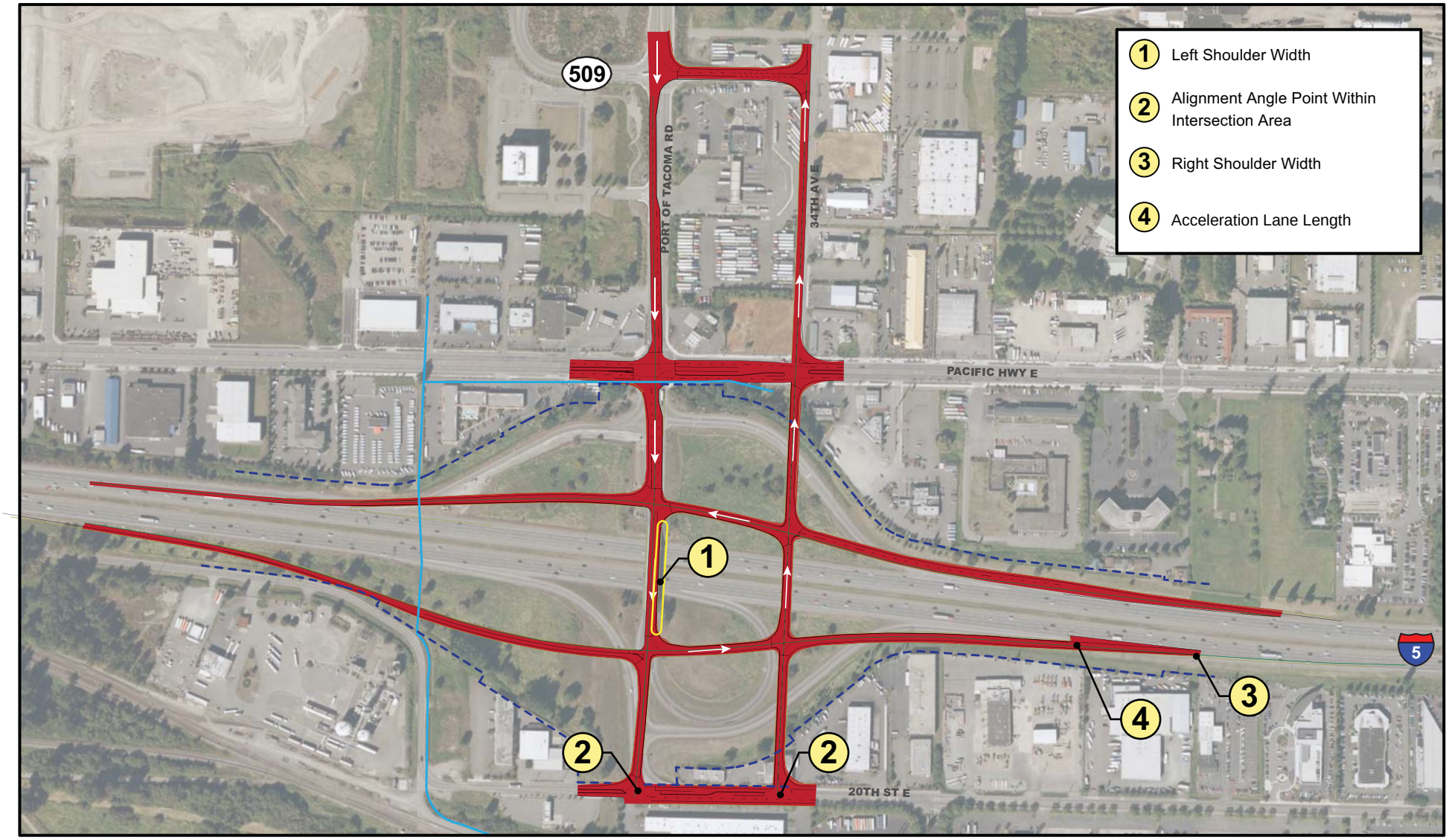
Table 4-2. Geometric Characteristics of the Proposed Alternative

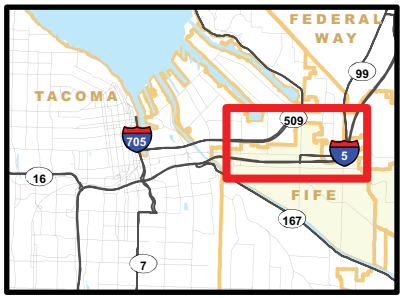
Access Point Revision	No. of Lanes	Ramp Connections Type	Horizontal Curvatures
Southbound I-5 off-ramp	1 lane off I-5, 3 lanes on 34th Ave E	Taper Off-connection	12661.1' R, 5000' R
Southbound I-5 on-ramp	2 lanes leaving POT Rd, 1 lane on I-5	Taper On-connection	4993.5' R, 2600' R
Northbound I-5 off-ramp	1 lane off I-5, 3 lanes on POT Rd	Taper Off-connection	3000' R, 2600' R
Northbound I-5 on-ramp	2 lanes leaving 34th Ave E, 1 lane on I-5	Taper On-connection	4500' R
Northbound 34th Ave E	2 lanes (+)	-	
Southbound POT Rd	2 lanes (+)	-	8000' R, 5355'R, 8000'R, 8000' R

The Proposed Alternative meets all the design requirements of the WSDOT DM with the exception of five locations (see Table 4-3). One deviation is required for the left shoulder width along the Port of Tacoma Road Bridge. One deviation is required for the right shoulder width on I-5. The other two deviations are for the angle points near the traveled way at the Port of Tacoma Road and 34th Avenue East intersections with 20th Street East. Another deviation is required for the acceleration lane length on I-5. The locations of the five design deviations are shown in Figure 4-1. Deviation reports are still in development and approval is expected in 2012.

Table 4-3. Deviations

ID No.	Location	Deviation Issue	Standard	Proposed	General Justification	Comments
1	SB POT Rd Bridge	Left shoulder width	4 ft	Varies 1.3 ft – 4ft	Existing bridge replacement out of scope	Existing shoulders are substandard.
2	20th St E and POT Rd	Alignment angle point within intersection area	No angle point within 100 feet of Intersection	1°38' Angle point within intersection	ROW acquisition / business Indemnification costs	Max angle without curve for 35 mph
2	20th St E and 34th Ave E	Alignment angle point within intersection area	No angle point within 100 feet of Intersection	1°38' Angle point within intersection	ROW acquisition / business Indemnification costs	Max angle without curve for 35 mph
3	I-5 Northbound on-ramp	Right shoulder width	8 ft	3.6 ft	Existing Wapato Creek Bridge replacement out of scope	
4	I-5 Northbound on-ramp	Acceleration lane length	1620 ft	1420 ft	Existing Wapato Creek Bridge replacement out of scope	





Existing ROW
Erdahl Ditch
Proposed Interchange Reconstruction
Direction of Travel

N

0 250 500 Feet

Source: Pierce County (2007) GIS Data (Streets, County Boundary, Water Bodies). Horizontal datum for all layers is NAD83(91), vertical datum for layers is NAVD88.

FIGURE 4-1
Geometric Deviation Locations

Port of Tacoma Road Interchange with I-5 Project

4.5 Ramp Terminals

Ramp terminals associated with the proposed modifications to access points meet current state and local full design level geometric control criteria. On-connections are consistent with design standards, based on DM Chapter 1360, Exhibit 1360-13a (Single-Lane, Tapered). Off-connections are consistent with design standards, based on DM Chapter 1360, Exhibit 1360-14a (Single-Lane, Tapered).

5 POLICY POINT 5: LAND USE AND TRANSPORTATION PLANS

Is the proposed access point revision compatible with all land use and transportation plans for the area?

5.1 Summary

The planning process that led to the Proposed Alternative for the Port of Tacoma Road Interchange with I-5 project considered land use and transportation plans and policies for the area. The proposed access point revision is compatible with the adopted plans. Plans considered include the following.

- Statewide: WTP and HSP
- Regional: PSRC Transportation Plan, Pierce County Comprehensive Plan, and Sound Transit's Sound Move
- Local: City of Tacoma Comprehensive Plan and City of Fife Comprehensive Plan

Detailed information on adopted plans is discussed in Sections 5.2 to 5.5 below. Where the proposed access point revision is not specifically referenced in a planning document, its consistency with that plan and the process for the appropriate agency to incorporate the project into its plan is discussed.

The coordination and consistency of the proposed project with adopted statewide and metropolitan plans is consistent with the processes prescribed in 23 CFR Part 450 (FHWA Regulation), as well as the air quality conformity requirements of 40 CFR Parts 51 and 93 (EPA Regulation).

5.2 Land Use

The City of Fife Comprehensive Plan identifies both current and future land uses for the City. The land use element of the City's Comprehensive Plan has been prepared in accordance with the requirements of the state Growth Management Act (GMA), countywide planning policies for Pierce County, and other mandates. The primary intent of the land use element is to guide local decision-making to allow the growth and development of the community.

5.2.1 Current Land Use

The current land uses adjacent to the I-5 corridor are described as commercial and industrial. The City's primary business district runs east and west along Pacific Highway East north of I-5. South of the Port of Tacoma Road interchange and I-5, the area along 20th Street East is also developed as heavy commercial with some industrial uses.

5.2.2 Future Land Use

Future land uses adjacent to I-5 will continue to be commercial and industrial with some high-density residential, consisting primarily of apartment buildings located to take advantage of nearby commercial areas and arterials served by public transit.

5.2.3 Land Use Impacts

No impacts have been identified in the Port of Tacoma Road Interchange with I-5 project that would affect the goals and objectives of the City's Comprehensive Plan.

5.3 Statewide Transportation Plans

5.3.1 Washington Transportation Plan

The WTP is the statewide, strategic 20-year plan for transportation modes, both state-owned and of state interest. The current WTP, which covers 2007 to 2026, was adopted in February 2002. The WTP is the WSDOT decision tool that links state and regional transportation plans to provide strategies for transportation investments. The HSP, described below, is an element of the WTP that addresses planning and programming of highway projects.

5.3.2 WSDOT State Highway System Plan

The HSP is the state highway element of the WTP. The HSP identifies state highway needs for a 20-year planning horizon and conceptual solutions (including conceptual cost estimates) for those needs. The HSP contains general information on Washington's highway programs and how they are balanced with funding projections. Appendix N (2007 to 2026) of the HSP, in conjunction with the WTP, identifies the Port of Tacoma Road interchange with I-5 as a truck bottleneck location (2005).

5.4 Regional Transportation Plans

5.4.1 PSRC Transportation 2040 Plan

Transportation 2040, the transportation plan developed by the PSRC, is a long-range plan for transportation in the Puget Sound region. The plan sets regional transportation policies, lists regional transportation needs in the form of programs and projects, describes a financial strategy to meet those needs, and discusses implementation and monitoring strategies. Transportation 2040 is an extensive revision to PSRC's Destination 2030 transportation plan that addresses new emerging transportation trends and enhances aspects that deal with the safety, security, and special needs of transportation. The Port of Tacoma Road Interchange with I-5 project is listed in the list of Transportation 2040 State Route Investments.

5.4.2 Pierce County Comprehensive Plan

The transportation element of the Pierce County Comprehensive Plan describes policies and recommends strategies that will help meet future demands for transportation services and infrastructure in Pierce County. Additional goals include improving the Port's accessibility to the freight market. The Port is among the largest container ports in North America and serves local, regional, national, and international markets. The Port of Tacoma Road Interchange with I-5 project is consistent with the Pierce County Comprehensive Plan as the project will improve mobility in the area, especially the ability of shippers to move freight to and from the Port.

5.4.3 Sound Transit

Sound Transit's regional transit plan, Sound Move, plans to create a comprehensive, regional high-capacity travel network that is dependable and helps maintain the region's economic strength. The plan's goal of connecting major economic focal points in the region depends on the travel corridors that link these locations. I-5 in the north-south direction is an example.

Within the study area, I-5 experiences traffic congestion during AM and PM peak hours and heavy traffic volumes during midday. Traffic is expected to increase significantly in the area

over the next few years, causing the Port of Tacoma Road with I-5 interchange to operate at unacceptable service levels and worsening congestion on mainline I-5. The proposed access revision will satisfy the current and future demand for travel in the study area and help relieve congestion on I-5 consistent with the goal of Sound Move—keeping the region moving in a dependable and efficient manner.

5.5 Local Transportation Plans

5.5.1 City of Tacoma Comprehensive Plan

The City of Tacoma's Comprehensive Plan was adopted in 1993 to set goals and policies to protect the health, welfare, safety, and quality of life of Tacoma's residents over the next 20 years. It was last updated in 2009, continuing the original 1993 plan vision. The plan contains five primary elements mandated by the state GMA: land use, transportation, housing, capital facilities, and utilities.

The goal of the plan's transportation element is to "achieve a multimodal transportation system that efficiently moves people and goods with optimum safety and speed, maximizes the conservation of energy, and minimally disrupts the desirable features of the environment." The proposed Port of Tacoma Road Interchange with I-5 project will provide additional roadway capacity and more efficient access for general traffic into the city's residential and business areas and improve freight mobility in and out of the Port, thus meeting the goal of the City of Tacoma's Comprehensive Plan.

5.5.2 City of Fife Comprehensive Plan

The City of Fife's Comprehensive Plan was adopted in 1996 to serve as the community's policy plan for growth and development over the next 20 years. It was last updated in 2005, continuing the original 1996 plan vision. The plan contains policies concerning land use, transportation, housing, utilities, parks and recreation, capital facilities, and economic development.

The transportation element of this plan was updated through a supplemental study in 2002. It reflects the City's goal of reducing congestion on local streets, addressing environmental concerns, and strengthening residential areas. This plan defines expected deficiencies as growth occurs and provides strategies and means to overcome these issues. The plan indicates that most of the arterial roads in the proposed project area will be operating at LOS D by 2012.

The City of Fife lies in one of the busiest transportation areas in Washington State. I-5, the state's major north-south arterial, travels through the northern portion of the city and the Port, one of the fastest growing ports in the nation, is situated just north of the interstate. The presence of I-5, the Port, and multiple railroad lines causes congestion in this area of the city.

The proposed Port of Tacoma Road Interchange with I-5 project is congruent with the City's comprehensive plan because the project will improve interchange spacing, give general and truck traffic more efficient access to the City's residential and business areas, and improve freight mobility in and out of the Port.

6 POLICY POINT 6: FUTURE INTERCHANGES

Is the proposed access point revision compatible with a comprehensive network plan? Is the proposal compatible with other known new access points and known revisions to existing points?

6.1 Summary

The revision of the access point of the interchange at I-5 and Port of Tacoma Road is compatible with the comprehensive transportation network in the region.

The development of the Proposed Alternative considered other access point revisions planned in the vicinity of the project area. Other than the access point revisions listed below, no additional proposed revisions are expected for the area.

- SR 167 Extension I-5/SR 167 Interchange
- I-5, SR 161/SR 18 Interchange Improvements
- Tacoma/Pierce County HOV Program

The Port of Tacoma Road with I-5 Interchange project will operate with or without the construction of these other projects.

6.2 Previous Planning for Revised Port of Tacoma Road Interchange with I-5

In 2003, a design charrette confirmed the need for improvements and identified a preferred configuration for the Port of Tacoma Road interchange. The 2003 preferred configuration would have removed the existing southbound off-ramp to Port of Tacoma Road; replaced it with new southbound on- and off-ramps connecting to 34th Avenue East, with a traffic signal at Pacific Highway East; and provided access to Port of Tacoma Road via 12th Street East. An additional southbound off-ramp would have connected to Port of Tacoma Road closer to the bridge structure with a traffic signal and provided additional north or southbound access to Port of Tacoma Road. Finally, the existing southbound on-ramp from Port of Tacoma Road would have been realigned to be closer to the bridge structure to increase the intersection spacing between the on ramp and Pacific Highway East.

The 2003 preferred configuration was included as Alternative 9 of this study and was described in Policy Point 2. The alternative was eliminated during the first stage of screening, but several of its main components – new southbound I-5 exit at 34th Avenue East, reconstruction of 34th Avenue East, reconstruction of 12th Street East, and a signal at the intersection of 34th Avenue East and Pacific Highway East – are incorporated in the Preferred Configuration.

6.3 Other Proposed Projects Considered

Within the study area, a number of additional improvements are planned. These improvements have been considered in the development and evaluation of this interchange revision.

6.3.1 SR 167 Extension Program

As mentioned above, the project is currently not fully funded and failure to construct the proposed SR 167 extension project will lessen the potential effects on the Port of Tacoma Road interchange area.

The SR 167 extension project is a 6-mile-long, limited access highway ultimately connecting SR 509 to SR 161 and SR 167 near Puyallup. The Port of Tacoma Road Interchange with I-5 project only included the section of SR 167 from Puyallup to I-5 in 2040. The northern section of SR 167 from I-5 to SR 509 was assumed to be completed after 2040. The analyzed project includes new freeway-to-freeway I-5 and new interchanges at Valley Avenue, and SR 161.

Operational analysis for the Port of Tacoma Road Interchange with I-5 project, which assumed the partial completion of the SR 167 extension project by 2040, produced acceptable results for I-5 and the Port of Tacoma Road interchange. In the event that the SR 167 extension and I-5/ SR 167 interchange is not constructed, traffic volumes would likely increase the effects on the Port of Tacoma Road interchange area.

The project is in the final design phase and partial funding has been secured. Until additional funding is identified, construction dates will remain undetermined.

6.3.2 I-5/SR 161/SR 18 Interchange Improvements

The I-5/SR 161/SR 18 Interchange improvements project (Triangle project) is a regional priority project designed to reduce congestion, improve safety, and increase freight mobility in the South King County area. It features the reconstruction of an existing cloverleaf interchange to a Parclo B with directional ramps for westbound SR 18 to southbound I-5 traffic and for eastbound SR 18 to northbound I-5 traffic. It also proposes access to SR 161 via two new southbound I-5 exit ramps to South 356th Street and South 359th Street. While funding for the entire project has not yet been obtained, funding has been secured for the first phase, which is scheduled for completion in 2012.

Located adjacent to the Pierce County border, the Triangle project will have a positive effect on the Proposed Alternative because it will improve circulation on I-5. Operational analysis for the Port of Tacoma Road Interchange with I-5 project produced acceptable results with the inclusion of the Triangle project improvements. The Proposed Alternative is compatible with the Triangle project access points.

6.3.3 Tacoma/Pierce County HOV Program

The state plans to implement HOV lanes along the I-5 corridor in an attempt to increase the efficiency of its road network. The goal is emphasize the movement of people and goods rather than automobiles. The Tacoma/Pierce County HOV program includes several projects in the vicinity of the Port of Tacoma Road Interchange with I-5 project that have been taken into consideration. The I-5: Port of Tacoma to King County Line - HOV project began construction in fall 2009 and the lanes are now open to traffic. The I-5: Portland Avenue to Port of Tacoma Road (northbound and southbound) HOV projects are currently under active design and are fully funded. The new HOV lanes extending from Portland Avenue to the King County line will assist the Proposed Alternative because the lanes will improve traffic mobility through the area. The Port of Tacoma Road Interchange with I-5 project is consistent with the Tacoma/Pierce HOV program, being accounted for in the operational models for opening year (2020) and design year (2040).

7 POLICY POINT 7: COORDINATION

Are all coordinating projects and actions programmed and funded?

7.1 Summary

As discussed in Policy Point 1, the traffic analysis for the Port of Tacoma Road with I-5 Interchange project showed that the completion of the SR 167 Extension project by year 2040 will be needed to maintain sufficient operation through the I-5 corridor within the study area. Both projects, Port of Tacoma Road with I-5 Interchange and SR 167 Extension, are partially funded.

7.2 SR 167 Extension Program

The SR 167 Extension program consists of two projects – the SR 167 Extension Puyallup to SR 509 and the I-5/SR 167 Interchange. These are described below.

7.2.1 SR 167 Extension Puyallup to SR 509

The realignment and expansion of SR 167 from SR 161 to SR 509 has long been identified in the state system plan. Design and environmental work on the project has been ongoing since the 1980s and includes development of a new system interchange on I-5. A separate interchange justification report has been developed for this project (WSDOT 2007).

7.2.2 I-5/SR 167 Interchange

The proposed I-5/SR 167 interchange is part of the SR 167 Extension project. The interchange is located in the vicinity of the existing 70th Avenue undercrossing, near I-5 MP 138.4. The interchange timeline and funding are the same as those of the SR 167 Extension project.

7.3 Project Funding

Funding for the Port of Tacoma Road with I-5 Interchange project and the SR 167 Extension program is described below.

7.3.1 Port of Tacoma Road Interchange with I-5

The Port of Tacoma Road Interchange with I-5 project is practically funded through several City, State and Federal sources. Table 7-1 below shows the project's current funding commitments. The first phase of the project is funded through design with partial funding through construction. The 18-month construction of the first phase is scheduled to begin in 2013 with ensuing construction phases beginning in 2015 and 2017.

7.3.2 SR 167 Extension Program

Currently, funding for the SR 167 Extension project consists of $126,000,000 from the 2003/2005 gas tax, $9,000,000 from pre-existing funds, $20,000 from the City of Fife, $45,000 from the City of Tacoma, $55,000 from Pierce County, $365,000 from the Port of Tacoma, $8.55 million from SAFETEA-LU, $1.8 million from the Puget Sound Regional Council, $7.57 million from a Non-Demonstration Grant, and $2.22 million from High Priority Demonstration. The total amount still unfunded is $2.01 billion.

Table 7-1. Port of Tacoma Road Interchange with I-5 Project Funding

Funding Source - Phase I	Contributions ($Millions)
FMSIB	3
Appropriations	6.1
Interstate Maintenance Discretionary	0.4
City of Fife	0.1
2012 Unsecured	4.1
Total - Phase I	**13.7**
Funding Source - Phase I	**Contributions ($Millions)**
FMSIB	8
City of Fife	0.8
Total - Phase II	**8.8**
Funding Source - Phase I	**Contributions ($Millions)**
Interstate Maintenance Discretionary	0.6
SAFETEA-LU High Priority	0.4
Unfunded	27
Total - Phase III	**28**
Other	**($Millions)**
Utility Relocation	1.5
TOTAL	52

Note:
FMSIB (Freight Mobility Strategic Investment Board)

8 POLICY POINT 8: ENVIRONMENTAL PROCESSES

What is the status of the proposal's environmental processes?

8.1 Summary

The Port of Tacoma Road Interchange with I-5 project has been identified as a transportation priority at the regional and local planning levels. Project and environmental planning over the past year have resulted in significant progress in determining interchange layout and assessing environmental effects.

8.2 Planning Requirements

The WTP is the state's blueprint for implementing transportation projects and programs over the next 20 years. The WSP is prepared in accordance with Title 23, USC 135, (e)(1). The following list addresses federal (Title 23, USC 111) requirements.

1. The Port of Tacoma Road Interchange with I-5 project supports economic vitality and encourages global competitiveness, productivity, and efficiency by improving safety and traffic circulation for freight and people in the vicinity of the interchange. Traffic volumes in the project area are expected to increase over the next 20 years as growth occurs in the Port, trade increases, and overall regional growth continues. The interchange improvements will help reduce congestion due to increased traffic volumes in the project area.
2. The Port of Tacoma Road Interchange with I-5 project increases mobility for freight by reducing congestion on the roadways.
3. The Port of Tacoma Road Interchange with I-5 project preserves and enhances the existing transportation system by providing a more effective interchange to connect to the existing roadways.

8.3 Schedule of Environmental and IJR Decision

The physical, cultural, and economic elements of the environment were evaluated in a series of discipline reports to determine the potential adverse effects of the project. These reports concluded that the Proposed Alternative will not pose significant deleterious effects to the human or natural environments. WSDOT has determined that this project is anticipated to be processed as NEPA DCE and does not require the preparation of an EIS.

Applicable permits will not be determined until an environmental review is substantially complete and the IJR has been reviewed. The IJR will serve as a companion document to each environmental document, providing review of the policy points for the entire project. Many environmental permits and required approvals will be determined when the environmental review is substantially complete and the IJR has been reviewed by FHWA.

Environmental clearance for the project is expected between 2012 and 2013. An initial finding of engineering and operational acceptability by FHWA is expected in 2012. IJR approval for the Port of Tacoma Road Interchange with I-5 project is expected when the environmental permitting is complete.

Interchange Justification Report
Port of Tacoma Interchange with I-5
City of Fife, Washington

Appendix A
Methods and Assumptions Technical Memorandum

Transportation Analysis: Methodologies and Assumptions

Port of Tacoma Road Interchange with I-5
Fife, Washington

Submitted to:
City of Fife
Public Works Department
Fife, Washington

14 July 2009
Revised on: 17 February 2010
Revised on: 12 May 2010

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1301 5th Avenue, Suite 1200
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Job No. SAPWT-09-139

Transportation Analysis: Methodologies and Assumptions

City of Fife
Port of Tacoma Road Interchange with I-5

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INTRODUCTION

The City of Fife is conducting a study to identify a preferred alternative for the reconstruction and/or reconfiguration of the Port of Tacoma Road Interchange with Interstate 5 (I-5) in Pierce County Washington. This memorandum sets the framework for the transportation forecasting and analysis for the alternatives evaluation and screening process as well as for resulting documentation which may include an Interchange Justification Report. The memorandum identifies the analysis years, the limits of the study, forecasting and modeling methodologies and truck forecasting. Therefore, this memorandum requires concurrence by the review agencies, as the outlined methodology will guide the traffic analysis throughout the life of this project.

SECTION 1: ANALYSIS YEARS AND TIME PERIODS

Assumed Analysis Years:

- Existing Year: 2006
- Opening Year: 2020
- Horizon Year: 2040

The analysis years for this project are 2006, 2020 and 2040. For most locations, traffic counts are available for both 2006 and 2009. A review of traffic counts in the study area has shown that AM and PM peak hours collected in 2009 are five-to-seven percent lower than those counts collected in 2006. Because of the reduction in traffic volume, we will use 2006 counts where available for this study. For those locations where we do not have 2006 counts, we will use 2009 counts, but scale these counts to better represent 2006 conditions. For all operational analyses, the existing year will represent 2006 conditions and all analyses will be conducted for the AM and PM peak hours.

In addition, we will compare the AM and PM peak hour counts to the mid-day counts at all intersections along Port of Tacoma Road between 20th Street E and the SE Frontage Road where the truck volumes (as a percentage of total traffic) are relatively high. To account for the high truck percentages, we will consider both the number of vehicles and passenger car equivalents during the AM and PM peak hour. In addition we will review Mid-Day peak hour for truck for additional sensitivity analysis.

SECTION 2: STUDY AREA

The study area for the traffic analysis will include the following roadway segments:

- On I-5 - From the 54th Avenue East interchange with I-5 to the Ferguson Street/Puyallup River Overcrossing; I-5 Milepost Boundaries: 135.5 to 137.0.
- On Port of Tacoma Road - From 20th Street East to 12th Street East.
- On 34th Avenue East - From Pacific Highway East to 12th Street East.
- On 12th Street East - From Port of Tacoma Road to 54th Avenue East. .

The above roadway segments will be analyzed using the VISSIM micro simulation modeling software package, with the model's boundaries extending from the I-705 interchange (NB on-ramp and SB off-ramp) to the SR 18 interchange (NB off-ramp and SB on-ramp). These extended model boundaries are required to capture how improvements at the Port of Tacoma interchange would influence operations on I-5.

The interchanges on I-5 included in the traffic analysis are shown in **Figure 1** on the following page.

Figure 1: I-5 Interchanges included in the Traffic Analysis

SECTION 3: TRAVEL DEMAND FORECASTING

Key Assumptions

The Puget Sound Regional Council's (PSRC) regional travel demand model (Version 1.0bb) in EMME software will be used for this analysis. We will refer them as EMME models in this document. The 2020 and 2040 roadway networks will be constrained to only include funded projects in 2020 and 2040. For the existing year 2006 model, we will use City of Fife's land use within the study area and PSRC's land use outside the study area.

Network Enhancements

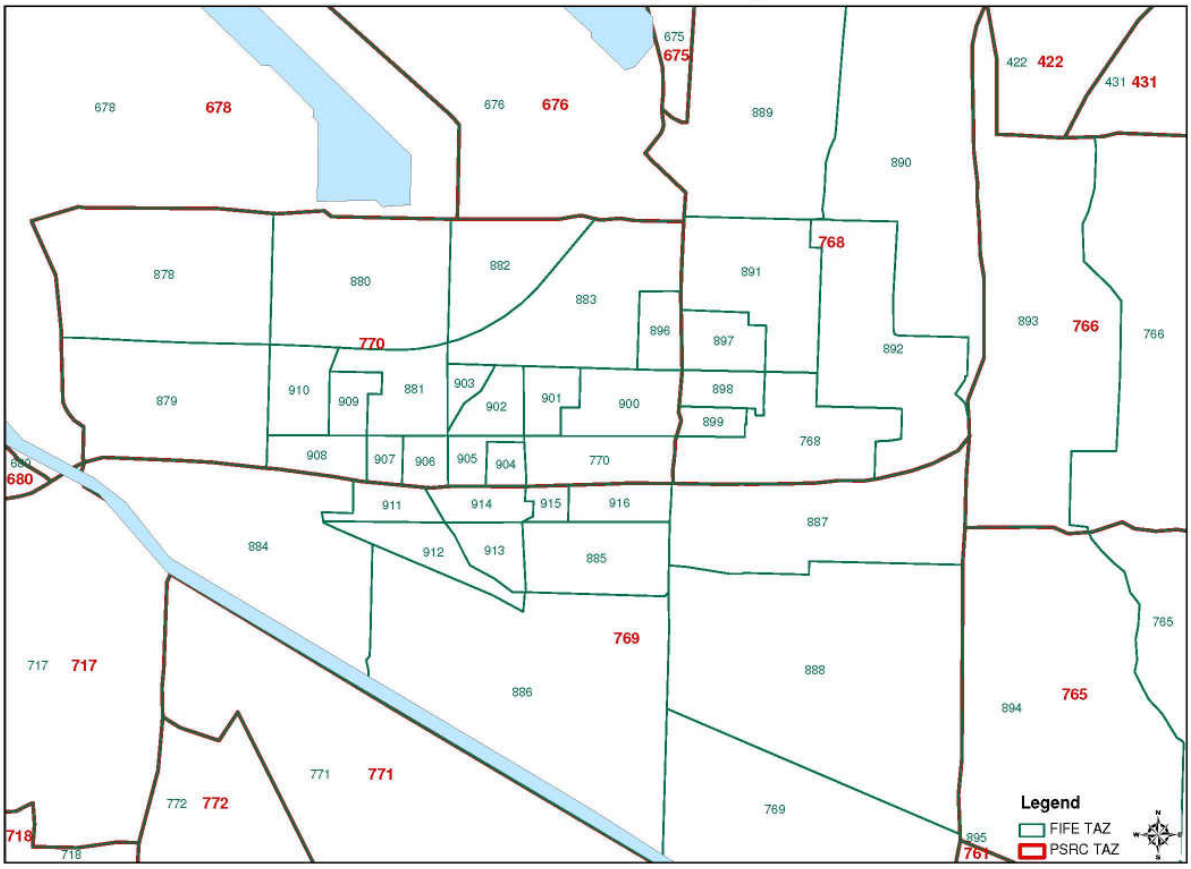
The PSRC model is a regional multi-modal model and its network includes the interstate highways and major arterials within the four county regions of King, Pierce, Kitsap, and Snohomish counties. The PSRC model network represents interstate interchanges as a single point intersection, but for the purpose of this study more network detail is needed to accurately represent access and operating conditions within the study area. Therefore, the roadway network will be refined to include full interchanges and ramps on I-5 between SR 18 and I-705, including separate links for northbound and southbound lanes on I-5 within the study area. The following interchanges will be modified in the PSRC model to reflect the actual ramp configurations:

- I-5 and 54th Avenue
- I-5 and Port of Tacoma Road
- I-5 and SR 167/E Portland Avenue

Transit routes that are affected by the roadway network refinements will be modified to operate over the more detailed interstate facility. In addition to the interstate modifications, the local street network will also be refined within the study area to better reflect the current roadway network.

The zone structure with the PSRC model will be refined around the Port of Tacoma, Portland Avenue, and 54th Avenue interchanges to provide a more accurate representation of land use and access within the study area. The consultant team will use the City of Fife's Traffic Model Land Use Report to update the existing conditions land use in the PSRC model and to apportion land use for any zone disaggregation within the City of Fife. **Figure 2** shows the traffic analysis zones (TAZs) on both sides of the I-5 corridor within the study area. The PSRC TAZs are shown in the red color and the proposed TAZs, based on the City's VISUM model zone structure, are shown in the blue color. In the PSRC model, the study area is covered by portions of six TAZs, which this study proposes to split into 45 zones.

Figure 2: Port of Tacoma Road Interchange Project – Zone Structure



Validation Process

The consultant team will use the 2006/2007 PSRC base model for validation purposes and to post-process volumes for the opening year (2020) and the horizon year (2040) traffic volume forecasts. Validation will be carried at link level volumes for the freeway and arterials using available counts for 2006. More detailed validation will not carried out in EMME model since a subarea model will be developed and validated at turning movement level in VISUM model before transferring the information to VISSIM. Once the EMME model demand has been validated to the existing conditions at link level, the base year demand will be used to create future year models.

Future Year Network Assumptions

We have reviewed the comprehensive plans and transportation improvement programs (TIPs) for the Cities of Fife, Tacoma, and Federal Way, as well as for Pierce County and WSDOT. In addition, we have identified projects included in Sound Transit 2 (ST 2) and the American Recovery and Reinvestment Act (ARRA) funding packages. We reviewed these resources to

develop a list of funded projects that should be included in the future roadway and transit networks.

Roadway Network

All of the funded roadway projects are planned to be completed by Year 2020. Thus, the 2020 and 2040 baseline conditions will reflect the same roadway network improvements. **Table 1** includes a list of funded roadway projects identified for inclusion in the 2020 and 2040 baseline conditions. The consultant team will review the 2020 and 2040 PSRC roadway networks to ensure that only funded projects are included in the baseline (No Build) models.

Table 1: PSRC Planned / Funded Projects Included in Future Baseline Models

Sponsor	Project
WSDOT	I-5 HOV lanes, SR-16 to 320th St vicinity
WSDOT	SR-16 HOV lanes, I-5 to Olympic Dr
Kent, Tukwila, SeaTac, Federal Way, WSDOT	SR-99 HOV lane extensions, S 138th St to S 170th St, Kent-Des Moines Rd to Dash Point Rd
WSDOT	SR-161 widening, S 360th St to 24th St E
WSDOT	SR 167, extend the SB HOV lane north to I-405; add a SB auxiliary lane from I-405 to the off-connection at SW 41st St.
WSDOT	SR-167 - add one SB GP lane and extend SB HOV, SE 180th St to I-405
WSDOT	SR-167 interchange with I-5 (2040 only)
WSDOT	I-405 widening project includes new interchanges at SR-515 and 132nd St NE and an HOV interchange at N 8th St in Renton
WSDOT	SR-410, widen to 4-lanes, 214th Ave to 234th Ave
WSDOT	SR-518 - add EB lane, N Airport Expressway to I-5/I-405 interchange
Federal Way	S 356th St - widen to 5 lanes to SR 99
Fife	Valley Ave E - upgrade to major arterial
Pierce County	176th St E - widen to 4 lanes, SR-7 to SR-161
Pierce County	Canyon Rd E - 106th St E to 192nd St E
Pierce County	Canyon Rd E - extend major arterial from 192nd St E to SR-7
Pierce County	Canyon Rd E - widen to 5 lanes, 84th St E to 99th St E
Tacoma	D St Overpass construction - Puyallup Ave to S 23rd St

In addition to the above projects included in the PSRC baseline conditions, **Table 2** summarizes projects from the City of Fife Transportation Improvement Program (TIP) that were identified for the future baseline conditions.

Table 2: City of Fife Funded Projects (Proposed Additions to Future Baseline Models)

Project Title	Project Description
Reconstruct 70th, 20th to Valley Ave	Currently 70th is 1 lane in each direction; the project will add 3 new lanes (Assumed 1 lane in each direction and a Two Way Left Turn Lane)
Reconstruct 20th, 54th to 63rd	Currently a portion of 20th is 3 lanes; the project will extend 3rd through project limits
Reconstruct 70th, (North Segment)	Currently 70th is 1 lane in each direction; the project will add an additional lane in each direction and widen the I-5 bridge.

For this analysis, we assume that I-5 will not have any toll or managed lanes in the future baseline or build alternatives and that the occupancy requirements for the High Occupancy Vehicle HOV lanes will remain at HOV 2+ in 2020, but will increase to HOV 3+ by 2040. Also SR-167 interchange with I-5 will be assumed to be constructed by 2040 only.

Transit Network

Table 3 summarizes the transit improvements that will be included in the 2020 and 2040 baseline conditions. All funded transit improvements will be completed by 2020, with the exception of three light rail extensions—from Bellevue to Overlake Transit Center (2021), from Northgate to Lynnwood (2023), and from SeaTac to S 272nd (2023). Thus, the only difference in transit services reflected in the 2020 and 2040 model networks is completion of the above light rail extensions.

Table 3: Funded Transit Projects

Sponsor	Project
Sound Transit	Light Rail Initial Segment - SeaTac Airport to UW (2016)
Sound Transit	Light Rail Extension - UW to Northgate, Seattle to Bellevue (2020)
Sound Transit	Light Rail Extension - Bellevue to Overlake Transit Center (2021)
Sound Transit	Light Rail Extension - Northgate to Lynnwood, SeaTac to S 272nd (2023)
Sound Transit	Light Rail stations - Redondo/Star Lake, Jackson Park, Shoreline, Bel-Red, Overlake
Sound Transit	Express Bus Service Increase (17% increase in service)
Sound Transit	Commuter Rail Service Increase (65% increase in capacity) Tacoma-Seattle
Sound Transit	Commuter Rail Extension - Tacoma to Lakewood
Sound Transit	Commuter Rail Station Improvements - Everett, Mukilteo, Edmonds, Tukwila, South Tacoma, Lakewood
Sound Transit	Parking Garage at Sounder stations - Mukilteo, Auburn, Sumner, Puyallup, South Tacoma, Lakewood
Sound Transit, WSDOT, Pierce Transit	Park & Ride Expansions - Everett LRT Station, Mercer Island, Mountlake Terrace I-5, S 200th, S Bellevue, Lynnwood Transit Center, Tacoma Dome Station, Kent vicinity of I-405, Puyallup, Kent Station, Burien, Marysville, SR-9/SR-2/Lake Stevens, Highline Community College Intermodal Transit facility, SR-16 Peninsula
King County Metro	RapidRide Bus Rapid Transit - Pacific Hwy S, Redmond TC to Bellevue TC, West Seattle to Downtown, Ballard to Downtown, Aurora to Downtown

We will reflect the 17% increase in Sound Transit express bus service by reducing headways of express bus service. The 65% increase in Sound Transit commuter rail capacity will be represented by increasing the train size (more cars per train), as well as by decreasing the headways of the Sounder commuter rail service. We will verify the capacities of the park-and-ride lots in the PSRC model to ensure that the model represents the increase in the number of stalls.

Alternatives Analysis
For the preliminary alternatives analysis, we will consider 2040 PM peak period conditions only and will use the EMME model to identify shifts in travel patterns and market sheds served by the Port of Tacoma Road/I-5 Interchange. The raw EMME volumes will be used to evaluate and screen the preliminary alternatives and to assist in the development of a preferred build alternative. If this approach doesn't yield results to make conclusive decision, we will create performance measures for all preliminary alternatives and compare them. Even if this comparison is not helpful to distinguish the preferred alternative, we will select top two alternatives and use VISSIM simulation to choose a preferred alternative. We will use only 2040 PM conditions for this simulation.

Once the preferred build alternative is selected, the travel demand model will be used to develop future forecast volumes for a more detailed analysis of the interstate corridor using a micro-simulation model (VISSIM). The consultant team will use the PSRC EMME model to develop future forecast volumes for the following conditions:

- 2020 No Build (AM & PM peaks)
- 2020 Preferred Alternative (AM & PM peaks)
- 2040 No Build (AM & PM peaks)
- 2040 Preferred Alternative (AM & PM peaks)

The future forecasts for the No Build and Preferred Alternative configuration will be post-processed for input to the VISSIM microscopic traffic simulation model of the study corridor. We will develop the origin-destination (O-D) tables from the EMME travel demand model for input into the VISSIM micro-simulation model to determine vehicle routing on I-5 and at the interchanges within the study area.

Truck Forecasting Methodology
Truck volumes for the Port of Tacoma Road Interchange analysis will be forecasted independently from other traffic. While the PSRC model has a freight model and uses special generators for high intensity truck activity, it has not been validated for sub-regional analysis. We will compare the modeled truck demand to observed counts to determine if the model accurately reflects truck activity in the study area. If necessary, the assumed Port of Tacoma special generators (developed by PSRC) and truck O-D matrices will be adjusted to reflect truck volumes in the study area based on the observed truck counts. Based on this work, truck volumes on Port of Tacoma Road interchange will be estimated and used in VISSIM to generate accurate truck percentages. A set of truck volumes will be generated for 2040 conditions assuming SR-167 interchange with I-5 and connection to SR-509.

Port-Related Trucks
Detailed truck counts performed in December 2006 classified trucks by purpose, instead of the typical size class. This allows us to separate the port-related truck trips (trucks with shipping containers, chassis-only, or just the tractor [bobtail]) from all the other truck traffic. Port

container traffic is expected to grow at a faster rate than other truck traffic, and will be forecast separately using the following steps:

1. Use the existing and planned future container terminal acreage at the Port of Tacoma (including the proposed Tribe/SSA terminal). The following information in Table 4 was provided by the Port of Tacoma in April 2009 for this effort.

Table 4: Terminal Acreage at Port of Tacoma

Terminal	Existing AC	Future AC
APMT	145	160
Terminal 7	76	87
Husky Terminal	93	93
WUT	102	102
PCT	148	160
TOTE	47	75
MVV/SSA	-	200
EB1	-	80
Total	611	957

2. Determine potential throughput based on the functional capacity for various types of terminals. The Port of Tacoma applies the following capacity thresholds:

   - Wheeled operation = 5,000 TEU/AC
   - Straddle Carrier operation = 7,000 TEU/AC
   - RTG/RMB operation = 10,000 TEU/AC

   [Note to team: Future capacity may increase to 8,000 TEU/AC to account for increased density. Will discuss this with Port of Tacoma.**]**

3. Determine the portion of container throughput that would be intermodal, meaning it would leave the area by train instead of by truck. For international cargo, 65 percent of all future cargo is estimated to be intermodal. No domestic cargo would be intermodal. These percentages would be applied to the terminals based on their intended shipping lines.

4. Estimate truck volumes for the non-intermodal cargo using factors to account for the gate moves on an average day.

5. Assign the truck volumes to various areas of the Port of Tacoma based on the net change in acreage.

6. Use the December 2006 truck counts to determine the likely routing of trucks to the street and highway network.

7. Estimate the net increase in port trucks at the study area intersections.

Non-Port Trucks

All other trucks—those on I-5 and the various interchanges—will be forecasted using a growth rate. The growth rate will be derived from both historic traffic count data and future employment projections for the region.

Historic counts on I-5 near the Puyallup River showed that from 2000 to 2008, trucks increased at the following compound rate:

- Single trucks = 2.8% per year
- Double trucks = 0.6% per year
- Triple trucks = 1.7% per year

Growth associated with future employment will consider both the growth within the Tideflats area of Tacoma as well as within the entire region. Once growth rates are determined, we will apply them to the non-Port truck trips from the December 2006 counts at the three interchanges serving the Tacoma Tideflats area. These will be added to the Port truck trips described above.

SECTION 4: MICROSIMULATION - FREEWAY, ARTERIALS AND INTERSECTION ANALYSES

The regional freeways and local arterials within the project study area operate as a system, with congestion and delays affecting both upstream and downstream operations. Therefore, a system approach will be used for the operations analysis. A system approach will be accomplished through the use of a combination of VISSIM (microscopic traffic operations analysis software) and VISUM model (macro-level pre-processor of traffic volumes).

VISSIM has the ability to dynamically assign select O-D pairs that are affected by the congestion throughout the study area. Based on congestion and delays associated with the operation of the freeways, on/off-ramps, and intersections, vehicles are re-assigned from the freeway and use multiple travel paths (i.e. route decision) to minimize delays and travel time to reach their destination. This dynamic assignment capability allows us to accurately reflect the effects of traffic congestion on the freeway and arterials in our operations analysis.

Using the VISSIM model, the consultant team will calculate the study area intersection level of service (LOS) and arterial queues. The merge and weave analyses, density, and travel time measures on the freeway will also be evaluated using the VISSIM model.

VISSIM Model Methodology, Calibration and Validation

The consultant will use the PSRC four-county EMME transportation demand model as a macro-level planning tool for trip generation, trip distribution, and mode choice, while the VISSIM model will be used as a micro-level operations tool for detailed vehicle trip assignment. We will create the VISSIM model from a base network, developed using aerial photography and land use data from the City of Fife VISUM model.

The tasks involved in developing the AM and PM VISSIM models are described below:

1. Use the City of Fife existing VISUM model and verify appropriate travel lanes, distances, and free flow travel speeds for both the regional (I-5) and local roadway system.

2. Refine the study area in the VISUM model to include intersection data (i.e. pocket lengths, lane configurations, intersection control and signal timing / phasing) and driveways to represent minor streets and adjacent land uses.

3. Use VISUM to refine the peak hour origin-destination trip table matrix (obtained from the EMME model) based on ground turning movement counts and demand volumes.

4. Based on the study area VISUM model, create a VISSIM model and refine microscopic traffic operations / simulation (i.e. on-ramp, merge, diverge, and weaving sections on freeway).

5. Use EMME and VISUM models to develop static peak hour traffic volume forecasts for study area freeway and roadway segments.

6. Conduct twenty (20) microscopic traffic simulation runs in VISSIM using different random seeds.

7. Calibrate / validate AM and PM VISSIM models based on counts, travel time surveys and queue lengths at bottleneck locations.

The VISUM model that will be used for this study will be a subarea model and will cover the study area only. In the process of refining this VISUM model, modifications may be necessary so that the existing model network accurately reflects the existing roadway network. This may include disaggregating large TAZ boundaries to improve land use boundaries and incorporating multiple access points (i.e. adding or relocating centroid connectors to represent minor streets or driveways) to the surrounding roadway system.

Traffic volumes for single-occupancy vehicles (SOVs), HOVs with two persons occupancy vehicles, HOV with 3 persons or more occupancy vehicles, and truck traffic (medium and heavy) will be developed.

The AM and PM peak one hour traffic volumes will be assigned to the project study area using the VISSIM microscopic operations / simulation model. The AM and PM peak hour VISSIM models will be run a total of 20 times using different random seed numbers and the results will be validated to field data.

Using traditional travel demand model validation criteria as shown in Table 5, we will validate the VISSIM model.

Table 5: Traditional Travel Demand Model Validation Criteria

	Criterion	Measure
1.	Freeway traffic volumes:	within 10% of counts.
2.	Intersection volumes: <u>If the existing intersection approach volume is:</u> Less than 100 vehicles: Between 100 and 600: Between 600 and 1,000: Greater than 1,000:	90% of the intersections meet the following criteria: <u>The VISSIM output volume should be within:</u> +/- 25 Percent (75% to 125%) +/- 20 Percent (80% to 120%) +/- 15 Percent (85% to 115%) +/- 10 Percent (90% to 110%)
3.	Average travel times:	Within one standard deviation (i.e. min, max, average) of travel time runs.
4.	Bottleneck locations:	Consistent with field observations.

5.	Queuing on mainline and on-ramps:	Consistent with field observations.

In order to validate the Existing Conditions VISSIM models, adjustments will be made to vehicle performance and driver behavior parameters. To enhance the model's ability to reflect existing conditions, the following parameters may be adjusted:

1. Traffic composition (passenger cars, pickup trucks, SUVs, HOV eligible vehicles, trucks [2-axle though 6-axle])
2. Saturation flow rates (freeways and arterials)
3. Free flow travel speeds (actual versus posted speed limit)
4. Operations of weaving sections
5. Operations of congested ramp merge locations (one-to-one merging)
6. Lane change behavior
7. Vehicle headways (freeway and arterial)
8. Distance between stopped vehicles
9. Gap acceptance at stop-controlled intersections
10. Reaction to amber signals on the parallel arterials

Parameters adjusted to validate/calibrate the model will be documented in the Validation/Calibration Report.

Future Year VISSIM Models

The consultant team will develop the Year 2020 and 2040 No Build models based on the existing conditions model, and use post-processed future year forecasts and O-D distributions generated from the travel demand EMME model to simulate future traffic conditions. The future year preferred alternative models will be developed from the future year No Build model, and the network will be modified to reflect the proposed geometric or operational modifications proposed for the future Build alternative configuration. The future year Build models will also use corresponding post-processed future year forecasts and O-D distributions generated from the travel demand model.

Measures of Effectiveness

The consultant team will collect measures of effectiveness (MOEs) from the VISSIM model to evaluate the preferred alternative. The VISSIM model will be run twenty times with different

seeds. The results from ten runs will be averaged to calculate MOEs leaving out ten run results which are on the extreme side The MOEs used for this analysis could include merge and weave analyses, density and travel time for freeway segments in addition to level of service calculations at the intersections and queues for the arterials. For the study area, the consultant will estimate vehicle miles traveled (VMT), speed and delay. The MOE's will be collected for general purpose traffic only. The intersections that will be analyzed are shown in Table 6.

Table 6. Intersections Analyzed in Study Area

No	ID	Intersection Name
1	636	E Portland Ave / E 27th St
2	746	E Portland Ave / E 28th St
3	641	E Bay St / E 27th St / I-5 SB Off Ramp
4	644	E Bay St / E 28th St / I-5 NB On Ramp
5	492	Port of Tacoma Rd / S Frontage Rd / 12th St E
6	565	Port of Tacoma Rd / Pacific Hwy E
7	660	Port of Tacoma Rd / I-5 Ramps WB
8	659	Port of Tacoma Rd / I-5 Ramps EB
9	753	Port of Tacoma Rd / 20th St E
10	754	Industry Dr E / 20th St E
11	575	54th Ave E / 12th St E
12	677	54th Ave E / Pacific Hwy E
13	678	54th Ave E / I-5 Ramps WB
14	763	54th Ave E / I-5 Ramps EB
15	764	54th Ave E / 20th St E

SECTION 5: MODELS USED TO EVALUATE ALTERNATIVES

A matrix of transportation modeling tools proposed for use in evaluating each of the analysis scenarios is shown in Table 7:

Table 7. Modeling Tools proposed for each Alternative

Models Used	2008		2040	2040		2020		2040		2020	
	Existing Conditions		Screening of Alternatives	No Build		No Build		Preferred Alternative		Preferred Alternative	
	AM	PM	PM	AM	PM	AM	PM	AM	PM	AM	PM
EMME	x	x	x	x	x	x	x	x	x	x	x
VISSIM	x	x	x	x	x	x	x	x	x	x	x

SECTION 6: COLLISION AND SAFETY ANALYSIS METHODOLOGY

The consultant team will conduct a collision and safety analysis for existing conditions on the I-5 mainline and ramps within the study area using the most recent 3-year data provided by WSDOT. The analysis will summarize the number, type, and location of collisions in the corridor by segment on I-5 mainline and at each of the ramps. This collision summary will help to identify factors, such as geometric deficiencies, that contribute to collisions. In addition, the collision rates (per million vehicles) will be summarized by segment on the I-5 mainline and at the ramps. These collision rates will be compared to the average collision rates in Washington State. We will also summarize the most recent WSDOT accident data in the study area.

The method for estimating accident rates for future scenarios includes comparing and applying accident rates for similar facilities to the forecasted volumes. Those accidents that could be eliminated or reduced because of future design improvements will also be identified.

Interchange Justification Report
Port of Tacoma Interchange with I-5
City of Fife, Washington

Appendix B
Operation Analysis Methods and Assumptions Technical Memorandum

FEHR & PEERS
TRANSPORTATION CONSULTANTS

TECHNICAL MEMORANDUM

Date: April 27, 2010

To: Jilma Jimenez, Berger/ABAM

From: Dave Stanek & Natarajan Janarthanan Fehr & Peers

Subject: ***I-5/Port of Tacoma Road Interchange Project – Traffic Operations and Analysis***

SE09-0157

Fehr & Peers analyzed freeway and arterial traffic operations using the VISSIM simulation model This memorandum describes the development of traffic operations simulation model, calibration and validation of existing year model, creating future year models with and without project for 2020 and 2040 and results of operations analysis. For the operations analysis, the study area includes I-705 to SR 18 on I-5, SR 509 to 20th St on Port of Tacoma Road, 12th St to 20th St on 54th Avenue E, and Pacific Highway and 20th St between Port of Tacoma Road and 54th Avenue E. The development of the VISSIM model for the existing year includes three basic components: (1) setup, (2) calibration, and (3) validation. The memorandum also includes tables that show VISSIM parameter changes from default values.

MODEL DEVELOPMENT PROCESS

The VISSIM model was constructed by first drawing the roadway network using aerial photography as a background in VISUM. The number of lanes and the location of lane additions and drops were confirmed by field observations. After the VISUM network was converted to VISSIM, the network coding was refined (additional connectors, etc.) to better reflect field conditions. Driver behavior parameters were adjusted based on field observations. The distribution of vehicle types was also calibrated to local conditions so that the percentage of trucks match traffic counts.

Since micro-simulation models like VISSIM rely on the random arrival of vehicles, multiple runs are needed to provide a reasonable level of statistical accuracy and validity. For each model, thirteen runs were performed, each using a different random seed number. The ten “best” runs (that is, removing the outliers) were averaged to determine the final results.

The VISSIM model was validated to existing conditions using the criteria suggested in *Guidelines for Applying Traffic Microsimulation Modeling Software* (FHWA, 2003) and additional criteria developed by Fehr & Peers. A number of iterations were required to successively adjust the default VISSIM parameters for geometrics and driver behavior until the model was validated to observed conditions.

The calibrated and validated model is used to generate performance measures that are consistent with the *Highway Capacity Manual* (HCM) (Transportation Research Board, 2000). The validated VISSIM model will serve as the basis for future conditions models. The VISSIM model will be revised based on planned roadway improvements and forecasted traffic demand volumes. Then, the model will be run for thirteen iterations using different random seeds, and the results checked for reasonableness. Finally, the

performance measures for intersections, freeway mainline sections, ramp junctions, and travel time segments will be extracted.

MODEL SET-UP

The model setup required the input of geometric, traffic control, and traffic flow data, each of which is described below.

Geometric Data

Roadway geometric data was gathered using aerial photographs, design plans, and field observations. The lane configurations that were taken initially from aerial photographs were confirmed or revised based on field observations.

Traffic Control Data

The cities of Fife and Tacoma provided signal timing sheets for the signalized study intersections. Stop and yield controlled approaches at study intersections were verified during field observations. The posted speed limits for the arterials, freeways, and ramps were collected during field observations.

Traffic Flow Data

Fehr & Peers assembled or collected the following traffic data for the study area.

- I-5 Mainline volumes
- I-5 Ramp volumes
- Intersection turn volumes
- Travel time information on I-5 mainline

I-5 mainline volumes were obtained from WSDOT for the years 2006 thru 2009. WSDOT also provided ramp volumes for 2009. This study used 2006 as the existing year; the model was calibrated with 2006 data. The ramp volumes were converted from 2009 to 2006 values based on the relationship between 2009 and 2006 mainline volumes. In general, 2009 volumes were lower than 2006 volumes.

The intersection turn volumes for 2006 were obtained from WSDOT's "Tacoma/Pierce County HOV Program – I-5 Port of Tacoma Road to King County Line – Transportation Discipline Report August 2008". For the locations where we didn't have intersection turning movements, the counts were obtained from the City of Fife and new counts were ordered. New counts were ordered on Port of Tacoma Road intersections for missing AM or PM counts and truck percentages. In addition, mid-day counts were collected at locations on Port of Tacoma Road intersections to study the truck volume.

Travel time studies were conducted on I-5 mainline for AM and PM peak hour conditions and used in validation of existing year VISSIM model.

Traffic volumes were collected for I-5 mainline, ramp locations and all intersections in the study area for AM and PM peak hour turn moves. In addition travel time data was collected for AM and PM peak hours on mainline I-5. The existing year model we used is for the year 2006. Most of the intersection counts and I-5 mainline counts were for 2006. For locations where we counted new counts, these 2009 counts were factored to get 2006 counts. In general 2009 counts were lower than 2006 by 5 to 9 percent.

MODEL CALIBRATION

Separate models were created for the AM and PM peak periods. Each peak period model has three one-hour intervals: before the peak hour, during the peak hour, and after the peak hour. Averaging across all location where multiple hour counts were available, the pre-peak hour was 84% and 93% of the peak hour volume during the AM and PM peak periods, respectively. For the post-peak hour, the factors were 91% and 99% for the AM and PM peak periods, respectively. These factors were used to determine the pre and post-peak hour volumes.

Adjustments to the VISSIM model focus on the model components related to driver behavior, driver performance, vehicle fleet mix, and vehicle performance. The following VISSIM model parameters are subject to adjustment.

- Vehicle fleet composition (passenger cars, pickup trucks, SUVs, HOV-lane eligible vehicles, medium and heavy trucks, etc.)
- Vehicle headways
- Distance between stopped vehicles (standstill distance)
- Driver behavior when changing lanes
- Driver behavior at merge areas (that is, weaving sections, ramp merges, etc.)

The VISSIM model was calibrated by replacing the default values with the values as shown in Table 1 (during the validation step, these values are further adjusted to refine the VISSIM model).

The default VISSIM input parameter values did not represent study-area conditions. The calibrated values in Table 1 represent field observation and our experiences with similar projects elsewhere. For example, the default vehicle composition contains only standard sedans. However, a significant portion of vehicles in the Puget Sound area (and most U.S. metropolitan areas) are SUVs and light trucks. As a result, the traffic composition has been revised to reflect this condition.

VISSIM uses two base models of driver behavior: one for urban and one for freeway driving conditions. The software distributor, PTV America, recommends using the a modified urban driving behavior for ramp merges and weaving sections since vehicles will better replicate observed operations under congested conditions. Under the urban driving behavior, vehicles will cooperate more with vehicles changing lanes so that on-ramp traffic is less likely to be stuck at a lane drop waiting for a gap in traffic. The urban driving behavior was used for ramp merges and weaving sections in congested areas for the existing conditions model. Table 2 presents other parameter values changed from default values in VISSIM.

TABLE 1 – CALIBRATION ADJUSTMENTS

Category	Parameter	Default Value	Adjusted Value
Vehicle Fleet Composition	Car percentage for sedans	98%	33%
	Car percentage for sports cars	2%	5%
	Car percentage for SUVs/Vans/Pickups	0%	62%
Freeway Lane Changing Behavior	Emergency stop distance (mainline/ramp)	16 ft	150/300 ft
	Anticipatory lane change distance (mainline/ramp)	656 ft	1,500/3,000 ft
	Safety distance reduction factor	0.6	0.1
	Maximum deceleration for cooperative braking	-9.84 ft/s^2	-29.49 ft/s^2
Merge Area Driver Behavior	Average standstill distance	6.56 ft	5.77 ft
	Additive part of safety distance	2.0	1.5
	Multiplicative part of safety distance	3.0	2.25
Arterial Driver Behavior	Wait time before diffusion	60 sec	120 sec

Source: Fehr & Peers, 2010

FEHR & PEERS
TRANSPORTATION CONSULTANTS

Table 2 General VISSIM Assumptions

Parameters not addressed in this document remained its default value/setting.

Type	Location	Section	Assumption	Reason
Base Data	Distribution	Desired Speed	85% Percentile, range - speed limit +/- 4 mph	Instead of default linear distribution, assumes some variation with majority at or near speed limit
	Driving Behavior	Freeway	Safety Distance Reduction Factor = 0.1	This factor was lowered due to drivers willing to accept smaller gaps during peak hour
			Max decel for cooperative braking = -29.49	This factor was lowered due to drivers willing to accept smaller gaps during peak hour
		Merge Area	Based on Urban with standstill distance = 5.77 ft, add part = 1.5, mult part = 2.25	Used to provide better lane changing behavior at merge areas
Traffic	Vehicle Compositions	Cars	33% sedans, 5% sports cars, 62% SUVs/Vans/pickups	To match actual fleet mix
		Trucks	Match Heffron study	Base year forecasting model percentages were adjusted to match counts provided by Heffron
Signal Control	Controllers	Intersections	(used actual timing plans)	
Connectors	Freeway Diverges	Through	Emergency stop distance = 150 ft, Anticipatory lane change distance = 1,500 ft	Increases default "look ahead" distances due to increased speed on freeways
		Off-ramp	Emergency stop distance = 300 ft, Anticipatory lane change distance = 3,000 ft	Increases default "look ahead" distances due to increased speed on freeways
		NB at Bay St Off	Emergency stop distance = 200/500 ft, Anticipatory lane change distance = 3,000/5,000 ft for through/off-ramp	Increased distances at freeway lane drop
		SB at I-705 Off	Emergency stop distance = 200/500 ft, Anticipatory lane change distance = 3,000/5,000 ft for through/off-ramp	Increased distances at freeway lane drop

	Freeway Lane Drop	SB at HOV end	Emergency stop distance = 100 ft, Anticipatory lane change distance = 3,000 ft	Increased distances at freeway lane drop
Vehicle Inputs	All Inputs	Pre-Peak Hour	0-3600: 84%/93% of AM/PM Peak Hour Volume	System-wide factor used to reduce peak hour volumes
		Analysis Time	Peak Hour - 3600 to 7200, Peak Period - 1800 to 9000	Used to appropriately compare data by assuring the same volume is compared between separate runs of the model
		Post-Peak Hour	7200-10800: 91%/99% of AM/PM Peak Hour Volume	System-wide factor used to reduce peak hour volumes
		Classes	Vehicles split into 5 classes: SOV, HOV2, HOV3+, Medium Truck & Heavy Truck	Uses forecasting base year model supplemented by truck counts
Routing Decisions	Static	All	5 Classes have varying routes	Using O-D estimation (TFlowFuzzy in VISUM), network-wide routing decisions developed from forecasting base year model and adjusted to match traffic counts. Then, split among 5 vehicle classes according to mode split from forecasting model
Desired Speed Decisions	Location	Ramps	Staggered Locations Used to Reduce/Increase Speed	Represents cars exiting/entering the interstate decelerating/accelerating
Reduced Speed Areas	Location	Intersections	Used to slow vehicles making turns	Used to slow vehicles making turns at intersections
Priority Rules	Location	Intersections	Used at critical locations	Unlike conflict area, can specify stop bar location. Used for "keep clear" areas so that vehicles do not stop in the middle of intersections
Conflict Areas	Location	Intersections	Right turns, overlapping connectors, conflicting movements at unsig interections, etc.	Allows vehicles on separate links to recognize each other (uses default settings)

MODEL VALIDATION

The parameters affecting the capacity were adjusted so that the observed traffic conditions (speed and queuing) were replicated in the VISSIM models. Table 3 lists the adjustments made to the VISSIM model parameters as part of the validation process.

TABLE 3 – VALIDATION ADJUSTMENTS

Category	Parameter	Initial Value	Adjusted Value(s)
Freeway Lane Changing Behavior	Emergency stop distance (mainline/ramp)	150/300 ft	200/500 ft
	Anticipatory lane change distance (mainline/ramp)	1,500/3,000 ft	3,000/4,500-5,000 ft

Source: Fehr & Peers, 2010

The adjustments listed in Table 3 were made for the ramp diverge locations with lane drops: northbound I-5 at the E Bay Street off-ramp and southbound I-5 at the I-705 off-ramp. To reflect actual driver behavior due to driver familiarity and advanced guide signs, the lane change distanced were increased so that through vehicles modeled did not become trapped in the exiting lane and right-turning vehicles did not stop in the through lanes to wait for a gap to change lanes into the exit lane.

In addition, the southbound lane drop that occurs after the end of the HOV lane was modified to have an emergency stop distance of 100 feet and an anticipatory lane change distance of 3,000 feet. These changes resulted in smoother merging at the lane drop so that vehicles were less likely to stop in the outside lane to wait for a gap to change lanes.

To better match actual traffic operations, the merge area driver behavior was also applied to the following three arterial sections that have substantial vehicle weaving: eastbound E 28th Street from Portland Avenue to E Bay Street, southbound 54th Avenue from Pacific Highway to I-5 Southbound on-ramp, and southbound 54th Avenue from I-5 Northbound off-ramp to 20th Street.

During validation, the VISSIM model output is compared against field data to determine if the output is within acceptable levels. FHWA suggests the following validation criteria (*Guidelines for Applying Traffic Microsimulation Modeling Software*, FHWA, 2003).

- Link volumes for more than 85 percent of cases meet the following criteria:
  - For volumes less than 700 vph, within 100 vph
  - For volumes between 700 and 2,700 vph, within 15 percent
  - For volumes greater than 2,700, within 400 vph
- Link volumes for more than 85 percent of cases have a GEH statistic (a measure of goodness of fit) less than 5
- Sum of link volumes within 5 percent
- Sum of link volumes have a GEH statistic less than 4
- Average travel times within 15 percent (or one minute, if higher) for more than 85 percent of cases

- Individual link speeds have a visually acceptable speed-flow relationship
- Bottlenecks create visually acceptable queuing

Based on our experience, Fehr & Peers has developed the following revised validation criteria to simplify the output post-processing from the VISSIM model.

- Link volumes apply to a subset of critical freeway links
- Peak-hour volumes at intersections within 5 percent of traffic counts for more than 85 percent of cases
- Sum of links and associated GEH applies only to study intersections

Table 4 shows how the results for the existing conditions VISSIM models compared to the validation criteria thresholds. See Attachment A for VISSIM output results.

TABLE 4 – VALIDATION CRITERIA THRESHOLDS COMPARISON

Criteria	Criteria Threshold	% Met Target	AM Peak Hour		PM Peak Hour	
			% Met	Pass/Fail	% Met	Pass/Fail
Freeway Link Volumes						
< 700 vph	100 vph	> 85%	100%	Pass	100%	Pass
between 700 & 2,700 vph	15%	> 85%	100%	Pass	100%	Pass
> 2,700 vph	400 vph	> 85%	100%	Pass	100%	Pass
GEH Statistic	5	> 85%	100%	Pass	100%	Pass
Sum of Intersection Volumes						
Intersections	5%	85%	100%	Pass	100%	Pass
Sum of All Intersections	5%	-	(1.7%)	Pass	(2.1%)	Pass
GEH Statistic	4	-	(1.7)	Pass	(4.0)	Pass
Travel Time						
Travel Paths	15%[1]	> 85%	100%	Pass	**50%**	**Fail**
Visual Inspection						
Queuing	match observations		-	Pass	-	Pass

Notes: **Bold font** indicates that the criteria is not met.
1. For travel times, the criterion is to be within 15% or one minute, if higher.
Source: Fehr & Peers, 2010

The volumes for all freeway mainline and ramp links meet the criteria threshold for both peak periods. Aggregations of link volumes for the total network and for the study interchanges meet the 5 percent tolerance. The GEH statistic criterion was met for the link volumes during both peak periods. The peak period travel times met the validation criteria for AM peak hour and I-5 NB for PM peak hour. The travel time criteria for PM peak hour SB direction did not meet the criteria. The model over-predicted the travel

time by 17%. This could be due to the fact that the travel times were run in 2009 and the model represents 2006. The speed-flow relationship and queuing at bottlenecks were visually inspected and found to be acceptable.

Table 5 compares the measured travel time and the modeled travel time for selected network paths.

TABLE 5 – TRAVEL TIME VALIDATION RESULTS

Segment	AM Peak Hour			PM Peak Hour		
	Observed[1]	Modeled[2]	Difference	Observed[1]	Modeled[2]	Difference
I-5 Southbound from SR 18 on-ramp to I-705 off-ramp	7:27	8:12	+0:45 (+10%)	10:12	8:25	-1:47 (-17%)
I-5 Northbound from I-705 on-ramp to SR 18 off-ramp	8:31	8:13	-0:18 (-4%)	7:55	8:13	+0:18 (+4%)

Notes: Travel time reported in "minutes:seconds" format.
1. Observed travel times were performed in March 2009. The 2009 counts are approximately 10% less than volumes used for the existing conditions model.
2. Modeled volumes represent 2006 conditions, which are approximately 10% higher than 2009 conditions.

Source: Fehr & Peers, 2010.

The modeled queues were compared to observed conditions for the AM and PM peak hours on I-5 and arterials in the study area. The areas where longer queues are observed during PM Peak hour are:

- Pacific Highway and Port of Tacoma Road
- Port of Tacoma Road and I-5 SB on ramp
- Port of Tacoma Road and I-5 NB off ramp
- 54th Avenue and Pacific Highway

EXISTING CONDITIONS ANALYSIS

Using the validated VISSIM models for the AM and PM peak periods, the traffic operations analysis results were determined. The analysis results include a descriptive term known as level of service (LOS). LOS is a measure of traffic operating conditions, which varies from LOS A (the best) to LOS F (the worst). Tables 6 and 7 describe the LOS thresholds from the HCM for intersections and freeway sections, respectively.

TABLE 6– INTERSECTION LOS THRESHOLDS

Level of Service	Description	Average Delay (sec/veh)[1]	
		Signalized	Unsignalized
A		≤ 10	≤ 10
B		> 10 to 20	> 10 to 15
C		> 20 to 35	> 15 to 25
D		> 36 to 55	> 25 to 35
E		> 55 to 80	> 35 to 50
F		> 80	> 50

Note: 1. Delay is reported in seconds per vehicle.
Source: *Highway Capacity Manual* (Transportation Research Board, 2000)

TABLE 7 – FREEWAY MAINLINE AND RAMP JUNCTION/ WEAVE SECTION LOS THRESHOLDS

Level of Service	Description	Density (vplpm)[1]	
		Mainline (Basic)	Ramp / Weave
A	Free-flow speeds prevail. Vehicles are almost completely unimpeded in their ability to maneuver.	≤ 11	≤ 10
B	Free-flow speeds are maintained. The ability to maneuver with the traffic stream is only slightly restricted.	> 11 to 18	> 10 to 20
C	Flow with speeds at or near free-flow speeds. Freedom to maneuver within the traffic stream is noticeably restricted, and lane changes require more care and vigilance on the part of the driver.	> 18 to 26	> 20 to 28
D	Speeds decline slightly with increasing flows. Freedom to maneuver with the traffic stream is more noticeably limited, and the driver experiences reduced physical and psychological comfort.	> 26 to 35	> 28 to 35
E	Operation at capacity. There are virtually no usable gaps within the traffic stream, leaving little room to maneuver. Any disruption can be expected to produce a breakdown with queuing.	> 35 to 45	> 35 to 43
F	Represents a breakdown in flow.	> 45	> 43

Note: 1. Density is reported in vehicles per lane per mile.
Source: *Highway Capacity Manual* (Transportation Research Board, 2000)

Table 8 shows the average delay by approach and overall intersection under existing conditions (see Attachment A for technical calculations backup)

Three of the study intersections have minor street stop-controls and nine are signalized. Two intersections are uncontrolled with the intersection serving a freeway on-ramp. During AM peak hour, all intersections operate at LOS C or better. Of the individual approaches, the westbound approach of the Port of Tacoma Road/I-5 southbound off-ramp operates at LOS E during the AM peak hour.

In the PM peak hour, the signal at E. Portland Avenue/E. 27th Street operates at LOS F with westbound and southbound failing approaches. The E. Portland Avenue/E. 28th Street intersections operates at LOS E overall, with the northbound approach operating at LOS F. The Port of Tacoma Road/Pacific Highway East/I-5 southbound ramps intersection operates at LOS E with the I-5 southbound ramp approach (westbound) and the westbound approach on Pacific Highway S operating at LOS F. The intersection of 54th Avenue E/Pacific Highway E operates at LOS E overall with the eastbound and southbound approaches operating at LOS F. All other intersections operate at LOS D or better overall in the PM peak hour.

TABLE 8
INTERSECTION LEVEL OF SERVICE AND DELAY
EXISTING CONDITIONS

Intersection		Traffic Control	AM Peak Hour					PM Peak Hour				
			NB	SB	EB	WB	Total	NB	SB	EB	WB	Total
1	E. Portland Ave/E. 27th St	Signal	B / 12	B / 12		B / 19	B / 14	D / 36	F / 182		F / 97	F / 133
2	E. Portland Ave/E. 28th St	Signal	B / 14	C / 22	D / 36		C / 21	F / 94	C / 28	D / 49		E / 56
3	E. Bay St/E. 27th St	SSSC		A / 6		A / 2	A / 3		C / 16		B / 14	B / 15
4	E. Bay St/E. 28th St	Signal		B / 20	A / 8		B / 11		C / 32	D / 43		D / 42
5	Port of Tacoma Rd/SR 509 NB Ramps	Signal	B / 13	B / 13	B / 17	A / 1	B / 13	B / 10	A / 9	B / 15	A / 2	B / 10
6	Port of Tacoma Rd/Pacific Hwy	Signal	A / 8	D / 50	D / 54	D / 49	C / 35	B / 13	E / 70	E / 76	F / 110	E / 79
7	Port of Tacoma Rd/I-5 SB Ramps	Signal	D / 39	A / 1		E / 64	C / 33	D / 48	A / 1		F / 91	C / 25
8	Port of Tacoma Rd/I-5 NB Ramps[2]	None	A / 0	A / 7	A / 2		A / 3	A / 0	C / 30	A / 2		A / 10
9	Port of Tacoma Rd/20th St E	SSSC	A / 6	A / 1	B / 13	B / 13	A / 6	B / 14	A / 1	B / 14	A / 7	A / 6
10	Industry Dr E/20th St E	SSSC	C / 26		A / 2	A / 2	A / 7	C / 27		A / 2	A / 2	A / 5
17	54th Ave E/12th St E	Signal	A / 6	A / 5	B / 16	B / 15	A / 8	A / 9	B / 10	B / 19	B / 19	B / 12
18	54th Ave E/Pacific Hwy	Signal	C / 25	D / 44	D / 47	C / 33	C / 35	C / 33	F / 129	F / 131	D / 42	E / 79
19	54th Ave E/I-5 SB Ramps[2]	Signal	A / 7	A / 2		C / 35	B / 12	A / 8	A / 9		D / 55	B / 18
20	54th Ave E/I-5 NB Ramps[2]	None	A / 0	B / 12	A / 9		A / 5	A / 1	E / 66	D / 47		C / 32
21	54th Ave E/20th St E	Signal	D / 42	C / 21	D / 42	C / 23	C / 30	D / 52	C / 24	D / 46	C / 30	D / 35

Notes: SSSC = Side Street Stop Control, None = no control, and **bold font** indicates LOS E or F conditions. Shading indicates intersection LOS and delay according to HCM 2000, which uses the worst approach for unsignalized intersections.

1. Free-flowing loop ramp volume not included in the intersection total.

Source: Fehr & Peers, 2010

Tables 9 and 10 show the average density and level of service at the freeway ramp junctions and mainline sections under existing conditions (see Attachment A for technical calculations).

TABLE 9
FREEWAY LEVEL OF SERVICE AND DENSITY – EXISTING CONDITIONS NORTHBOUND I-5

Location	Type	AM Peak Hour		PM Peak Hour	
		LOS	Density[1]	LOS	Density[1]
I-5 NB on-ramp from I-705	Merge	**E**	**35**	**E**	**42**
I-5 NB off-ramp to E 28th Street/Portland Avenue	Diverge	**E**	**42**	**F**	**44**
I-5 NB Between E 28th St and SR 167 (River Rd)	Basic	**E**	**38**	D	33
I-5 NB off-ramp to E Bay Street	Diverge	**E**	**36**	D	34
I-5 NB between E Bay Street off/on-ramps	Basic	**E**	**38**	D	34
I-5 NB on-ramp from E 28th Street	Merge	D	33	D	29
I-5 NB between E 28th Street. On-ramp and Port of Tacoma Road off-ramp	Basic	D	33	D	29
I-5 NB off-ramp to Port of Tacoma Road SB	Diverge	D	34	D	29
I-5 NB off-ramp to Port of Tacoma Road NB	Diverge	D	30	C	27
I-5 NB between Port of Tacoma Road NB off/on-ramps	Basic	D	30	D	27
I-5 NB on-ramp from Port of Tacoma Road	Merge	C	27	C	26
I-5 NB between Port of Tacoma Road and 54th Avenue E	Basic	D	30	D	29
I-5 NB off-ramp to 54th Avenue E	Diverge	D	31	D	30
I-5 NB between 54th Avenue E on/off ramps	Basic	D	27	C	26
I-5 NB on-ramp from 54th Avenue E	Merge	C	27	D	28
I-5 NB Between 54th Ave on ramp and HOV lane start	Basic	D	29	D	28
I-5 NB Between HOV lane start and Truck Scales off ramp	Basic	D	28	D	28
I-5 NB Truck Scales off-ramp	Diverge	D	29	D	29
I-5 NB Between Truck Scales off-ramp and on-ramp	Basic	D	28	D	28
I-5 NB Truck Scales on-ramp	Merge	D	29	D	30
I-5 NB Between Truck Scales and SR 18	Basic	D	33	D	33
I-5 NB off ramp to SR 18	Diverge	**E**	**39**	**E**	**40**

Note: **Bold** font indicates LOS E or F conditions.

Source: Fehr & Peers, 2010.

TABLE 10
FREEWAY LEVEL OF SERVICE AND DENSITY – EXISTING CONDITIONS SOUTHBOUND I-5

Location	Type	AM Peak Hour		PM Peak Hour	
		LOS	Density[1]	LOS	Density[1]
I-5 SB on-ramp from SR 18	Merge	C	27	D	30
I-5 SB Between SR 18 and Truck Scales	Basic	D	27	D	30
I-5 SB off-ramp to truck scales	Diverge	D	28	D	31
I-5 SB between truck scales off/on-ramps	Basic	D	27	D	30
I-5 SB on-ramp from truck scales	Merge	C	27	D	31
I-5 SB Between Truck Scales and HOV lane end	Basic	D	29	D	34
I-5 SB Between HOV lane end and lane drop	Basic	D	32	**E**	**36**
I-5 SB Between lane drop and 54th Ave	Basic	D	29	D	34
I-5 SB off-ramp to 54th Avenue E	Diverge	D	33	**E**	**38**
I-5 SB between 54th Avenue E on/off ramps	Basic	D	30	**E**	**43**
I-5 SB on-ramp from 54th Avenue E	Merge	C	27	D	29
I-5 SB Between 54th Ave and Port of Tacoma Rd	Basic	D	30	**E**	**36**
I-5 SB off-ramp to Port of Tacoma Road	Diverge	D	31	**E**	**41**
I-5 SB between Port of Tacoma Road off/on-ramps	Basic	D	29	**F**	**56**
I-5 SB on-ramp from Port of Tacoma Road	Merge	D	32	**E**	**39**
I-5 SB off-ramp to Bay Street	Diverge	D	34	**F**	**44**
I-5 SB between Bay Street on/off ramps	Basic	D	28	D	30
I-5 SB on-ramp from Bay Street	Merge	D	33	D	34
I-5 SB between Bay Street and E 27th Street/Portland Avenue	Basic	D	33	**E**	**36**
I-5 SB weave between E 27th Street/Portland Avenue and I-705	Weave	D	33	D	30

Note: **Bold** font indicates LOS E or F conditions.

Source: Fehr & Peers, 2010.

During AM peak hour, six of the 18 northbound freeway segments on I-5 operate at LOS E. These segments are: the I-705 on-ramp; the diverge at off-ramp to E 28th St/Portland Avenue; the segment between Portland Avenue and SR 167 (River Road); the diverge to the SR 167 off-ramp; the segment between SR 167 (River Road) off/on-ramps; and the off-ramp to SR 18. All southbound freeway segments operate at LOS D or better during AM peak hour.

During PM peak hour, three northbound and nine southbound freeway segments operate at LOS E or LOS F. In the northbound direction, the I-705 merge, Portland Avenue diverge, and the SR 18 diverge operate at LOS E or LOS F. All other northbound segments operate at LOS D or better.

In the southbound direction, all but one of the seven segments from the diverge at 54th Avenue E to the diverge at SR 167 operates at LOS E or LOS F. In addition, the basic segments approaching Portland Avenue and south of the HOV lane terminus operate at LOS E. The two failing southbound segments are between the Port of Tacoma Road on-ramps and off-ramps, and the diverge approaching SR 167.

2020 NO BUILD ANALYSIS

Freeway Segment Analysis

The freeway basic mainline segments, merge and diverge, and weaving segments were analyzed for the 2020 No-Build conditions.

The northbound I-5 mainline in the AM peak hour would generally operate at LOS E. Twelve out of twenty mainline segments would operate at LOS E during the AM peak hour. The LOS E segments extend from the 28th Street on-ramp to SR 18. A comparison to the existing conditions shows that only six segments operate at LOS E in the northbound direction in the AM peak hour. However, all of these segments are south of the 28th Street on-ramp. The extension of the HOV lane through the study area will shift the freeway bottleneck location so that segments south of the 28th Street on-ramp will have improved to LOS D while those further north will worsen to LOS E.

The southbound I-5 mainline in the AM peak hour would better than the northbound. Only two segments will operate at LOS E and one will operate at LOS F in the 2020 No Build conditions. The diverge segment at the off-ramp to 54th Avenue E would operate at LOS F due to queues extending back from the local street intersection. In the existing conditions all segments operate at LOS D or better.

During PM peak hour in the northbound I-5 segments, three of 20 segments would operate at LOS E. They are the diverge segment at the off-ramp to E 28th Street/Portland Avenue, the basic segment between Port of Tacoma Road off and on-ramps, and the merge segment at the on-ramp from the truck scales. The analysis of existing conditions show that two segments operate at LOS E and one operates at LOS F.

The I-5 mainline in the southbound direction during PM peak hour would operate with fewer segments at LOS E or F than existing conditions. The extension of the HOV lane south to Tacoma would remove or reduce existing bottlenecks to improve traffic operations.

Tables 11 and 12 summarize the I-5 mainline operations for the 2020 No Build Conditions. Compared with the results for 2006, traffic volumes, density, and congestion have increased significantly under the 2020 no-build condition in the AM peak hour in the northbound directions and in the southbound direction during PM peak hour.

TABLE 11
2020 NO-BUILD I-5 MAINLINE FREEWAY OPERATIONS SUMMARY

	Type	AM Peak Hour		PM Peak Hour	
		LOS	Density[1]	LOS	Density[1]
I-5 Northbound					
I-5 NB on-ramp from I-705	Merge	D	29	D	35
I-5 NB off-ramp to E 28th Street/Portland Avenue	Diverge	C	28	**E**	**36**
I-5 NB off-ramp to E Bay Street	Diverge	D	31	D	34
I-5 NB between E Bay Street off/on-ramps	Basic	D	33	D	27
I-5 NB on-ramp from E 28th Street	Merge	D	31	C	25
I-5 NB between E 28th Street. On-ramp and Port of Tacoma Road off-ramp	Basic	**E**	**35**	D	29
I-5 NB off-ramp to Port of Tacoma Road SB	Diverge	**E**	**36**	D	30
I-5 NB off-ramp to Port of Tacoma Road NB	Diverge	**E**	**41**	D	33
I-5 NB between Port of Tacoma Road NB off/on-ramps	Basic	**E**	**41**	**E**	**35**
I-5 NB on-ramp from Port of Tacoma Road	Merge	C	27	C	24
I-5 NB between Port of Tacoma Road and 54th Avenue E	Basic	**E**	**36**	D	32
I-5 NB off-ramp to 54th Avenue E	Diverge	**E**	**37**	D	33
I-5 NB between 54th Avenue E on/off ramps	Basic	D	30	D	26
I-5 NB on-ramp from 54th Avenue E	Merge	**E**	**41**	D	33
I-5 NB between 54th Avenue E on ramp and truck scales off ramp	Basic	**E**	**37**	D	32
I-5 NB off-ramp to truck scales	Diverge	**E**	**37**	D	33
I-5 NB between truck scales off/on-ramps	Basic	**E**	**39**	D	35
I-5 NB on-ramp from truck scales	Merge	**E**	**43**	**E**	**40**
I-5 NB between truck scales and SR 18	Basic	**E**	**39**	D	35
I-5 NB off-ramp to SR 18	Diverge	D	33	D	31

Note:
Average volumes based on 13 VISSIM runs.
Bold indicates unacceptable operation.
1. Modeled traffic volume expressed as a percent of observed traffic volume.
For example: 100 % indicates an exact replication of field conditions.

Source: Fehr & Peers, 2010.

Table 12

TABLE 12
2020 NO-BUILD I-5 MAINLINE FREEWAY OPERATIONS SUMMARY

	Type	AM Peak Hour		PM Peak Hour	
		LOS	Density[1]	LOS	Density[1]
I-5 Southbound					
I-5 SB on-ramp from SR 18	Merge	C	24	C	26
I-5 SB between SR 18 and truck scales	Basic	D	26	D	31
I-5 SB off-ramp to truck scales	Diverge	C	25	C	28
I-5 SB between truck scales off/on-ramps	Basic	D	26	D	30
I-5 SB on-ramp from truck scales	Merge	C	25	C	28
I-5 SB between truck scales and 54th Avenue E off ramp	Basic	D	27	D	30
I-5 SB off-ramp to 54th Avenue E	Diverge	**F**	**46**	**E**	**36**
I-5 SB between 54th Avenue E on/off ramps	Basic	C	24	D	28
I-5 SB on-ramp from 54th Avenue E	Merge	D	31	D	34
I-5 SB off-ramp to Port of Tacoma Road	Diverge	D	32	D	34
I-5 SB between Port of Tacoma Road off/on-ramps	Basic	D	29	D	32
I-5 SB on-ramp from Port of Tacoma Road	Merge	D	28	D	34
I-5 SB off-ramp to Bay Street	Diverge	C	27	D	34
I-5 SB between Bay Street on/off ramps	Basic	D	29	D	33
I-5 SB on-ramp from Bay Street	Merge	D	34	D	29
I-5 SB between Bay Street and E 27th Street/Portland Avenue	Basic	**E**	**38**	D	32
I-5 SB weave between E 27th Street/Portland Avenue and I-705	Weave	**E**	**40**	D	35

Note:
Average volumes based on 13 VISSIM runs.
1. Modeled traffic volume expressed as a percent of observed traffic volume.
For example: 100 % indicates an exact replication of field conditions.

Source: Fehr & Peers, 2010.

Intersection Analysis

With these system improvements, the traffic volumes and LOS operation were calculated for each of the study area intersections. As part of corridor improvements, study intersections are planned to be improved by 2020 with additional turn lanes or other traffic control improvements. The 20th Street East/Port of Tacoma Road and 20th Street East/Industry Drive stop-controlled intersections are planned to be signalized during this period.

During the AM peak hour, the intersection of Port of Tacoma Road and I-5southbound ramps and the intersection of 54th Avenue East/20th Street East would operate at LOS E under No Build conditions. All other study intersection would operate at LOS D or better. During the PM peak hour, six intersections would operate at LOS E or F under No Build conditions. The longest delay would occur at the intersection of 54th Avenue East and Pacific Highway. All other study intersection would operate at LOS D or better.

Table 13 summarizes the LOS operation and calculated delay for the AM and PM peak hours for the study intersections for the 2020 No-Build analysis.

Intersection Analysis

Table 13

TABLE 13
INTERSECTION LEVELS OF SERVICE
2020 PEAK HOUR CONDITIONS – NO BUILD

Intersection		Traffic Control	AM Peak Hour					PM Peak Hour				
			NB	SB	EB	WB	Total	NB	SB	EB	WB	Total
1	E. Portland Ave/E. 27th St	Signal	C / 29	B / 15		D / 43	C / 28	D / 44	**F / 81**		**E / 65**	**E / 71**
2	E. Portland Ave/E. 28th St	Signal	D / 35	B / 16	**E / 56**		D / 38	C / 33	B / 15	C / 34		C / 23
3	E. Bay St/E. 27th St	SSSC		A / 8		A / 2	A / 4		B / 13		A / 4	A / 5
4	E. Bay St/E. 28th St	Signal		B / 15	A / 7		A / 8		C / 25	B / 13		B / 14
5	Port of Tacoma Rd/I-509 EB Ramps	Signal	B / 14	B / 14	B / 17	B / 15	B / 15	B / 13	B / 19	B / 16	B / 14	B / 16
6	Port of Tacoma Rd/Pacific Hwy	Signal	B / 12	**F / 86**	D / 52	D / 48	D / 45	B / 11	**F / 146**	**E / 76**	**E / 66**	**E / 75**
7	Port of Tacoma Rd/I-5SB Ramps	Signal	**F / 122**	A / 1		**E / 74**	**E / 78**	**F / 140**	A / 1		**E / 79**	**E / 62**
8	Port of Tacoma Rd/I-5 NB Ramps	Unct.	A / 1	A / 3	A / 4		A / 3	A / 5	A / 9	A / 4		A / 6
9	Port of Tacoma Rd/20th St E	Signal	B / 14	A / 8	B / 14	A / 5	A / 8	C / 25	A / 10	C / 24	**E / 65**	D / 38
10	Industry Dr. E/20th St E	Signal	C / 21		A / 9	A / 6	B / 11	**E / 63**		A / 10	**F / 171**	**F / 85**
11	54th Ave E/12th St E	Signal	A / 9	A / 10	D / 50	D / 44	B / 17	B / 18	D / 50	**F / 116**	D / 52	D / 47
12	54th Ave E/Pacific Hwy	Signal	C / 28	D / 39	**E / 56**	D / 51	D / 42	C / 32	**F / 112**	**F / >200**	**F / 158**	**F / >200**
13	54th Ave E/I-5 SB Ramps	Signal	A / 10	A / 4		**F / 114**	D / 37	C / 32	C / 33		C / 30	C / 32
14	54th Ave E/I-5 NB Ramps	Unct.	A / 6	C / 28	C / 35		B / 17	A / 3	**E / 72**	B / 11		C / 30
15	54th Ave E/20th St E	Signal	**E / 78**	C / 25	D / 52	**F / 188**	**E / 79**	**F / >200**	A / 1	**F / 125**	D / 40	**F / 92**

Note:
SSSC = Side-Street Stop-Controlled. Unct. = Uncontrolled

Source: Fehr & Peers, 2010.

2020 PROPOSED ALLTERNATIVE ANALYSIS

Freeway Segment Analysis

The freeway mainline, merge and diverge points, and weaving segments were analyzed for the Proposed and No-Build alternatives in the year of opening. Tables 14 and 15 summarize the I-5 mainline operations for the 2020 Proposed Alternative.

In the AM peak hour, four of the I-5 northbound and one of the I-5 southbound mainline segments would improve to LOS D or better with the Proposed Alternative. However, Of the 19 mainline segments, eight segments in I-5 northbound direction would continue to operate at LOS E or F in the AM peak hour for the 2020 Proposed Alternative. Of the five merge/diverge/weave segments in the northbound direction would operate at LOS E. In the southbound direction, one mainline segment and one merge/diverge/weave segment would operate at LOS E during the AM peak hour for the 2020 Proposed Alternative.

In the PM peak hour, I-5 southbound operations would improve to operate at LOS D or better, with the exception of two segments, the diverge segment at the off ramp to 54th Avenue East and the merge segment on ramp from Port of Tacoma Road/34th Avenue. Northbound freeway segments are expected to continue to operate at LOS D or better except for the diverge segment at the off ramp to East 28th Street/Portland Avenue and the merge segment at the on ramp from truck scale. The operation at the basic mainline segment between Port of Tacoma Road northbound on and off ramp would improve to LOS D.

TABLE 14
2020 PROPOSED ALTERNATIVE I-5 MAINLINE FREEWAY OPERATIONS SUMMARY

	Type	AM Peak Hour		PM Peak Hour	
		LOS	Density[1]	LOS	Density[1]
I-5 Northbound					
I-5 NB on-ramp from I-705	Merge	C	28	D	35
I-5 NB off-ramp to E 28th Street/Portland Avenue	Diverge	C	27	**E**	**36**
I-5 NB off-ramp to E Bay Street	Diverge	D	31	D	34
I-5 NB between E Bay Street off/on-ramps	Basic	D	32	D	28
I-5 NB on-ramp from E 28th Street	Merge	D	30	C	25
I-5 NB between E 28th Street. On-ramp and Port of Tacoma Road off-ramp	Basic	D	31	D	26
I-5 NB off-ramp to Port of Tacoma Road/34th Ave	Diverge	D	31	C	26
I-5 NB between Port of Tacoma Road NB off/on-ramps	Basic	D	33	D	29
I-5 NB on-ramp from Port of Tacoma Road/34th Ave	Merge	D	30	C	28
I-5 NB between Port of Tacoma Road and 54th Avenue E	Basic	**E**	**35**	D	32
I-5 NB off-ramp to 54th Avenue E	Diverge	**E**	**36**	D	33
I-5 NB between 54th Avenue E on/off ramps	Basic	D	29	D	26
I-5 NB on-ramp from 54th Avenue E	Merge	**E**	**35**	D	32
I-5 NB between 54th Avenue E on ramp and truck scales off ramp	Basic	**E**	**35**	D	32
I-5 NB off-ramp to truck scales	Diverge	**E**	**35**	D	33
I-5 NB between truck scales off/on-ramps	Basic	**E**	**37**	D	34
I-5 NB on-ramp from truck scales	Merge	**E**	**41**	**E**	**40**
I-5 NB between truck scales and SR 18	Basic	**E**	**37**	D	35
I-5 NB off-ramp to SR 18	Diverge	D	31	D	31

Note:
Average volumes based on 13 VISSIM runs.
Bold indicates unacceptable operation.
1. Modeled traffic volume expressed as a percent of observed traffic volume.
For example: 100 % indicates an exact replication of field conditions.

Source: Fehr & Peers, 2010.

TABLE 15
2020 PROPOSED ALTERNATIVE I-5 MAINLINE FREEWAY OPERATIONS SUMMARY

	Type	AM Peak Hour		PM Peak Hour	
		LOS	Density[1]	LOS	Density[1]
I-5 Southbound					
I-5 SB on-ramp from SR 18	Merge	C	23	C	26
I-5 SB between SR 18 and truck scales	Basic	C	26	D	31
I-5 SB off-ramp to truck scales	Diverge	C	24	C	28
I-5 SB between truck scales off/on-ramps	Basic	C	25	D	30
I-5 SB on-ramp from truck scales	Merge	C	24	C	28
I-5 SB between truck scales on ramp and 54th Avenue E off ramp	Basic	C	26	D	31
I-5 SB off ramp to 54th Ave E	Diverge	D	32	**E**	**38**
I-5 SB between 54th Avenue E on/off ramps	Basic	C	22	D	28
I-5 SB on-ramp from 54th Avenue E	Merge	D	30	D	33
I-5 SB off-ramp to Port of Tacoma Road/34th Ave	Diverge	D	31	D	34
I-5 SB between Port of Tacoma Road off/on-ramps	Basic	D	28	D	32
I-5 SB on-ramp from Port of Tacoma Road/34th Ave	Merge	C	28	**E**	**36**
I-5 SB off-ramp to Bay Street	Diverge	C	27	D	34
I-5 SB between Bay Street on/off ramps	Basic	D	28	D	34
I-5 SB on-ramp from Bay Street	Merge	D	33	D	30
I-5 SB between Bay Street and E 27th Street/Portland Avenue	Basic	**E**	**36**	D	33
I-5 SB weave between E 27th Street/Portland Avenue and I-705	Weave	**E**	**36**	D	35

Note:
Average volumes based on 13 VISSIM runs.
1. Modeled traffic volume expressed as a percent of observed traffic volume.
For example: 100 % indicates an exact replication of field conditions.

Source: Fehr & Peers, 2010.

Intersection Analysis

The intersection analysis for the year of opening was based on the HCM2000 methods for unsignalized and signalized intersections. Using the forecasted volumes for 2020, the study area intersections were evaluated to calculate the performance of intersection operations during the AM and PM peak hours. The analysis includes the intersections formed by the Proposed Alternative. Table 16 presents the results of intersection analysis for 2020 AM and PM peak hour for the Proposed Alternative.

The Proposed Alternative changes the operation of intersections on Port of Tacoma Road, creating a one-way couplet with southbound traffic traveling on Port of Tacoma Road and northbound traffic on 34th Avenue E.

In the 2020 AM peak hour, all intersections would operate overall at LOS D or better in the Proposed Alternative. The westbound, eastbound and southbound approaches at the intersection of 54th Avenue E/Pacific Highway E operate at LOS E or F. The northbound approach at the intersection of 54th Avenue East and 20th Street operates at LOS E.

In the 2020 PM peak hour, four intersections would still operate overall at LOS E or F in the Proposed Alternative, which include three intersections along 54th Avenue East, intersections at East 12th Street, Pacific Highway and East 20th Street and the intersection of East Portland Avenue and East 27th Street.

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Table 16

TABLE 16
INTERSECTION LEVELS OF SERVICE
2020 PEAK HOUR CONDITIONS – PROPOSED ALTERNATIVE

Intersection		Traffic Control	AM Peak Hour					PM Peak Hour				
			NB	SB	EB	WB	Total	NB	SB	EB	WB	Total
1	E Portland Ave/E 27th St	Signal	C / 21	B / 15		E / 63	C / 29	C / 34	**F / 127**		**F / 82**	**F / 99**
2	E Portland Ave/E 28th St	Signal	D / 36	B / 16	D / 51		D / 36	C / 26	B / 17	C / 32		C / 22
3	E Bay St/E 27th St	SSSC		A / 10		A / 2	A / 5		C / 15		A / 4	A / 6
4	E Bay St/E 28th St	Signal		B / 15	A / 7		A / 9		C / 23	B / 12		B / 13
5	Port of Tacoma Rd/SR-509 NB Ramps-12th Ave	Signal		A / 10	C / 24	B / 18	B / 18		A / 8	B / 17	B / 17	B / 13
6	Port of Tacoma Rd/Pacific Hwy	Signal		C / 31	B / 20	B / 11	C / 22		C / 35	D / 47	B / 17	C / 27
7	Port of Tacoma Rd/I-5 SB Ramps	Signal		A / 1		C / 32	B / 12		A / 4		C / 33	B / 11
8	Port of Tacoma Rd/I-5 NB Ramps	Signal		A / 6	C / 30		C / 23		A / 7	C / 23		B / 17
9	Port of Tacoma Rd/20th St	Signal	A / 8	A / 8	D / 44	D / 36	B / 18	A / 9	A / 8	D / 38	D / 40	C / 21
10	Industry Dr/20th St	Signal	D / 44		A / 5	A / 6	B / 13	D / 43		A / 2	A / 8	B / 11
17	54th Ave/12th St	Signal	B / 15	B / 12	D / 48	D / 42	B / 19	B / 18	**E / 80**	**F / >200**	**E / 56**	**E / 78**
18	54th Ave/Pacific Hwy	Signal	C / 27	**F / 103**	**E / 56**	**E / 56**	D / 54	C / 26	**F / 188**	**F / >200**	**E / 58**	**F / >200**
19	54th Ave/I-5 SB Ramps	Signal	B / 19	A / 2		D / 51	C / 23	D / 42	D / 36		D / 52	D / 43
20	54th Ave/I-5 NB Ramps	Signal	A / 2	D / 36	C / 24		B / 15	A / 3	**E / 76**	B / 16		C / 31
21	54th Ave/20th St	Signal	**E / 60**	C / 27	D / 45	D / 44	D / 43	**F / >200**	**F */**	**F / 146**	D / 39	**F / 96**
22	34th Ave/Pacific Hwy	Signal	B / 14		C / 24	D / 36	C / 24	**E / 59**		**F / 110**	C / 22	D / 41
23	34th Ave/I-5 SB Ramps	Signal	A / 7			D / 46	B / 12	A / 6			D / 46	B / 12
24	34th Ave/I-5 NB Ramps	Signal	B / 12		C / 27		C / 21	A / 4		D / 41		B / 16
25	34th Ave/20th St	Signal			A / 2	A / 3	A / 2			B / 19	A / 9	B / 14

Note:
SSSC = Side-Street Stop-Controlled.

Source: Fehr & Peers, 2010.

2040 NO BUILD ANALYSIS

Freeway Segment Analysis

For the freeway mainline, the basic, merge and diverge, and weaving segments were analyzed for the 2040 No-Build conditions for comparison with the design year for the Proposed Alternative. The 2040 analysis includes regional improvements to I-5 including the extension of the HOV lanes through the study area and the construction of the SR-167 extension project. Tables 17 and 18 summarize the LOS operation for the northbound and southbound directions for the 2040 No-Build Alternative.

The northbound I-5 mainline in the AM peak hour would be congested through the study corridor. Of the 27 mainline segments in the northbound direction, 24 would operate at LOS E or F during the AM peak hour for 2040 No Build Conditions. Of the 16 merge/diverge/weave segments in the northbound direction, 14 would operate at either LOS E or LOS F. The northbound I-5 mainline segments in the PM peak hour would operate at similar LOS with AM. Twenty two segments out of total twenty seven segments would operate at LOS E or F. The most congested segment is at East 28th Street interchange in the AM peak hour and at truck scale interchange in the PM peak hour.

In the southbound direction, 18 segments would operate at LOS E or LOS F in the AM peak hour and 15 segments would operate at LOS E or F in the PM peak hour. The most congested segment is at 54th Avenue East interchange in the AM peak hour and at truck scale interchange in the PM peak hour.

A comparison to existing conditions or 2020 No Build shows that the freeway segments would operate severally congested during 2040 No Build conditions.

Table 1-18 shows the 2020 No Build I-5 mainline freeway LOS and density for all segments within the study area.

TABLE 17
2040 NO-BUILD I-5 MAINLINE FREEWAY OPERATIONS SUMMARY

	Type	AM Peak Hour		PM Peak Hour	
		LOS	Density[1]	LOS	Density[1]
I-5 Northbound					
I-5 NB on-ramp from I-705	Merge	**F**	**107**	**E**	**36**
I-5 NB off-ramp to E 28th Street/Portland Avenue	Diverge	**F**	**100**	**E**	**37**
I-5 NB off-ramp to E Bay Street	Diverge	**F**	**104**	**E**	**38**
I-5 NB between E Bay Street off/on-ramps	Basic	**F**	**106**	**E**	**36**
I-5 NB on-ramp from E 28th Street	Merge	**F**	**110**	D	31
I-5 NB between E 28th Street. On-ramp and Port of Tacoma Road off-ramp	Basic	**F**	**101**	D	32
I-5 NB off-ramp to Port of Tacoma Road SB	Diverge	**F**	**100**	**E**	**41**
I-5 NB off-ramp to Port of Tacoma Road NB	Diverge	**F**	**94**	**E**	**40**
I-5 NB between Port of Tacoma Road NB off/on-ramps	Basic	**F**	**66**	**E**	**37**
I-5 NB on-ramp from Port of Tacoma Road	Merge	**F**	**75**	**E**	**39**
I-5 NB between Port of Tacoma Road and 54th Avenue E	Basic	**F**	**67**	**E**	**42**
I-5 NB off-ramp to 54th Avenue E	Diverge	**F**	**70**	**F**	**50**
I-5 NB off-ramp to SR 167	Diverge	D	31	**E**	**37**
I-5 NB off-ramp to SR 167 HOV	Diverge	C	24	C	25
I-5 NB between SR 167 HOV and 54th Avenue E on-ramps	Basic	D	31	D	28
I-5 NB on-ramp from 54th Avenue E	Merge	**E**	**39**	**E**	**37**
I-5 NB between 54th Avenue E and SR 167 HOV	Basic	**F**	**47**	**E**	**41**
I-5 NB on-ramp from SR 167 HOV	Merge	**E**	**42**	D	32
I-5 NB between SR 167 HOV and SR 167	Basic	**F**	**53**	**F**	**47**
I-5 NB on-ramp from SR 167	Merge	**E**	**36**	**E**	**36**
I-5 NB between SR 167 and 6-lane section ends	Basic	**E**	**44**	**E**	**41**
I-5 NB between 5-lane section and truck scales off-ramp	Basic	**F**	**53**	**F**	**48**
I-5 NB off-ramp to truck scales	Diverge	**F**	**51**	**F**	**48**
I-5 NB between truck scales off/on-ramps	Basic	**F**	**49**	**F**	**50**
I-5 NB on-ramp from truck scales	Merge	**F**	**53**	**F**	**53**
I-5 NB between truck scales and SR 18	Basic	**F**	**47**	**F**	**46**
I-5 NB off-ramp to SR 18	Diverge	**E**	**39**	**E**	**40**

Note: Average volumes based on 13 VISSIM runs. **Bold** indicates unacceptable operation.
1. Modeled traffic volume expressed as a percent of observed traffic volume. For example: 100 % indicates an exact replication of field conditions.

Source: Fehr & Peers, 2010.

TABLE 1-18
2040 NO-BUILD I-5 MAINLINE FREEWAY OPERATIONS SUMMARY

	Type	AM Peak Hour		PM Peak Hour	
		LOS	Density[1]	LOS	Density[1]
I-5 Southbound					
I-5 SB on-ramp from SR 18	Merge	D	29	**F**	**79**
I-5 SB between SR 18 and truck scales	Basic	**E**	**37**	**F**	**90**
I-5 SB off-ramp to truck scales	Diverge	D	30	**F**	**92**
I-5 SB between truck scales off/on-ramps	Basic	**E**	**36**	**F**	**91**
I-5 SB on-ramp from truck scales	Merge	D	31	**F**	**100**
I-5 SB between truck scales and 5-lane section ends	Basic	**E**	**39**	**F**	**78**
I-5 SB between 6-lane section and SR 167	Basic	**E**	**36**	**E**	**35**
I-5 SB off-ramp to SR 167	Diverge	**E**	**37**	D	31
I-5 SB off-ramp to SR 167 HOV	Diverge	**E**	**37**	D	31
I-5 SB between SR 167 HOV end and 54th Avenue E	Basic	**F**	**47**	D	29
I-5 SB off-ramp to 54th Avenue E	Diverge	**F**	**52**	C	20
I-5 SB between 54th Avenue E and SR 167 HOV	Basic	**F**	**72**	D	27
I-5 SB on-ramp from SR 167 HOV	Merge	**F**	**71**	C	25
I-5 SB on-ramp from SR 167	Merge	**F**	**118**	D	28
I-5 SB between SR 167 and 54th Avenue E	Basic	**F**	**79**	**E**	**38**
I-5 SB on-ramp from 54th Avenue E	Merge	**F**	**121**	**E**	**35**
I-5 SB off-ramp to Port of Tacoma Road	Diverge	**F**	**88**	**F**	**53**
I-5 SB between Port of Tacoma Road off/on-ramps	Basic	D	32	**E**	**37**
I-5 SB on-ramp from Port of Tacoma Road	Merge	D	33	**E**	**36**
I-5 SB off-ramp to Bay Street	Diverge	**E**	**40**	**E**	**41**
I-5 SB between Bay Street on/off ramps	Basic	D	32	**E**	**38**
I-5 SB on-ramp from Bay Street	Merge	**E**	**35**	D	34
I-5 SB between Bay Street and E 27th Street/Portland Avenue	Basic	**E**	**36**	D	34
I-5 SB weave between E 27th Street/Portland Avenue and I-705	Weave	**E**	**36**	**E**	**36**

Note:
Average volumes based on 13 VISSIM runs.
1. Modeled traffic volume expressed as a percent of observed traffic volume.
For example: 100 % indicates an exact replication of field conditions.

Source: Fehr & Peers, 2010.

Intersection Analysis

The operational analysis of the 15 intersections within the study area includes system improvements listed in Table 1-1 for the 2040 No-Build analysis. Assuming that these improvements are in place by 2040, the traffic volumes and LOS operation were calculated for each of the study area intersections.

There will be significant congestion during the 2040 peak periods under No-build conditions. During the AM peak hour, a total of six intersections would operate LOS F including three intersections along Port of Tacoma Road between the SR 509 ramps to the southbound I-5 ramps would operate at LOS F. The intersections along 54th Avenue East would operate at LOS F during the AM peak hour except the intersections at ramps.

During the PM peak hour, seven of the 15 intersections would operate at LOS F under No Build conditions, including three along Port of Tacoma Road – the I-509 Ramps, Pacific Highway E, and the I-5 southbound ramps. Other failing intersections in the study area would include: E Portland Avenue/E 27th Street; 54th Avenue E/12th Street E; 54th Avenue E/Pacific Highway E; and Industry Drive E/20th Street E. The remaining eight study intersection would operate at LOS D or better.

Table 19 summarizes the LOS operation and calculated delay for the AM and PM peak hours for the study intersections for the 2040 No-Build analysis.

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TRANSPORTATION CONSULTANTS

Table 19

TABLE 19
INTERSECTION LEVELS OF SERVICE
2040 PEAK HOUR CONDITIONS – NO BUILD

Intersection		Traffic Control	AM Peak Hour					PM Peak Hour				
			NB	SB	EB	WB	Total	NB	SB	EB	WB	Total
1	E. Portland Ave/E. 27th St	Signal	C / 22	B / 13		D / 43	C / 23	C / 29	**F / 122**		**E / 57**	**F / 86**
2	E. Portland Ave/E. 28th St	Signal	C / 28	B / 12	**E / 75**		C / 34	C / 30	B / 14	D / 39		C / 24
3	E. Bay St/E. 27th St	SSSC		B / 14		A / 2	A / 7		A / 8		A / 2	A / 3
4	E. Bay St/E. 28th St	Signal		C / 33	A / 9		B / 13		C / 29	B / 16		B / 17
5	Port of Tacoma Rd/I-509 EB Ramps	Signal	B / 17	**F / 170**	**F / 126**	C / 23	**F / 91**	B / 13	**F / >200**	**F / >200**	A / 0	**F / >200**
6	Port of Tacoma Rd/Pacific Hwy	Signal	A / 9	**F / >200**	**F / >200**	**E / 67**	**F / 175**	B / 19	**F / >200**	**F / >200**	**F / >200**	**F / >200**
7	Port of Tacoma Rd/ I-5 SB Ramps	Signal	**F / 115**	A / 1		**F / >200**	**F / >200**	**F / 122**	A / 1		**F / >200**	**F / 144**
8	Port of Tacoma Rd/I-5 NB Ramps	Unct.	A / 4	A / 10	D / 38		B / 15	A / 4	C / 28	A / 3		B / 12
9	Port of Tacoma Rd/20th St E	Signal	B / 15	B / 14	B / 19	D / 35	C / 21	C / 27	B / 15	B / 18	**E / 56**	D / 36
10	Industry Dr. E/20th St E	Signal	**E / 70**		B / 14	D / 48	D / 36	**F / >200**		C / 21	**F / >200**	**F / 165**
17	54th Ave E/12th St E	Signal	B / 16	**F / >200**	**F / 146**	**E / 63**	**F / 119**	B / 16	**F / >200**	**F / >200**	**F / 169**	**F / >200**
18	54th Ave E/Pacific Hwy	Signal	A / 4	**F / >200**	**F / >200**	**F / >200**	**F / >200**	D / 46	**F / >200**	**F / 91**	**F / >200**	**F / 184**
19	54th Ave E/I-5 SB Ramps	Signal	D / 37	**F / 98**		D / 35	D / 44	C / 22	A / 5		D / 53	B / 18
20	54th Ave E/I-5 NB Ramps	Unct.	B / 19	D / 52	D / 54		C / 32	A / 1	C / 27	D / 37		B / 14
21	54th Ave E/20th St E	Signal	**F / >200**	B / 19	**E / 78**	**F / >200**	**F / 137**	**E / 61**	D / 35	D / 50	**E / 65**	D / 50

Note:
SSSC = Side-Street Stop-Controlled. Unct. = Uncontrolled
>200 = Delay calculated beyond 200 seconds.

Source: Fehr & Peers, 2010.

2040 PROPOSED ALTERNATIVE ANALYSIS

Freeway Segment Analysis

The freeway basic, merge, diverge, and weaving mainline segments were analyzed for the Proposed Alternative in the year of opening. Tables 20 and 21 summarize the I-5 mainline operations for the 2040 Proposed Alternative.

In the 2040 design year, most of the I-5 segments in the northbound direction would operate at LOS E or F during the AM peak hour. Of the 26 freeway segments in the northbound direction, 17 would operate at LOS F and five at LOS E during the AM peak hour for the 2040 Proposed Alternative. Of the 15 merge/diverge/weave segments in the northbound direction, all but 3 would operate at LOS E or LOS F. During the PM peak hour all but nine segments would operate LOS E or F. Six segments would operate LOS F and 11 would operate LOS E during the PM peak hour for the 2040 Proposed Alternative. A comparison to the 2040 No Build reveals only slight improvement with the preferred alternative. The objective of this project is focused on the Port of Tacoma Road and its interchange with I-5. And it is not surprising that the freeway mainline operations are not improved significantly with the project.

In the southbound direction, four basic segments and five merge/diverge/weave segments would operate at LOS E during the AM peak hour for the 2040 Proposed Alternative. None of the southbound freeway segments would operate at LOS F. This is significant improvement compared to the No Build conditions with 18 segments operating at LOS E or F. During PM peak hour seven basic segments and seven merge/diverge/weave segments would operate at LOS E or F. This in comparison to 2040 No Build improves only one segment from LOS E to LOS D.

TABLE 20
2040 PROPOSED ALTERNATIVE I-5 MAINLINE FREEWAY OPERATIONS

	Type	AM Peak Hour		PM Peak Hour	
		LOS	Density[1]	LOS	Density[1]
I-5 Northbound					
I-5 NB on-ramp from I-705	Merge	D	33	D	34
I-5 NB off-ramp to E 28th Street/Portland Avenue	Diverge	**E**	**38**	**E**	**36**
I-5 NB off-ramp to E Bay Street	Diverge	**E**	**41**	**E**	**37**
I-5 NB between E Bay Street off/on-ramps	Basic	**E**	**42**	**E**	**35**
I-5 NB on-ramp from E 28th Street	Merge	**E**	**41**	D	30
I-5 NB between E 28th Street. On-ramp and Port of Tacoma Road off-ramp	Basic	**F**	**45**	D	31
I-5 NB off-ramp to Port of Tacoma Road/34th Ave	Diverge	**F**	**48**	D	35
I-5 NB between Port of Tacoma Road NB off/on-ramps	Basic	**F**	**50**	**E**	**36**
I-5 NB on-ramp from Port of Tacoma Road/34th Ave	Merge	**F**	**68**	**E**	**39**
I-5 NB between Port of Tacoma Road and 54th Avenue E	Basic	**F**	**58**	**E**	**41**
I-5 NB off-ramp to 54th Avenue E	Diverge	**F**	**57**	**F**	**51**
I-5 NB off-ramp to SR 167	Diverge	D	32	**E**	**37**
I-5 NB off-ramp to SR 167 HOV	Diverge	C	23	C	23
I-5 NB between SR 167 HOV and 54th Avenue E on-ramps	Basic	D	31	D	27
I-5 NB on-ramp from 54th Avenue E	Merge	**F**	**46**	D	34
I-5 NB between 54th Avenue E and SR 167 HOV	Basic	**F**	**56**	**E**	**40**
I-5 NB on-ramp from SR 167 HOV	Merge	**F**	**58**	D	32
I-5 NB between SR 167 HOV and SR 167	Basic	**F**	**61**	**F**	**46**
I-5 NB on-ramp from SR 167	Merge	**F**	**56**	D	34
I-5 NB between SR 167 and truck scales off-ramp	Basic	**F**	**78**	**E**	**40**
I-5 NB between SR 167 and truck scales off-ramp	Basic	**F**	**72**	**F**	**46**
I-5 NB off-ramp to truck scales	Diverge	**F**	**73**	**F**	**44**
I-5 NB between truck scales off/on-ramps	Basic	**F**	**54**	**F**	**48**
I-5 NB on-ramp from truck scales	Merge	**F**	**55**	**F**	**51**
I-5 NB between truck scales and SR 18	Basic	**F**	**50**	**E**	**44**
I-5 NB off-ramp to SR 18	Diverge	**E**	**40**	**E**	**38**

Note:
Average volumes based on 13 VISSIM runs.
Bold indicates unacceptable operation.
1. Modeled traffic volume expressed as a percent of observed traffic volume.
For example: 100 % indicates an exact replication of field conditions.

Source: Fehr & Peers, 2010.

TABLE 21
2040 PROPOSED ALTERNATIVE I-5 MAINLINE FREEWAY OPERATIONS SUMMARY

	Type	AM Peak Hour		PM Peak Hour	
		LOS	Density[1]	LOS	Density[1]
I-5 Southbound					
I-5 SB on-ramp from SR 18	Merge	C	28	**F**	**70**
I-5 SB between SR 18 and truck scales	Basic	**E**	**36**	**F**	**85**
I-5 SB off-ramp to truck scales	Diverge	D	29	**F**	**87**
I-5 SB between truck scales off/on-ramps	Basic	D	35	**F**	**87**
I-5 SB on-ramp from truck scales	Merge	D	30	**F**	**96**
I-5 SB between truck scales and SR 167	Basic	**E**	**36**	**F**	**75**
I-5 SB between truck scales and SR 167	Basic	D	32	D	34
I-5 SB off-ramp to SR 167	Diverge	D	30	D	29
I-5 SB off-ramp to SR 167 HOV	Diverge	C	27	D	30
I-5 SB between SR 167 HOV end and 54th Avenue E	Basic	D	28	D	28
I-5 SB off-ramp to 54th Avenue E	Diverge	C	25	B	19
I-5 SB between 54th Avenue E and SR 167 HOV	Basic	C	25	D	26
I-5 SB on-ramp from SR 167 HOV	Merge	C	22	C	24
I-5 SB on-ramp from SR 167	Merge	**E**	**36**	C	26
I-5 SB between SR 167 and 54th Avenue E	Basic	**E**	**38**	**E**	**37**
I-5 SB on-ramp from 54th Avenue E	Merge	D	34	D	34
I-5 SB off-ramp to Port of Tacoma Road/34th Ave	Diverge	**E**	**41**	**E**	**36**
I-5 SB between Port of Tacoma Road off/on-ramps	Basic	D	32	**E**	**36**
I-5 SB on-ramp from Port of Tacoma Road/34th Ave	Merge	D	35	**E**	**40**
I-5 SB off-ramp to Bay Street	Diverge	**E**	**43**	**F**	**43**
I-5 SB between Bay Street on/off ramps	Basic	D	34	**E**	**39**
I-5 SB on-ramp from Bay Street	Merge	**E**	**36**	D	34
I-5 SB between Bay Street and E 27th Street/Portland Avenue	Basic	**E**	**36**	**E**	**35**
I-5 SB weave between E 27th Street/Portland Avenue and I-705	Weave	**E**	**36**	**E**	**37**

Note:
Average volumes based on 13 VISSIM runs.
1. Modeled traffic volume expressed as a percent of observed traffic volume.
   For example: 100 % indicates an exact replication of field conditions.

Source: Fehr & Peers, 2010.

Intersection Analysis

The intersection analysis for the design year was based on the HCM2000 methods for unsignalized and signalized intersections. Using the forecasted volumes for 2040, the study area intersections were evaluated to calculate the performance of intersection operations during the AM and PM peak hours. The analysis includes four additional intersections along the 34th Avenue E corridor formed by the Proposed Alternative.

The Proposed Alternative changes the operation of intersections on Port of Tacoma Road, creating a one-way couplet with southbound traffic traveling on Port of Tacoma Road and northbound traffic on 34th Avenue E.

The travel forecasting model was run to estimate the 2040 traffic volumes associated with the Proposed Alternative.

The Proposed Alternative, by creating a north-south couplet with 34th Avenue E, would improve peak hour LOS operations at all Port of Tacoma Road intersections by simplifying signal phasing and increasing directional capacity as compared to the No Build Alternative. For example, the intersection of Port of Tacoma Road/Pacific Highway E would change from an 8-phase to a 4-phase signal under the Proposed Alternative. Table 22 summarizes the intersection control delay and LOS conditions for the AM and PM peak hours for the 2040 Proposed Alternative. The LOS is reported by individual approach and for the overall intersection.

The Proposed Alternative would improve the operation of the Port of Tacoma Road interchange during the AM peak hour. Only the 34th Avenue/I-5 SB Ramps intersection would operate at LOS E during the AM peak hour, with all other interchange intersections operating at LOS D or better. The intersections of 54th Avenue E/Pacific Highway E and 54th Avenue E/20th Street E would operate at LOS F due to westbound congestion related to morning commute patterns and traffic volumes. All other study area intersections would operate overall at LOS D or better during the AM peak hour.

The PM peak hour operations at Port of Tacoma Road intersections would improve with the Proposed Alternative by simplifying signal phasing and increasing directional capacity. For example, the intersection of Port of Tacoma Road/Pacific Highway E would change from an 8-phase to a 4-phase signal, improving from LOS F under the 2040 No Action Alternative to LOS D with the Proposed Alternative. The Portland Avenue and 54th Avenue E interchanges would continue to have intersections that operate at LOS F during the 2040 PM peak hour. The signal at E Portland Avenue/E 27th Street would operate at LOS F overall with failing approaches for the eastbound and southbound movements. Two intersections on 54th Avenue E, at Pacific Highway E and at 12th Street E, would operate at LOS F with long delays during the evening commute. All other intersections operate at LOS D or better overall during the PM peak hour with the Proposed Alternative.

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TABLE 22
INTERSECTION LEVELS OF SERVICE
2040 PEAK HOUR CONDITIONS – PROPOSED ALTERNATIVE

Intersection		Traffic Control	AM Peak Hour					PM Peak Hour				
			NB	SB	EB	WB	Total	NB	SB	EB	WB	Total
1	E. Portland Ave/E. 27th St	Signal	C / 22	B / 14		**E / 56**	C / 27	C / 25	**F / 137**		**E / 65**	**F / 95**
2	E. Portland Ave/E. 28th St	Signal	C / 20	B / 18	D / 42		C / 24	C / 23	B / 13	C / 31		B / 17
3	E. Bay St/E. 27th St	SSSC		B / 13		A / 2	A / 7		A / 9		A / 3	A / 5
4	E. Bay St/E. 28th St	Signal		B / 17	A / 8		A / 10		C / 29	B / 15		B / 17
5	Port of Tacoma Rd/I-509 EB Ramps	Signal		B / 15	C / 25	C / 25	C / 23		C / 26	D / 38	C / 31	C / 31
6	Port of Tacoma Rd/Pacific Hwy	Signal		C / 34	C / 26	B / 10	C / 24		**F / 82**	C / 30	B / 17	D / 42
7	Port of Tacoma Rd/I-5 SB Ramps	Signal		A / 2		D / 48	B / 16		A / 6		D / 46	B / 15
8	Port of Tacoma Rd/I-5 NB Ramps	Signal		B / 15	E / 61		D / 48		A / 8	C / 27		B / 16
9	Port of Tacoma Rd/20th St E	Signal	A / 9	B / 12	D / 40	C / 33	C / 23	C / 32	B / 12	D / 36	C / 31	C / 26
10	Industry Dr. E/20th St E	Signal	D / 41		A / 6	A / 7	B / 14	D / 41		A / 7	B / 14	B / 16
17	54th Ave E/12th St E	Signal	B / 16	D / 42	**F / 116**	D / 45	D / 42	B / 15	**F / 196**	**F / >200**	**F / 133**	**F / 191**
18	54th Ave E/Pacific Hwy	Signal	**F* /**	**E / 64**	D / 39	**F / >200**	**F / 122**	D / 35	**F / 88**	**F / 81**	**F / >200**	**F / 108**
19	54th Ave E/I-5 SB Ramps	Signal	D / 51	B / 17		C / 31	D / 38	A / 9	A / 3		D / 41	A / 9
20	54th Ave E/I-5 NB Ramps	None	C / 26	F / 90	B / 15		D / 38	A / 1	C / 15	C / 20		A / 9
21	54th Ave E/20th St E	Signal	**F / >200**	B / 14	**E / 64**	**F / >200**	**F / 151**	D / 53	C / 21	D / 53	C / 34	D / 39
22	34th Ave/Pacific Hwy	Signal	C / 30		C / 20	D / 36	C / 28	D / 36		B / 18	C / 32	C / 29
23	34th Ave/I-5 SB Ramps	Signal	E / 55			**E / 69**	**E / 62**	A / 5			D / 42	B / 17
24	34th Ave/I-5 NB Ramps	Signal	D / 39		**E / 64**		D / 53	A / 8		D / 44		C / 25
25	34th Ave/20th St	Signal			A / 4	A / 5	A / 4			A / 4	A / 9	A / 7

Note:
SSSC = Side-Street Stop-Controlled. Unct. = Uncontrolled

Source: Fehr & Peers, 2010.

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ATTACHMENT A

Technical Calculations

TABLE A1
FREEWAY MAINLINE AND RAMP VOLUME CALIBRATION AND VALIDATION
EXISTING CONDITIONS – NORTHBOUND I-5

	AM Peak Hour				PM Peak Hour			
	Count	Model	% Served[1]	GEH	Count	Model	% Served[1]	GEH
I-705 On-ramp	1,342	1,360	101%	0.5	2,426	2,427	100%	0.0
E 27th Ave/Portland Ave Off-ramp	446	484	109%	1.8	430	439	102%	0.4
E 27th Ave/Portland Ave to E Bay St	6,966	6,943	100%	0.3	6,940	7,004	101%	0.8
E Bay St Off-ramp	797	790	99%	0.2	1,598	1,595	100%	0.1
E Bay St off to on-ramp	6,169	6,142	100%	0.3	5,342	5,401	101%	0.8
E 28th St On-ramp	1,000	998	100%	0.1	840	814	97%	0.9
E 28th St to Port of Tacoma Rd	7,169	7,129	99%	0.5	6,182	6,213	101%	0.4
SB Port of Tacoma Rd Off-ramp	520	522	100%	0.1	300	307	102%	0.4
NB Port of Tacoma Rd Off-ramp	360	349	97%	0.6	164	172	105%	0.6
Port of Tacoma Rd off to on-ramp	6,289	6,251	99%	0.5	5,718	5,730	100%	0.2
Port of Tacoma Rd On-ramp	211	217	103%	0.4	359	361	101%	0.1
Port of Tacoma Rd to 54th Ave	6,500	6,458	99%	0.5	6,077	6,092	100%	0.2
54th Ave Off-ramp	680	683	100%	0.1	631	636	101%	0.2
54th Ave off to on-ramp	5,820	5,762	99%	0.8	5,446	5,457	100%	0.1
54th Ave On-ramp	396	390	98%	0.3	633	622	98%	0.4
54th Ave to HOV lane start	6,216	6,119	98%	1.2	6,079	6,078	100%	0.0
HOV lane start to Truck Scales	6,216	6,112	98%	1.3	6,079	6,077	100%	0.0
Truck Scales Off-ramp	29	33	114%	0.7	42	61	145%	2.6
Truck Scales off to on-ramp	6,187	6,048	98%	1.8	6,037	6,010	100%	0.3
Truck Scales On-ramp	29	30	103%	0.2	42	52	124%	1.5
Truck Scales to SR 18	6,216	6,077	98%	1.8	6,079	6,060	100%	0.2
SR 18 Off-ramp	1,703	1,644	97%	1.4	1,672	1,678	100%	0.1

Notes: **Bold font** indicates GEH statistic greater than 5.

1. Modeled traffic volume expressed as a percent of counted traffic volume: for example, 100 % indicates an exact replication of field conditions.

Source: Fehr & Peers, 2010

TABLE A2
FREEWAY MAINLINE AND RAMP VOLUME CALIBRATION AND VALIDATION
EXISTING CONDITIONS – SOUTHBOUND I-5

	AM Peak Hour				PM Peak Hour			
	Count	Model	% Served[1]	GEH	Count	Model	% Served[1]	GEH
SR 18 On-ramp	478	478	100%	0.0	417	419	100%	0.1
SR 18 to Truck Scales	5,974	5,956	100%	0.2	7,019	7,185	102%	2.0
Truck Scales Off-ramp	28	30	107%	0.4	49	51	104%	0.3
Truck Scales off to on-ramp	5,946	5,910	99%	0.5	6,970	7,124	102%	1.8
Truck Scales On-ramp	28	28	100%	0.0	49	60	122%	1.5
Truck Scales to HOV lane end	5,974	5,921	99%	0.7	7,019	7,178	102%	1.9
HOV lane end to lane drop	5,974	5,916	99%	0.8	7,019	6,871	98%	1.8
Lane drop to 54th Ave	5,974	5,898	99%	1.0	7,019	7,165	102%	1.7
54th Ave Off-ramp	532	519	98%	0.6	492	512	104%	0.9
54th Ave off to on-ramp	5,442	5,366	99%	1.0	6,527	6,636	102%	1.3
54th Ave On-ramp	1,010	1,006	100%	0.1	987	973	99%	0.4
54th Ave to Port of Tacoma Rd	6,452	6,364	99%	1.1	7,514	7,601	101%	1.0
Port of Tacoma Rd Off-ramp	308	303	98%	0.3	114	129	113%	1.4
Port of Tacoma Rd off to on-ramp	6,144	6,039	98%	1.3	7,400	7,437	101%	0.4
Port of Tacoma Rd On-ramp	386	379	98%	0.4	1,080	1,055	98%	0.8
E 27th St Off-ramp	593	589	99%	0.2	957	954	100%	0.1
E 27th St off-ramp to E Bay St on-ramp	5,937	5,811	98%	1.6	7,523	7,512	100%	0.1
E Bay St On-ramp	1,775	1,773	100%	0.0	913	914	100%	0.0
E Bay St on-ramp to E 27th St/Portland Ave on-ramp	7,712	7,568	98%	1.6	8,436	8,420	100%	0.2
E 27th St/Portland Ave to I-705	2,605	2,547	98%	1.1	2,232	2,206	99%	0.6

Notes: **Bold font** indicates GEH statistic greater than 5.

1. Modeled traffic volume expressed as a percent of counted traffic volume: for example, 100 % indicates an exact replication of field conditions.

Source: Fehr & Peers, 2010

TABLE A3
INTERSECTION VOLUME CALIBRATION AND VALIDATION
EXISTING CONDITIONS

Intersection		AM Peak Hour				PM Peak Hour			
		Count	Model	% Served[1]	GEH	Count	Model	% Served[1]	GEH
1	E. Portland Ave/E. 27th St	2,140	2,113	98.7%	0.6	3,660	3,518	96.1%	2.4
2	E. Portland Ave/E. 28th St	2,024	2,005	99.1%	0.4	2,656	2,582	97.2%	1.4
3	E. Bay St/E. 27th St	824	812	98.5%	0.4	1,144	1,131	98.8%	0.4
4	E. Bay St/E. 28th St	1,288	1,267	98.4%	0.6	2,048	1,974	96.4%	1.7
5	Port of Tacoma Rd/SR 509 NB Ramps	1,248	1,282	102.7%	1.0	1,340	1,319	98.5%	0.6
6	Port of Tacoma Rd/Pacific Hwy	2,060	2,045	99.3%	0.3	2,836	2,868	101.1%	0.6
7	Port of Tacoma Rd/ I-5 SB Ramps	1,540	1,516	98.4%	0.6	2,084	2,087	100.2%	0.1
8	Port of Tacoma Rd/I-5 NB Ramps[2]	1,372	1,351	98.5%	0.6	1,556	1,566	100.6%	0.3
9	Port of Tacoma Rd/20th St E	1,420	1,376	96.9%	1.2	1,600	1,598	99.9%	0.0
10	Industry Dr. E/20th St E	1,320	1,304	98.8%	0.4	1,476	1,476	100.0%	0.0
17	54th Ave E/12th St E	1,460	1,475	101.0%	0.4	2,036	2,058	101.1%	0.5
18	54th Ave E/Pacific Hwy	3,060	3,045	99.5%	0.3	4,416	4,392	99.5%	0.4
19	54th Ave E/I-5 SB Ramps[2]	2,260	2,235	98.9%	0.5	2,736	2,742	100.2%	0.1
20	54th Ave E/I-5 NB Ramps[2]	2,320	2,285	98.5%	0.7	2,760	2,756	99.9%	0.1
21	54th Ave E/20th St E	2,644	2,588	97.9%	1.1	3,224	3,212	99.6%	0.2

Notes: Volumes reported are for the total intersection
1. Modeled traffic volume expressed as a percent of counted traffic volume: for example, 100 % indicates an exact replication of field conditions.
2. Free-flowing loop ramp volume not included in the intersection total.

Source: Fehr & Peers, 2010

TABLE A4
SYSTEM WIDE MEASURES OF EFFECTIVENESS – EXISTING CONDITIONS

Performance Measure	AM Peak Period	PM Peak Period
Vehicles Served in Network	43,676	54,049
Vehicle-miles of Travel (VMT)	231,814	270,143
Vehicle-hours of Travel	4761	6,322
Average Speed (mph)	48.7	42.7
Vehicle-hours of Delay (VHD)	413	1,080
Average Delay per Vehicle (seconds)	32	68
VHD/VMT [min/mile]	0.11	0.24

Note: The two-hour peak period includes the peak hour plus 30 minutes before and after the peak hour.

Source: Fehr & Peers, 2010

TABLE A-5
SYSTEM WIDE MEASURES OF EFFECTIVENESS – 2020 NO BUILD

TABLE A5
SYSTEM WIDE MEASURES OF EFFECTIVENESS – 2020 NP CONDITIONS

Performance Measure	AM Peak Period	PM Peak Period
Vehicles Served in Network	48,304	55,860
Vehicle-miles of Travel (VMT)	261,452	288,694
Vehicle-hours of Travel	6,129	7,997
Average Speed (mph)	42.7	36
Vehicle-hours of Delay (VHD)	911	2,213
Average Delay per Vehicle (seconds)	64	131
VHD/VMT [min/mile]	0.21	0.46

Note: The two-hour peak period includes the peak hour plus 30 minutes before and after the peak hour.

Source: Fehr & Peers, 2010

TABLE A-6
SYSTEM WIDE MEASURES OF EFFECTIVENESS – 2020 PROPOSED ALTERNATIVE

TABLE A6 SYSTEM WIDE MEASURES OF EFFECTIVENESS – 2020 WP ALT6 CONDITIONS		
Performance Measure	**AM Peak Period**	**PM Peak Period**
Vehicles Served in Network	48,437	55,718
Vehicle-miles of Travel (VMT)	261,980	288,628
Vehicle-hours of Travel	6021	7933
Average Speed (mph)	43.5	36.4
Vehicle-hours of Delay (VHD)	848	2,209
Average Delay per Vehicle (seconds)	60	132
VHD/VMT [min/mile]	0.19	0.46

Note: The two-hour peak period includes the peak hour plus 30 minutes before and after the peak hour.

Source: Fehr & Peers, 2010

TABLE A-7
SYSTEM WIDE MEASURES OF EFFECTIVENESS – 2040 NO BUILD

TABLE A7 SYSTEM WIDE MEASURES OF EFFECTIVENESS – 2040 NP CONDITIONS		
Performance Measure	**AM Peak Period**	**PM Peak Period**
Vehicles Served in Network	60,408	70,885
Vehicle-miles of Travel (VMT)	301,195	340,209
Vehicle-hours of Travel	10,766	11,547
Average Speed (mph)	28.0	29.5
Vehicle-hours of Delay (VHD)	4,684	4,601
Average Delay per Vehicle (seconds)	253	214
VHD/VMT [min/mile]	0.93	0.81

Note: The two-hour peak period includes the peak hour plus 30 minutes before and after the peak hour.

Source: Fehr & Peers, 2010

TABLE A-8
SYSTEM WIDE MEASURES OF EFFECTIVENESS – 2040 PROPOSED ALTERNATIVE

TABLE A8
SYSTEM WIDE MEASURES OF EFFECTIVENESS – 2040 WP ALT6 CONDITIONS

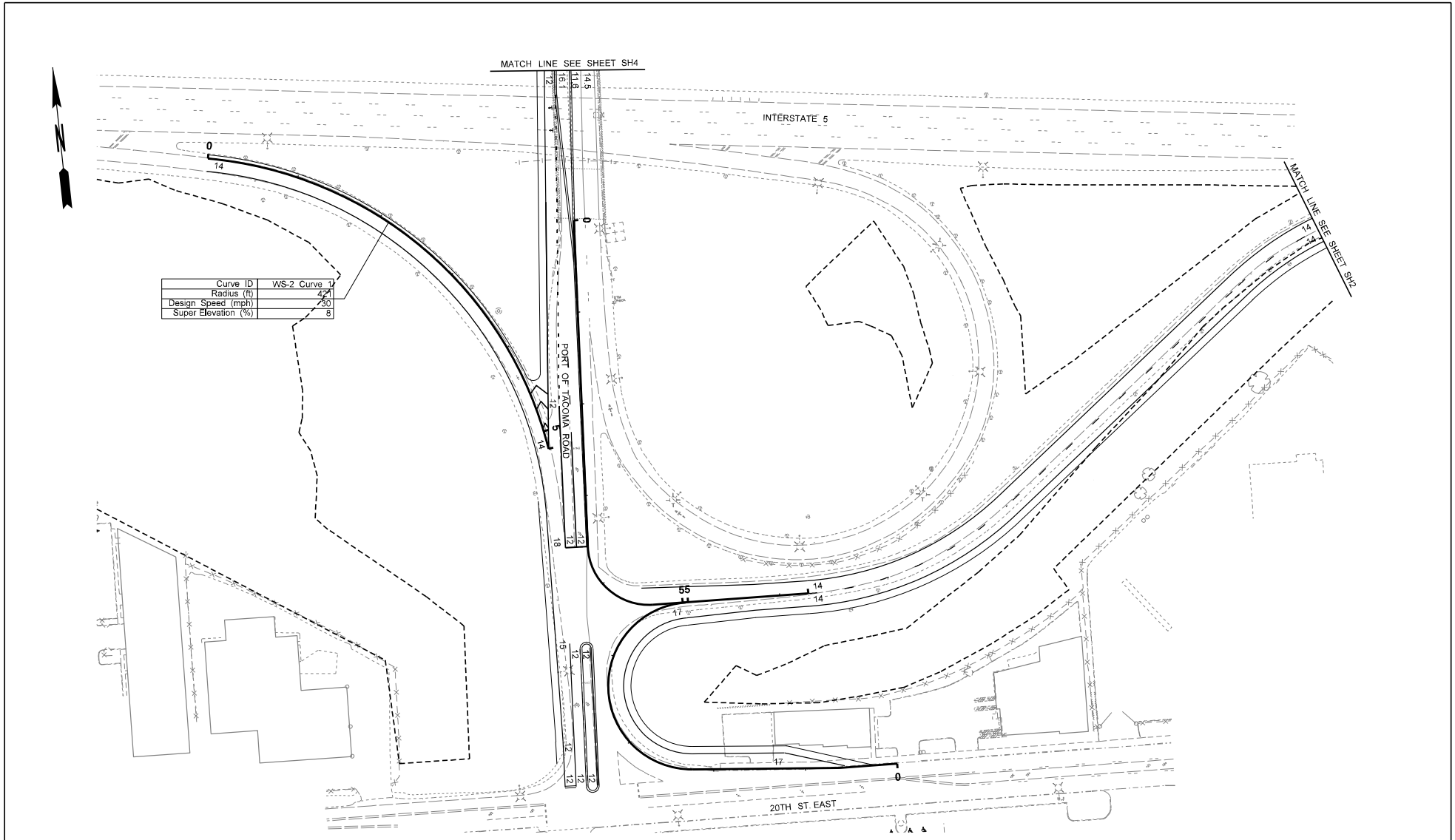
Performance Measure	AM Peak Period	PM Peak Period
Vehicles Served in Network	66,247	74,818
Vehicle-miles of Travel (VMT)	327,832	348,159
Vehicle-hours of Travel	9140	10,187
Average Speed (mph)	35.9	34.2
Vehicle-hours of Delay (VHD)	2,561	3,105
Average Delay per Vehicle (seconds)	129	139
VHD/VMT [min/mile]	0.47	0.54

Note: The two-hour peak period includes the peak hour plus 30 minutes before and after the peak hour.

Source: Fehr & Peers, 2010

Interchange Justification Report
Port of Tacoma Interchange with I-5
City of Fife, Washington

Appendix C
CADD Drawings



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ENTERED BY						
CHECKED BY						
PROJ. ENGR.						
REGIONAL ADM.		REVISION	DATE	BY		

REGION NO. 10 | STATE WASH | FED.AID PROJ.NO.

JOB NUMBER

CONTRACT NO. | LOCATION NO.

BergerABAM
1301 Fifth Avenue, Suite 1200
Seattle, WA 98101
(206) 357-5600 FAX: (206) 357-5601

CITY OF FIFE

PORT OF TACOMA ROAD INTERCHANGE WITH I-5 ALTERNATIVE 2

CAPACITY WIDENING

Plot 1

PLAN REF NO 1

SHEET 1 OF 4 SHEETS

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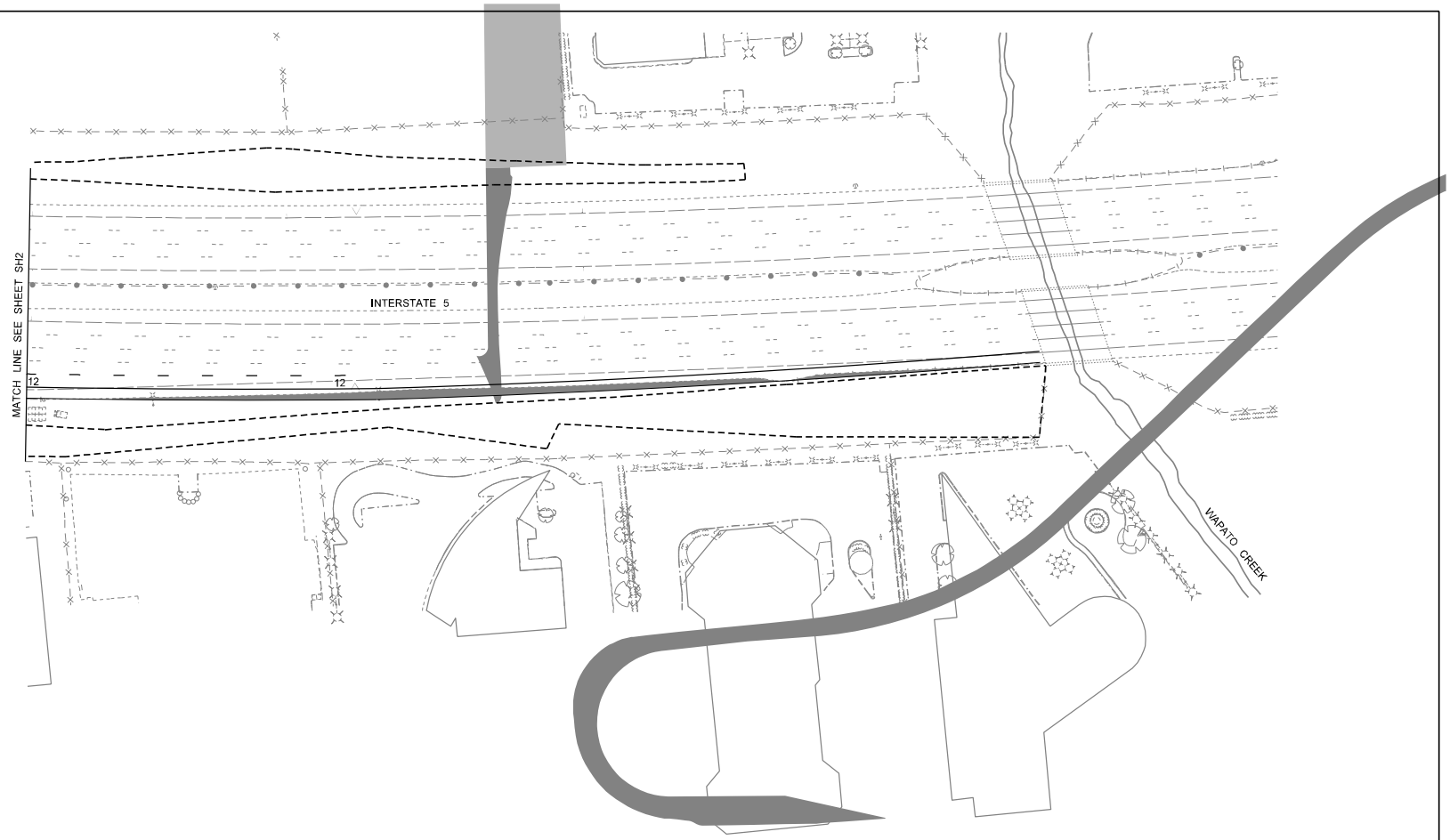
PORT OF TACOMA ROAD INTERCHANGE WITH I-5
ALTERNATIVE 2

CAPACITY WIDENING

Plot 2

PLAN REF NO 2

SHEET 2 OF 4 SHEETS



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CITY OF FIFE

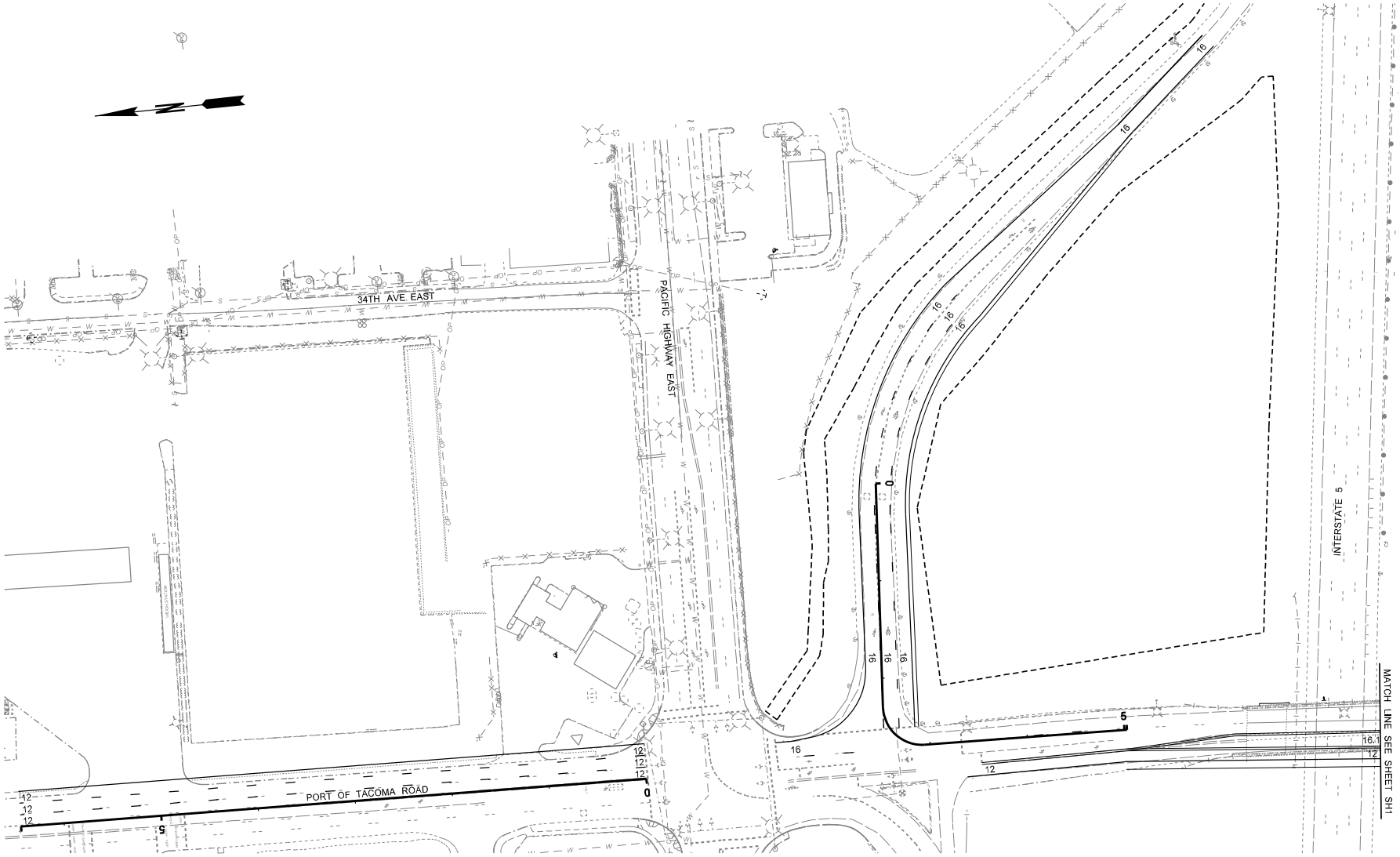
PORT OF TACOMA ROAD INTERCHANGE WITH I-5 ALTERNATIVE 2

CAPACITY WIDENING

Plot 3

PLAN REF NO 3

SHEET 3 OF 4 SHEETS



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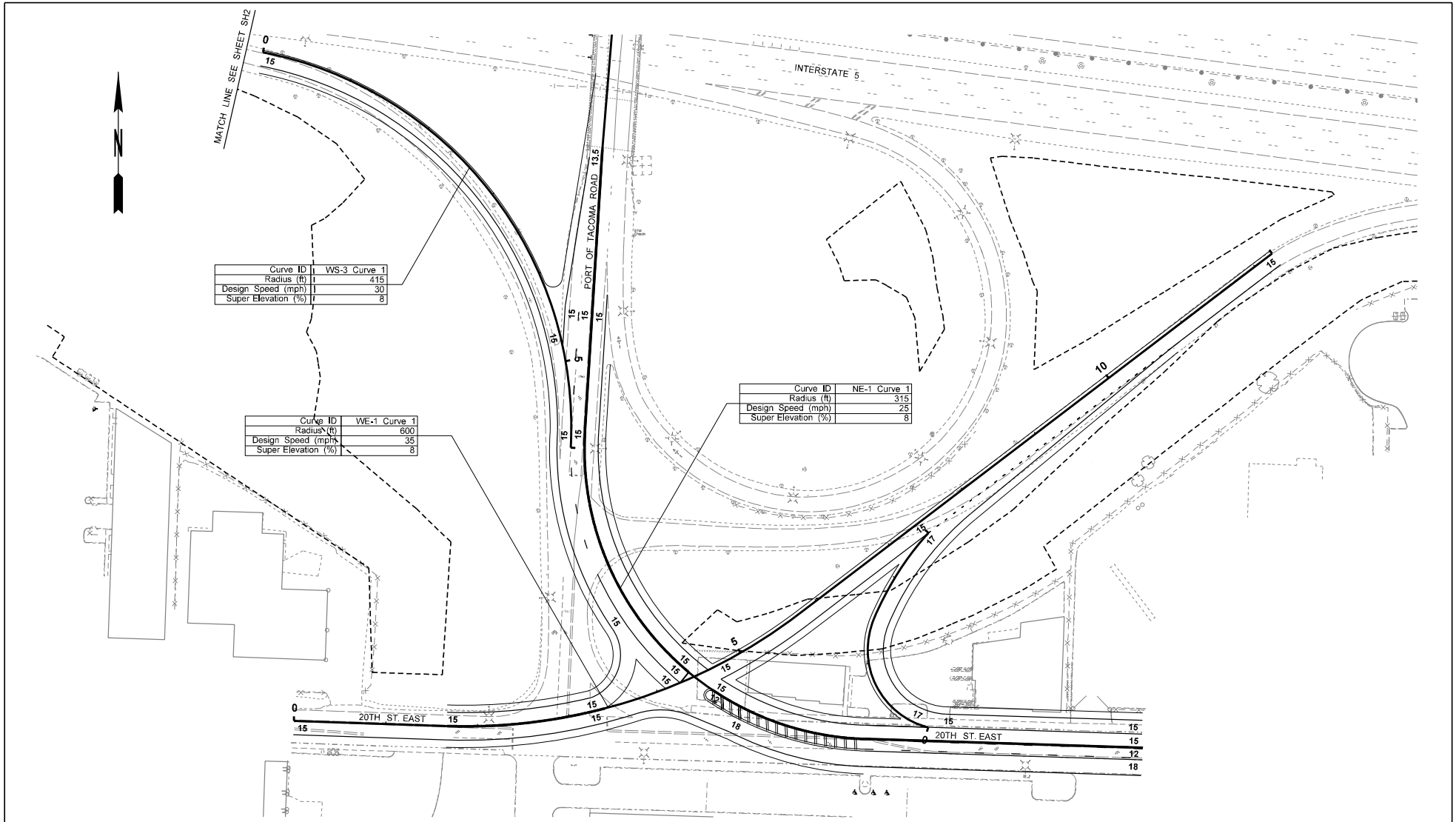
PORT OF TACOMA ROAD INTERCHANGE WITH I-5
ALTERNATIVE 2

CAPACITY WIDENING

Plot 4

PLAN REF NO 4

SHEET 4 OF 4 SHEETS



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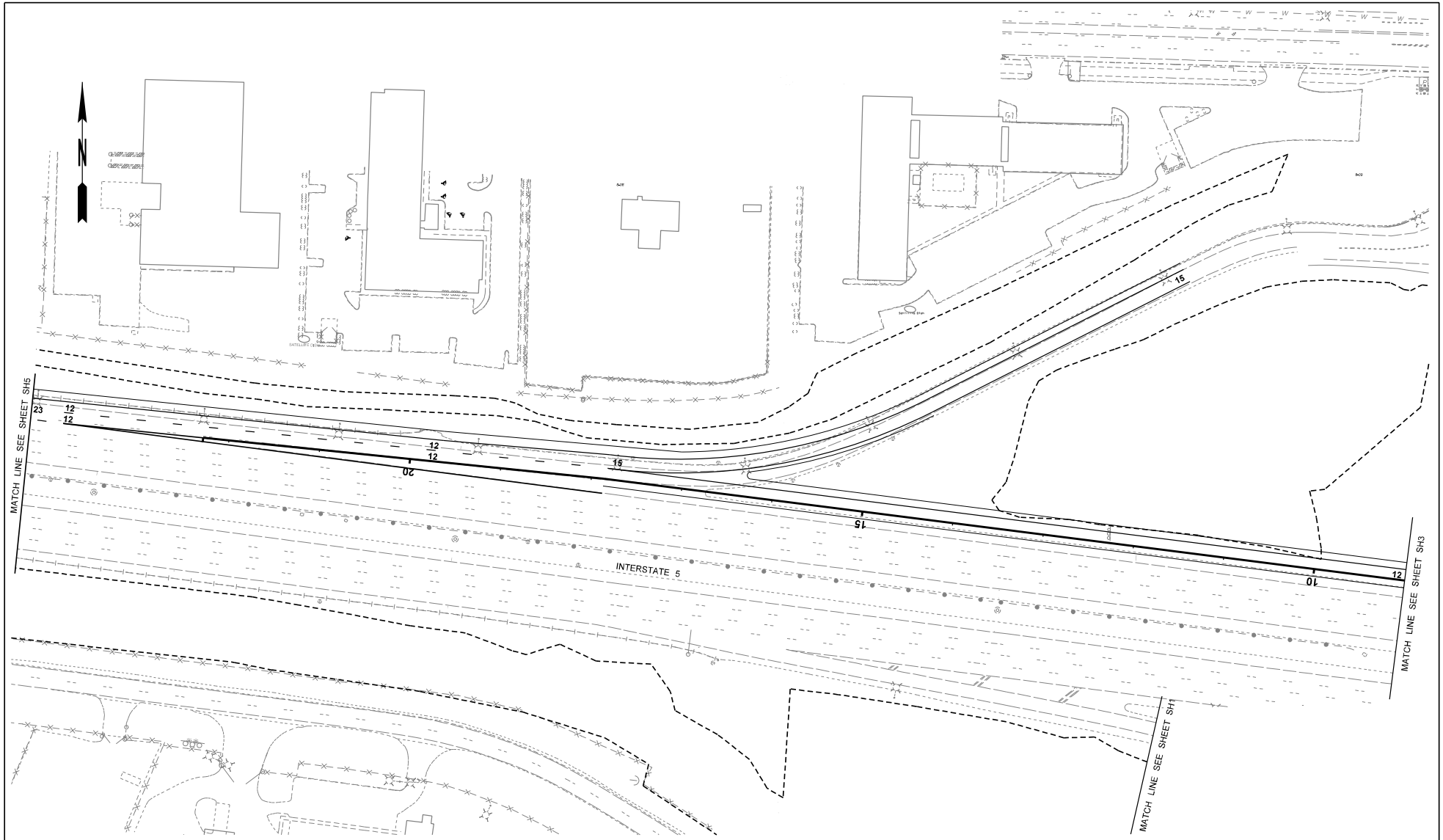
CITY OF FIFE

PORT OF TACOMA ROAD INTERCHANGE WITH I-5
ALTERNATIVE 4

RAMPS AT 34TH AVENUE E WITH A REVISED INTERSECTION AT 20TH STREET E

Plot 1
PLAN REF NO 1
SHEET 1 OF 5 SHEETS



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DESIGNED BY						
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CHECKED BY						
PROJ. ENGR.						
REGIONAL ADM.		REVISION	DATE	BY		

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CITY OF FIFE

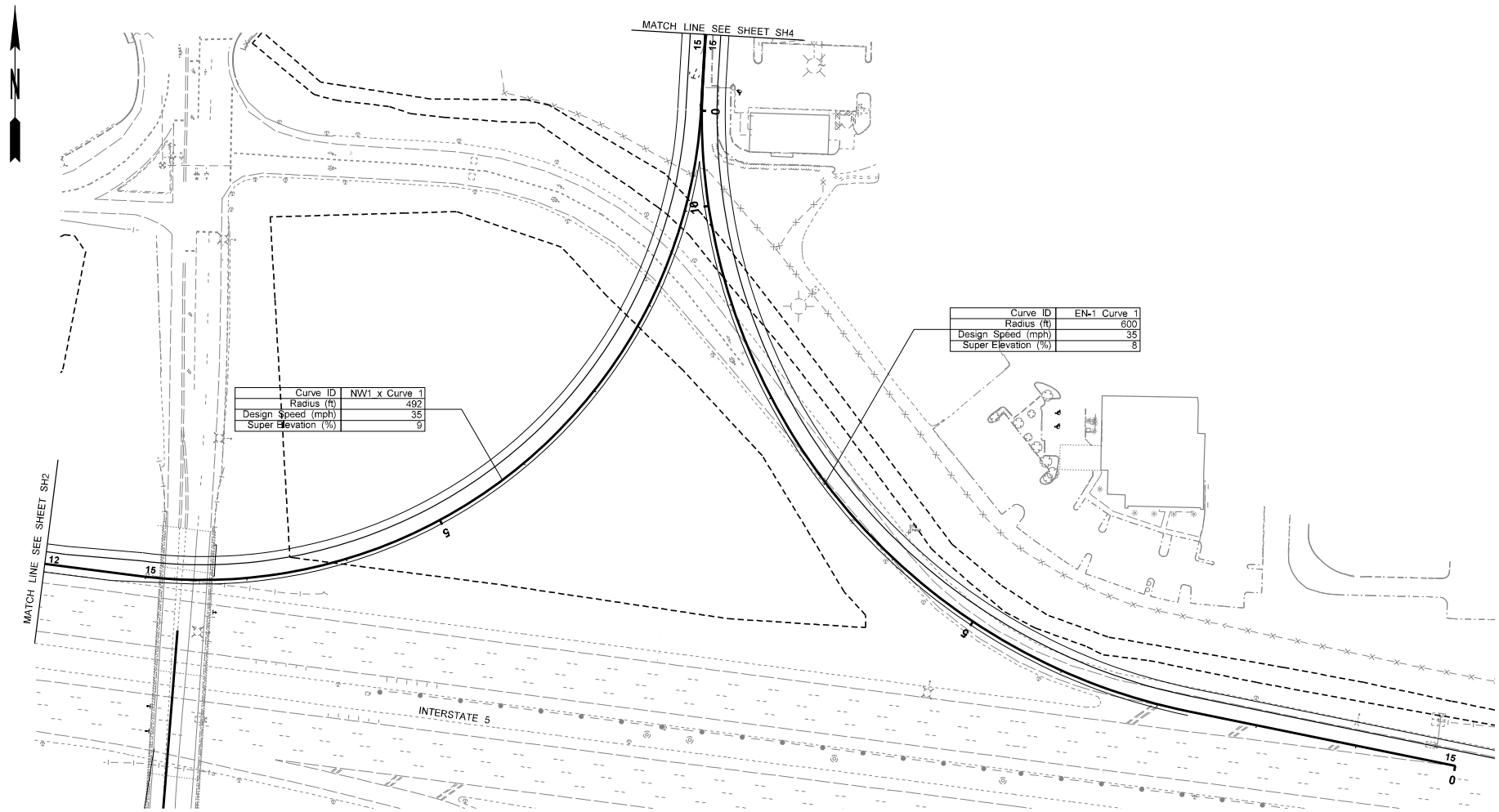
PORT OF TACOMA ROAD INTERCHANGE WITH I-5
ALTERNATIVE 4

RAMPS AT 34TH AVENUE E WITH A REVISED INTERSECTION AT 20TH STREET E

Plot 2

PLAN REF NO 2

SHEET 2 OF 5 SHEETS



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DATE	6/15/2010					
PLOTTED BY	schurman			JOB NUMBER		
DESIGNED BY						
ENTERED BY				CONTRACT NO.		LOCATION NO.
CHECKED BY						
PROJ. ENGR.						
REGIONAL ADM.		REVISION	DATE	BY		

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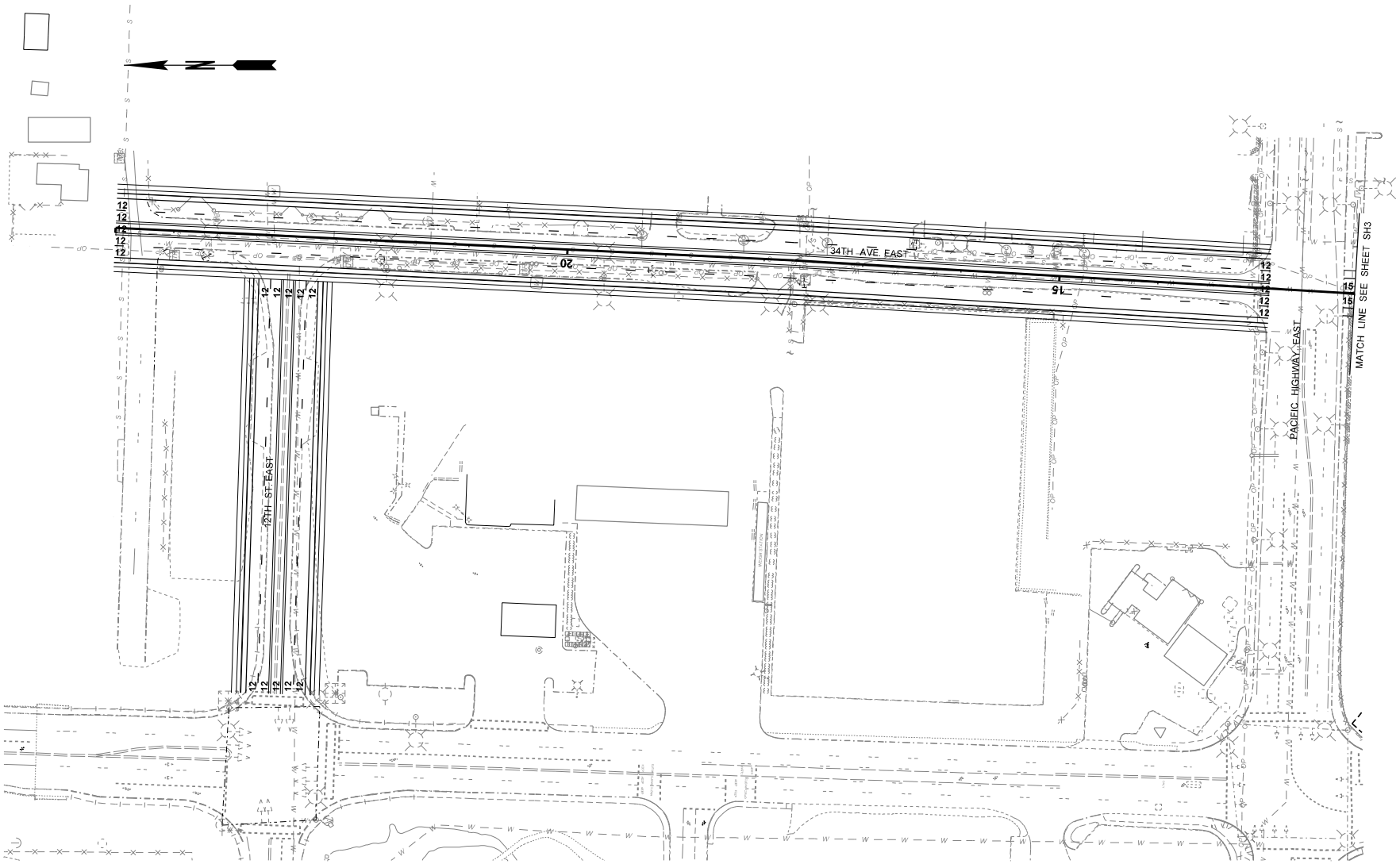
CITY OF FIFE

PORT OF TACOMA ROAD INTERCHANGE WITH I-5
ALTERNATIVE 4

RAMPS AT 34TH AVENUE E WITH A REVISED INTERSECTION AT 20TH STREET E

Plot 3
PLAN REF NO 3
SHEET 3 OF 5 SHEETS



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ENTERED BY				CONTRACT NO.		LOCATION NO.	
CHECKED BY							
PROJ. ENGR.							
REGIONAL ADM.		REVISION	DATE	BY			

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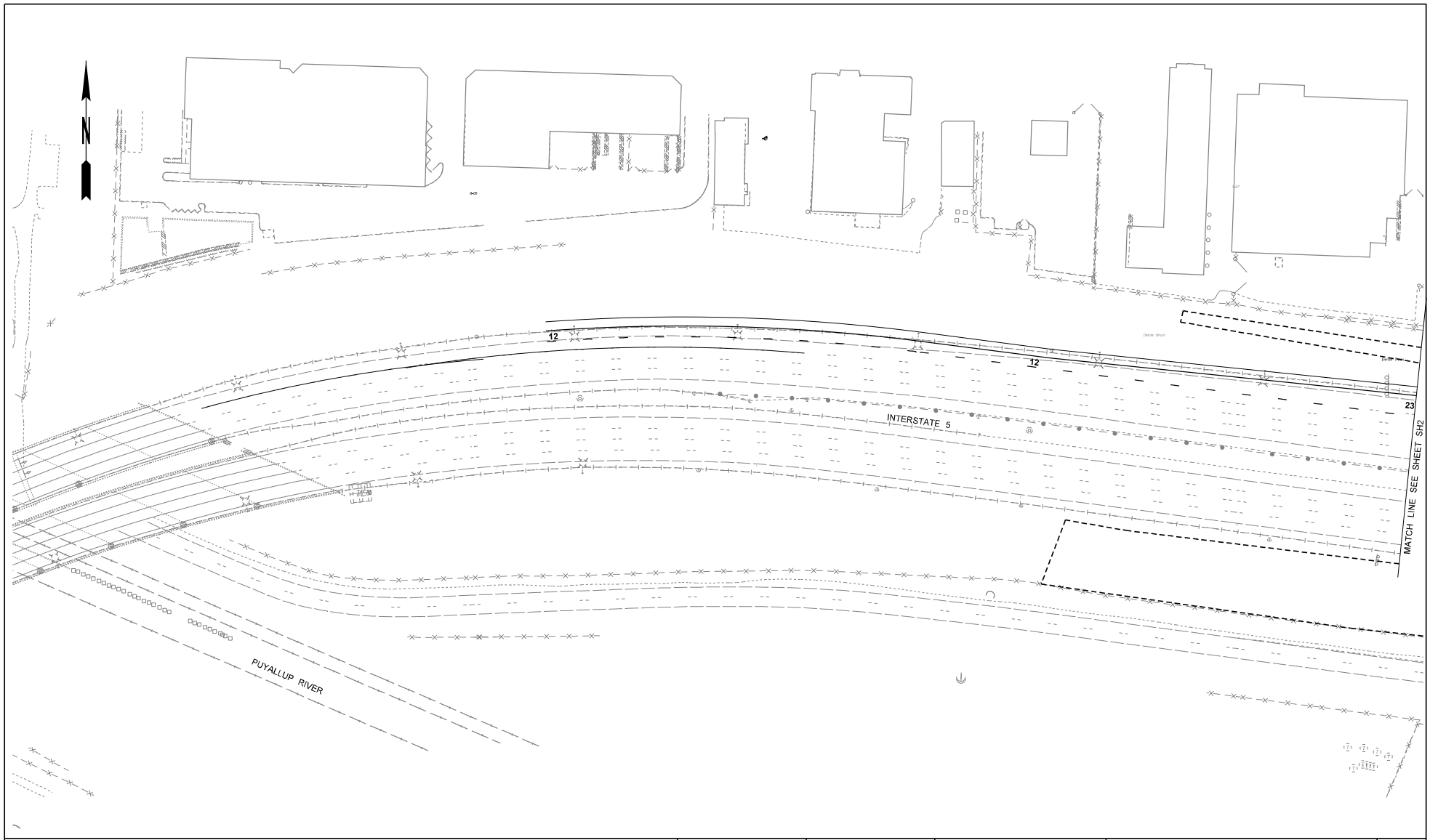
PORT OF TACOMA ROAD INTERCHANGE WITH I-5
ALTERNATIVE 4

RAMPS AT 34TH AVENUE E WITH A REVISED INTERSECTION AT 20TH STREET E

Plot 4

PLAN REF NO 4

SHEET 4 OF 5 SHEETS



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DESIGNED BY						
ENTERED BY				CONTRACT NO.		LOCATION NO.
CHECKED BY						
PROJ. ENGR.						
REGIONAL ADM.		REVISION	DATE	BY		

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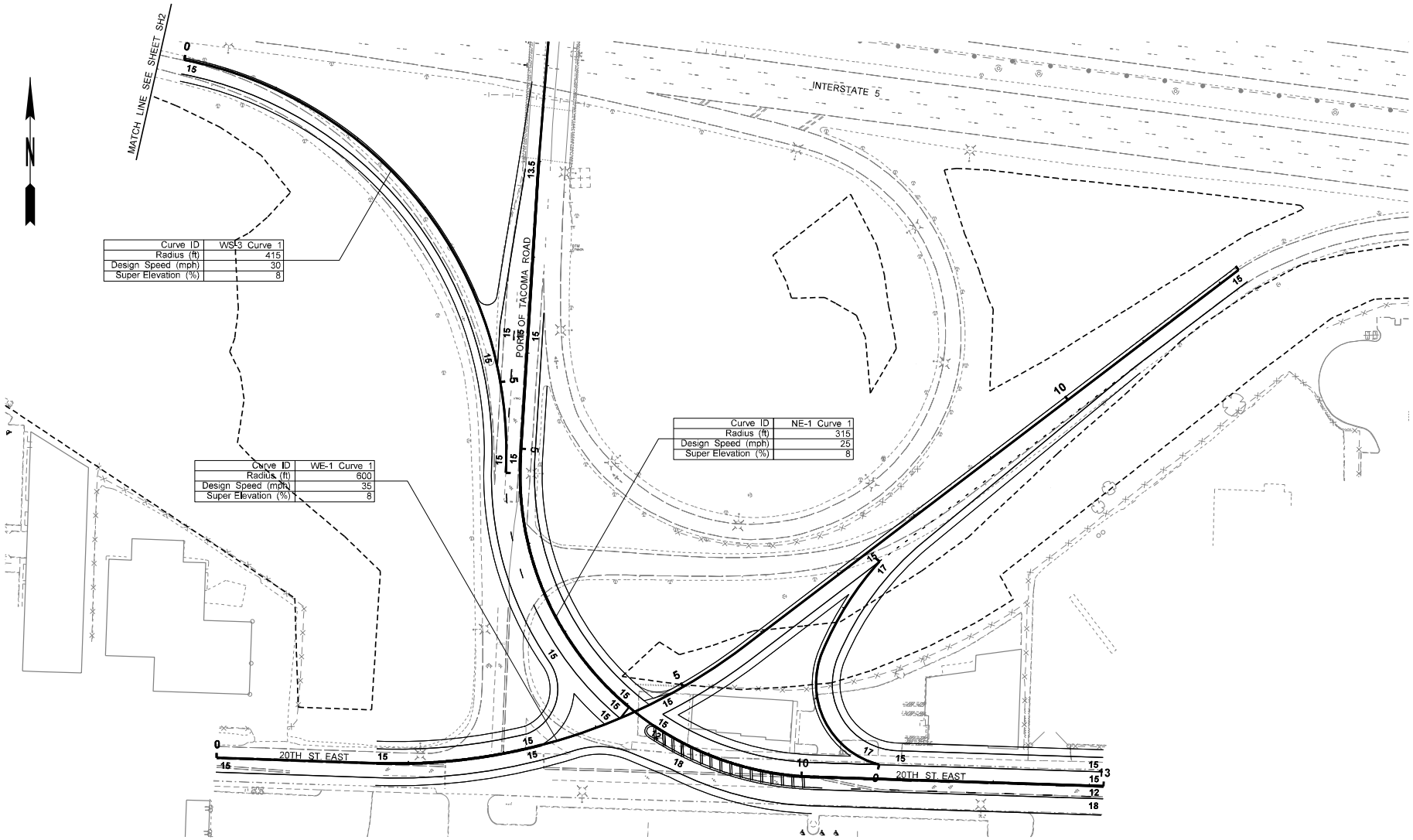
PORT OF TACOMA ROAD INTERCHANGE WITH I-5
ALTERNATIVE 4

RAMPS AT 34TH AVENUE E WITH A REVISED INTERSECTION AT 20TH STREET E

Plot 5

PLAN REF NO 5

SHEET 5 OF 5 SHEETS



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PROJ. ENGR.							
REGIONAL ADM.		REVISION	DATE	BY			

REGION NO. 10 | STATE WASH | FED.AID PROJ.NO.

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CONTRACT NO. | LOCATION NO.

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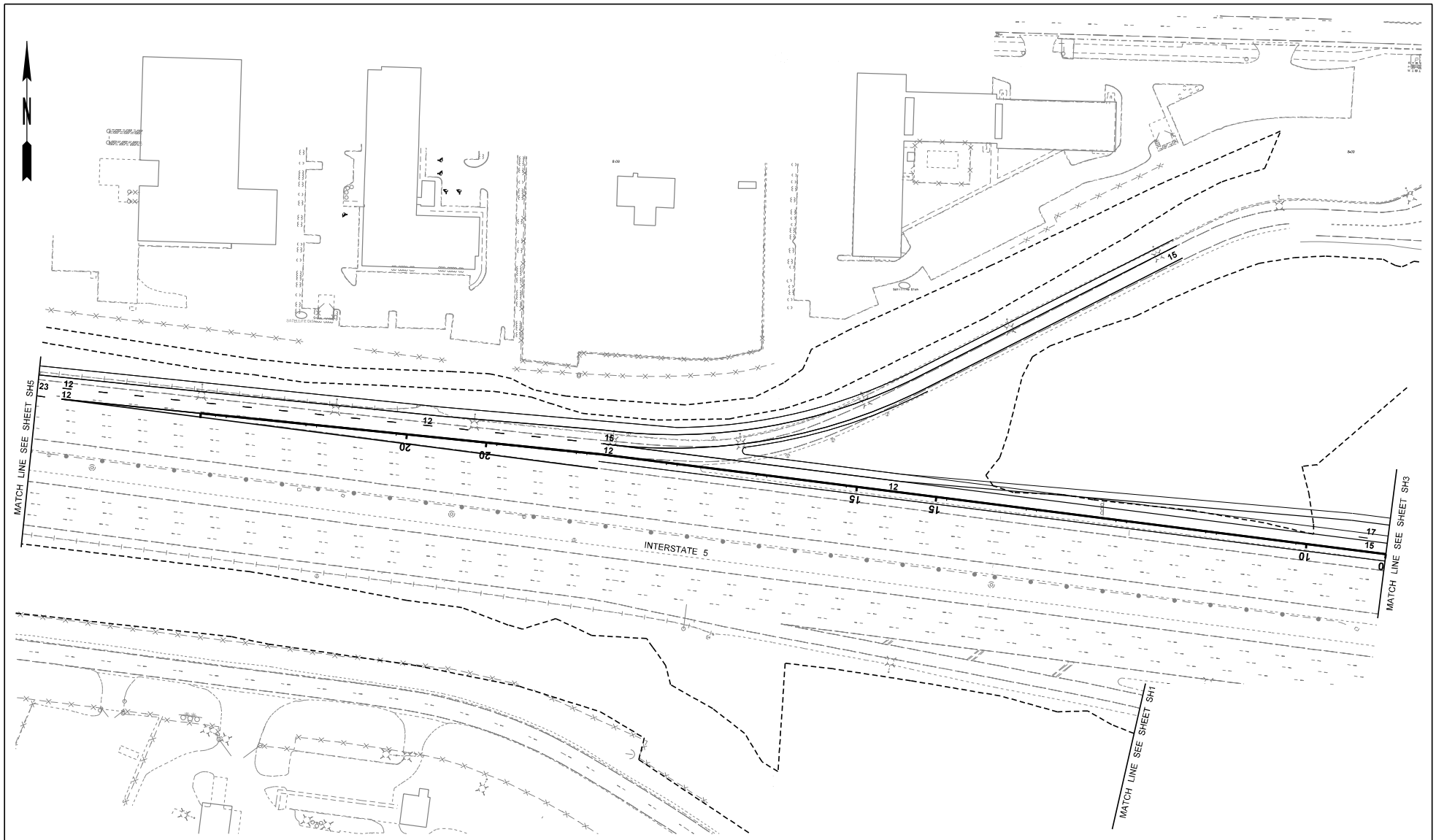
PORT OF TACOMA ROAD INTERCHANGE WITH I-5
ALTERNATIVE 4A

PARCLO A/B

Plot 1

PLAN REF NO 1

SHEET 1 OF 5 SHEETS



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DESIGNED BY						
ENTERED BY				CONTRACT NO.		LOCATION NO.
CHECKED BY						
PROJ. ENGR.						
REGIONAL ADM.		REVISION	DATE	BY		

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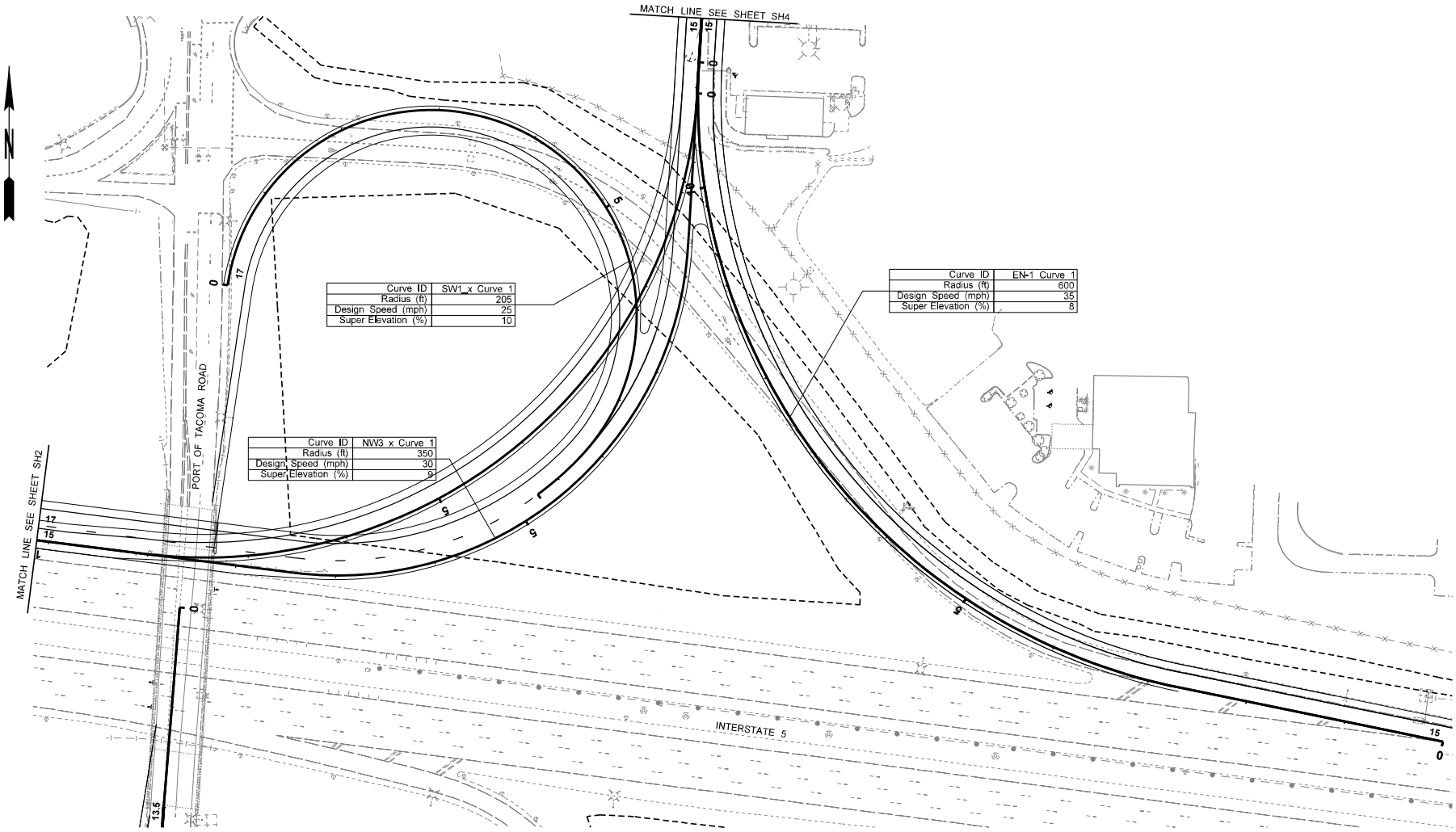
PORT OF TACOMA ROAD INTERCHANGE WITH I-5 ALTERNATIVE 4A

PARCLO A/B

Plot 2

PLAN REF NO 2

SHEET 2 OF 5 SHEETS



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REGION NO. 10 | STATE WASH | FED.AID PROJ.NO.

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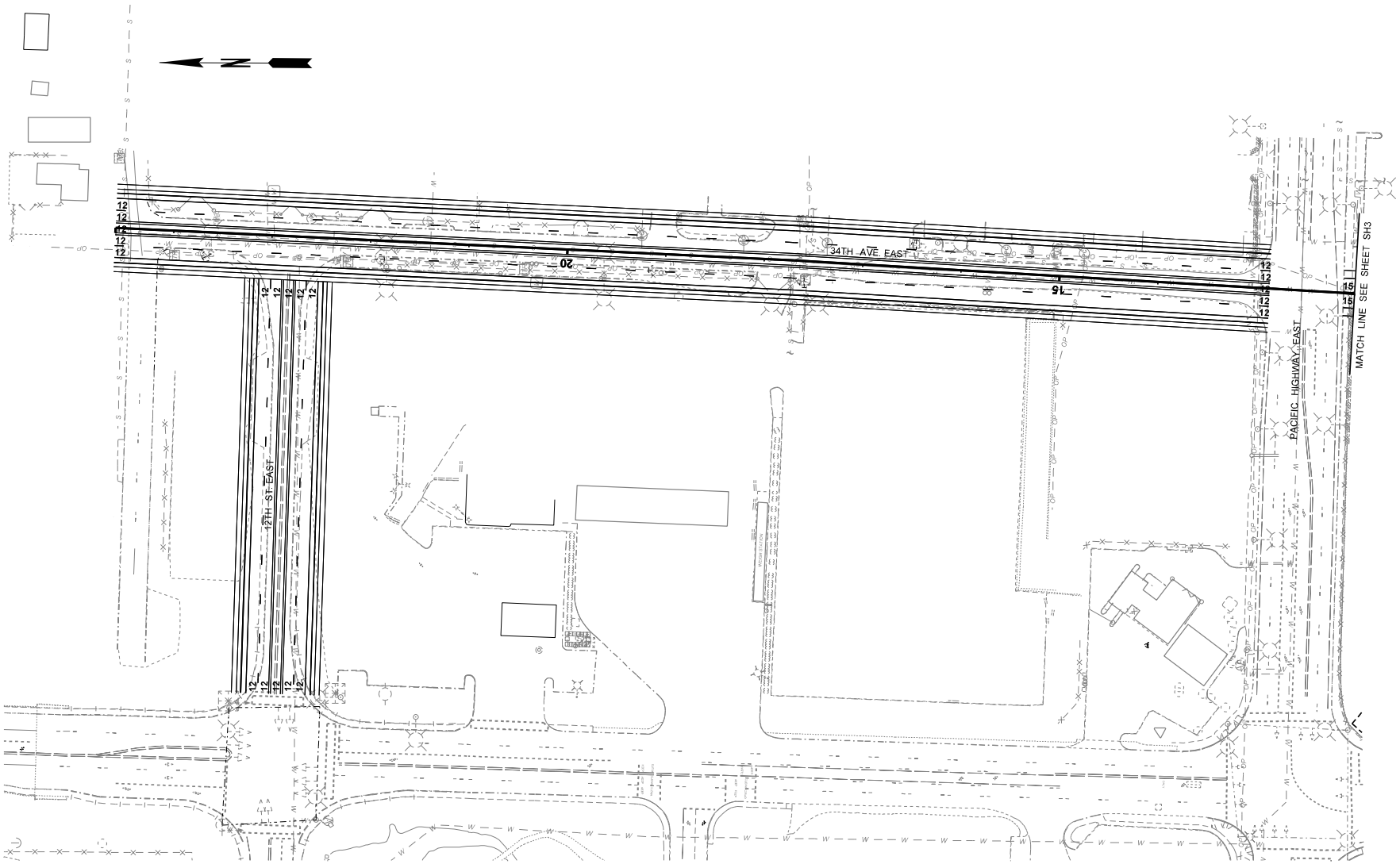
PORT OF TACOMA ROAD INTERCHANGE WITH I-5
ALTERNATIVE 4A

PARCLO A/B

Plot 3

PLAN REF NO 3

SHEET 3 OF 5 SHEETS



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PROJ. ENGR.						
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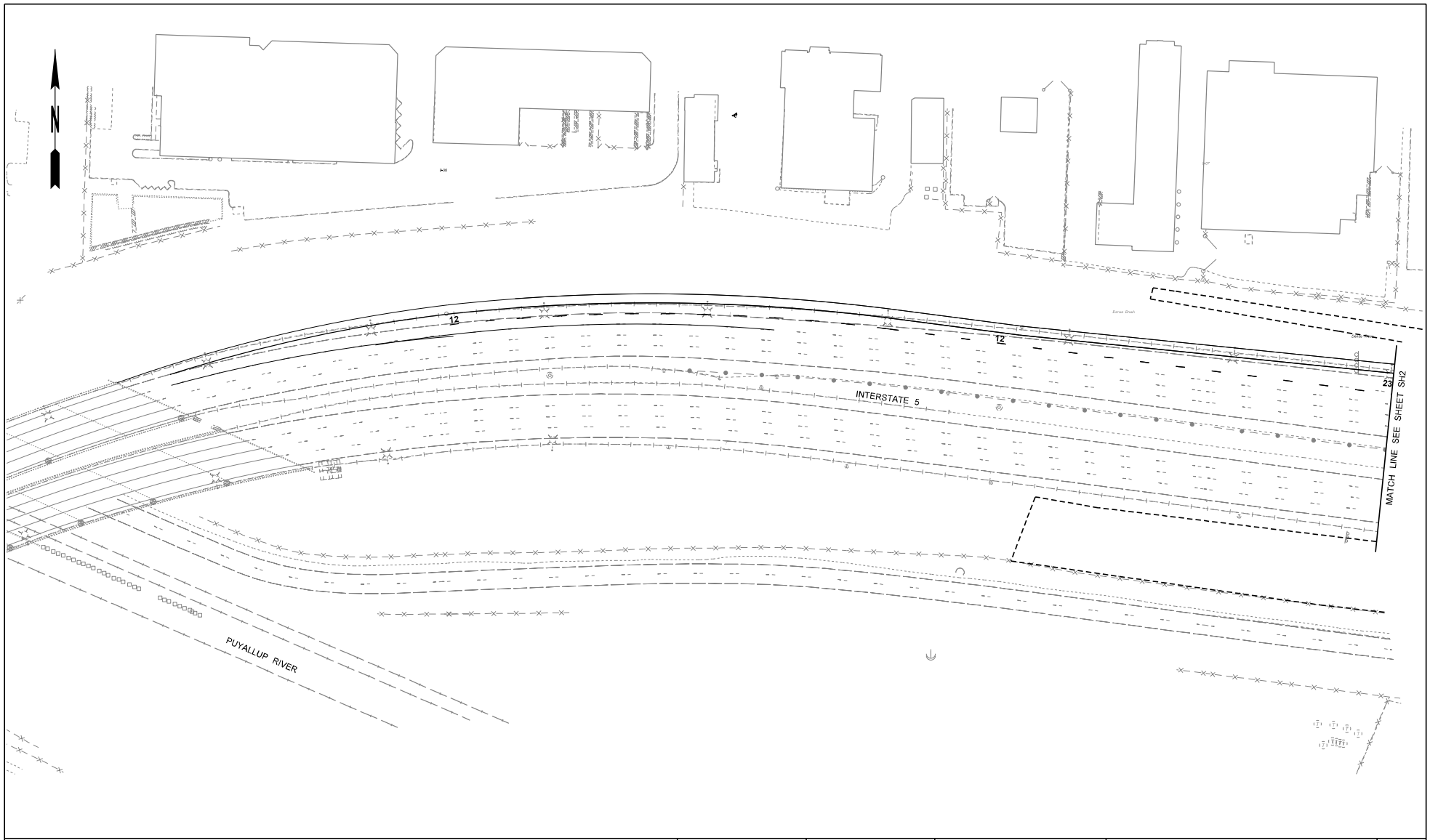
PORT OF TACOMA ROAD INTERCHANGE WITH I-5
ALTERNATIVE 4A

PARCLO A/B

Plot 4

PLAN REF NO 4

SHEET 4 OF 5 SHEETS



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DESIGNED BY				CONTRACT NO.		LOCATION NO.
ENTERED BY						
CHECKED BY						
PROJ. ENGR.						
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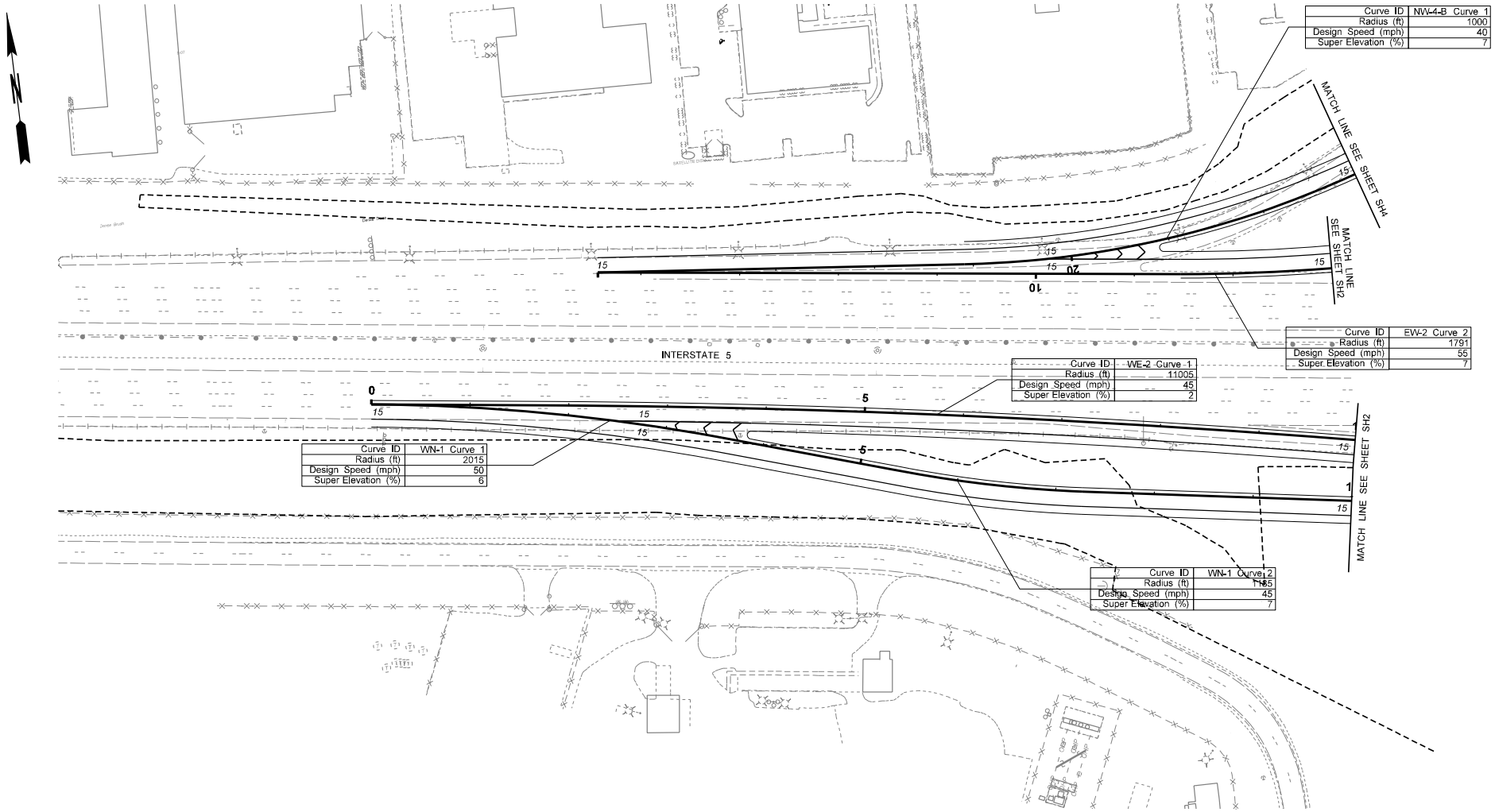
PORT OF TACOMA ROAD INTERCHANGE WITH I-5 ALTERNATIVE 4A

PARCLO A/B

Plot 5

PLAN REF NO 5

SHEET 5 OF 5 SHEETS



Curve ID	NW-4-B Curve 1
Radius (ft)	1000
Design Speed (mph)	40
Super Elevation (%)	7

Curve ID	EW-2 Curve 2
Radius (ft)	1791
Design Speed (mph)	55
Super Elevation (%)	7

Curve ID	WE-2 Curve 1
Radius (ft)	11005
Design Speed (mph)	45
Super Elevation (%)	2

Curve ID	WN-1 Curve 1
Radius (ft)	2015
Design Speed (mph)	50
Super Elevation (%)	6

Curve ID	WN-1 Curve 2
Radius (ft)	1185
Design Speed (mph)	45
Super Elevation (%)	7

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PLOTTED BY	schurman			JOB NUMBER		
DESIGNED BY						
ENTERED BY				CONTRACT NO.		LOCATION NO.
CHECKED BY						
PROJ. ENGR.						
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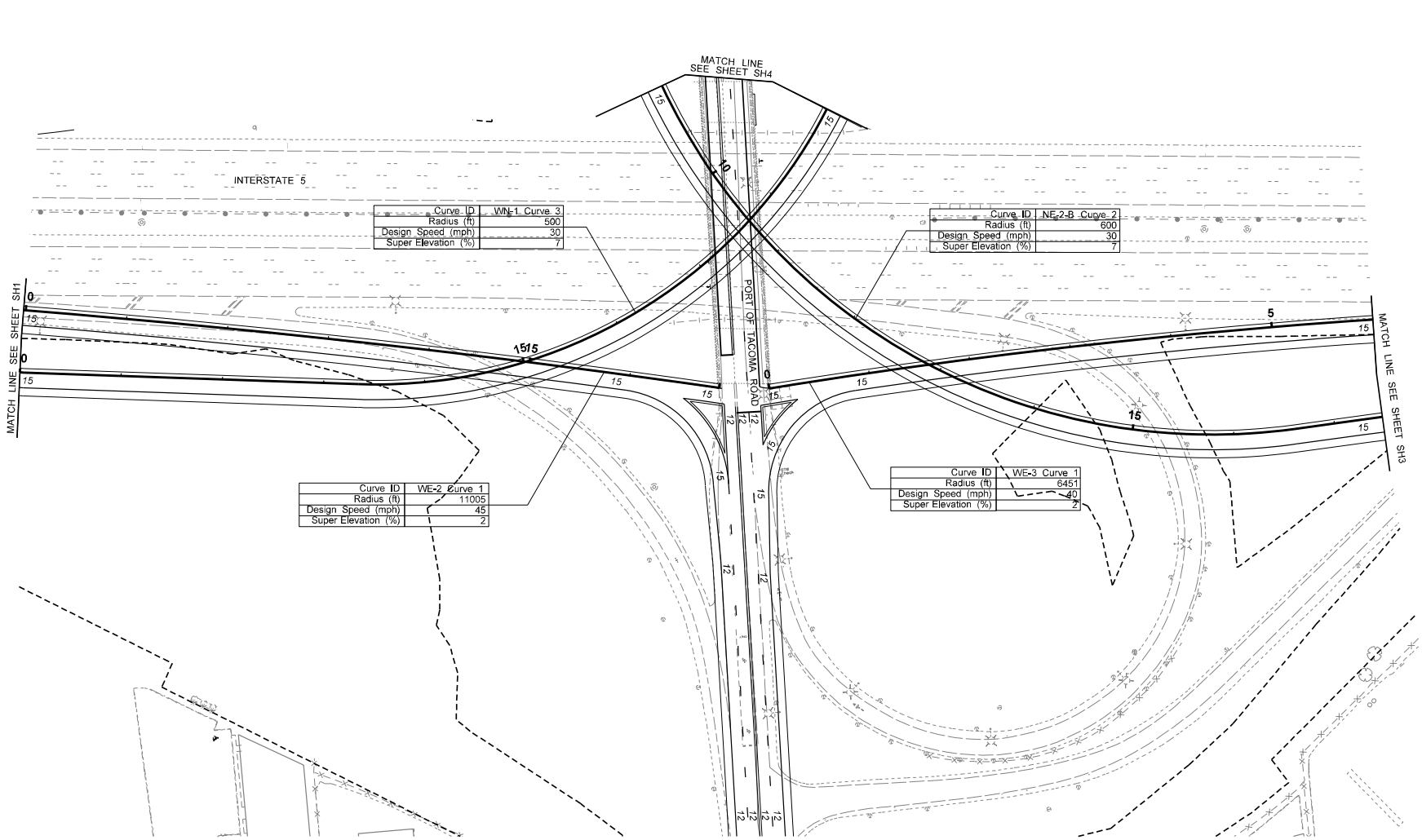
PORT OF TACOMA ROAD INTERCHANGE WITH I-5
ALTERNATIVE 5

DIRECTIONAL INTERCHANGE PLUS DIAMOND INTERCHANGE

Plot 1
PLAN REF NO 1
SHEET 1 OF 5 SHEETS



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DATE	6/15/2010						
PLOTTED BY	schurman			JOB NUMBER			
DESIGNED BY							
ENTERED BY				CONTRACT NO.		LOCATION NO.	
CHECKED BY							
PROJ. ENGR.							
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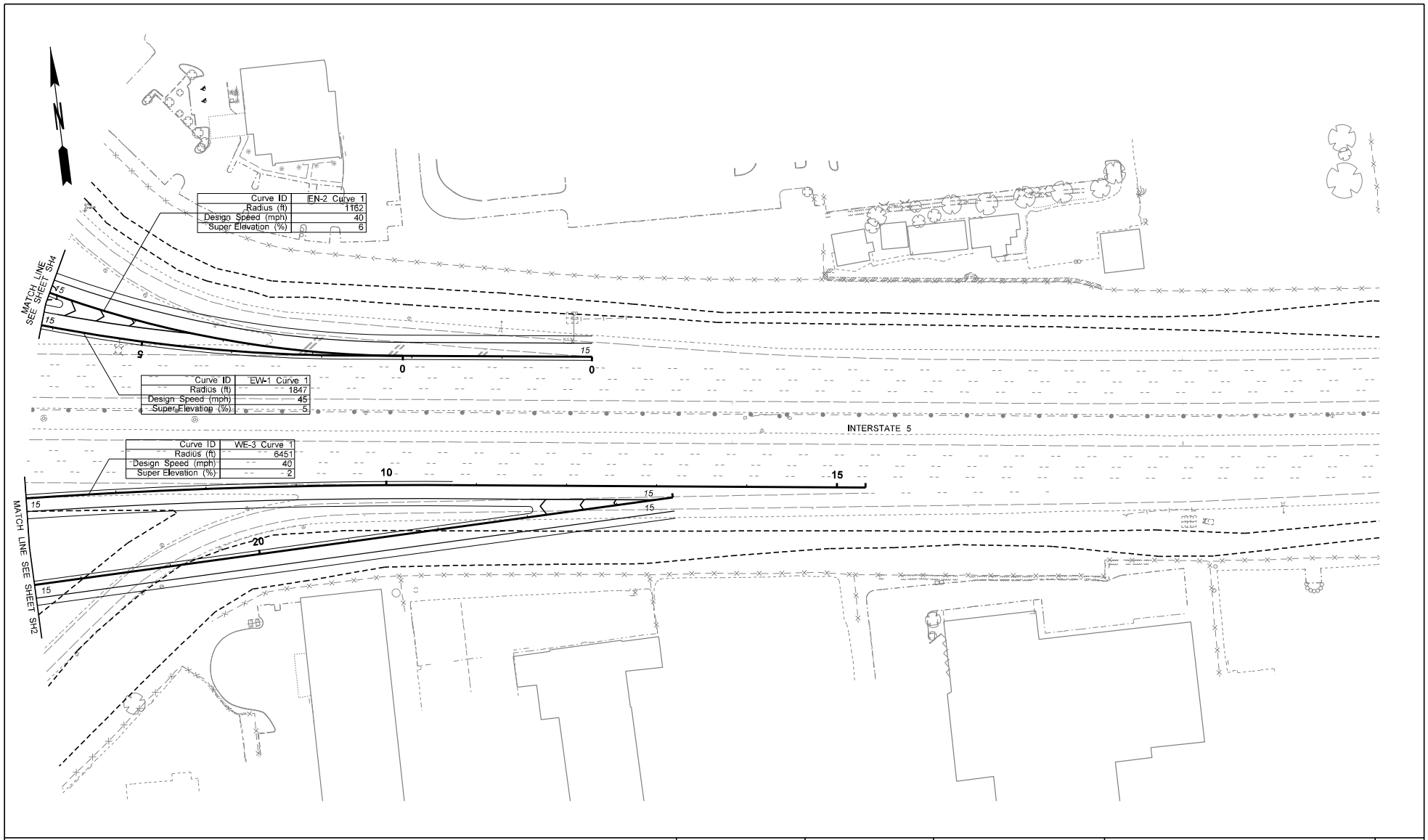
CITY OF FIFE

PORT OF TACOMA ROAD INTERCHANGE WITH I-5
ALTERNATIVE 5

DIRECTIONAL INTERCHANGE PLUS DIAMOND INTERCHANGE

Plot 2
PLAN REF NO 2
SHEET 2 OF 5 SHEETS



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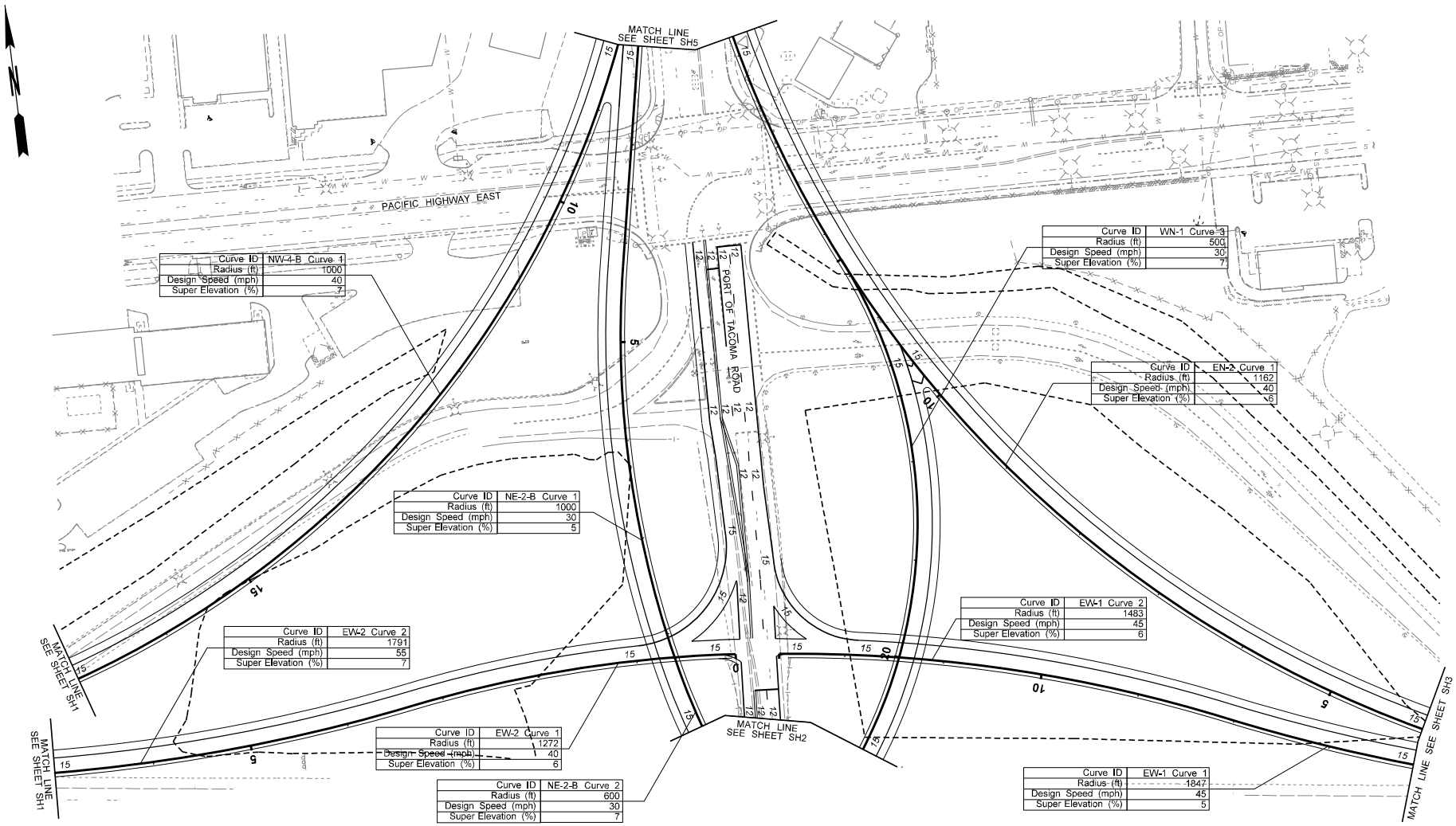
PORT OF TACOMA ROAD INTERCHANGE WITH I-5
ALTERNATIVE 5

DIRECTIONAL INTERCHANGE PLUS DIAMOND INTERCHANGE

Plot 3
PLAN REF NO 3
SHEET 3 OF 5 SHEETS



Curve ID	NW-4-B Curve 1
Radius (ft)	1000
Design Speed (mph)	40
Super Elevation (%)	7

Curve ID	WN-1 Curve 3
Radius (ft)	500
Design Speed (mph)	30
Super Elevation (%)	7

Curve ID	EN-2 Curve 1
Radius (ft)	1162
Design Speed (mph)	40
Super Elevation (%)	6

Curve ID	NE-2-B Curve 1
Radius (ft)	1000
Design Speed (mph)	30
Super Elevation (%)	5

Curve ID	EW-1 Curve 2
Radius (ft)	1483
Design Speed (mph)	45
Super Elevation (%)	6

Curve ID	EW-2 Curve 2
Radius (ft)	1791
Design Speed (mph)	55
Super Elevation (%)	7

Curve ID	EW-2 Curve 1
Radius (ft)	1272
Design Speed (mph)	40
Super Elevation (%)	6

Curve ID	NE-2-B Curve 2
Radius (ft)	600
Design Speed (mph)	30
Super Elevation (%)	7

Curve ID	EW-1 Curve 1
Radius (ft)	1847
Design Speed (mph)	45
Super Elevation (%)	5

FILE NAME	Q:\Seattle\2009\SAPWT-09-139\CADD\Design\RS\IJR\Alternative 5.dgn		
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PLOTTED BY	schurman		
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PROJ. ENGR.			
REGIONAL ADM.	REVISION	DATE	BY

REGION NO. 10 | STATE WASH | FED.AID PROJ.NO.

JOB NUMBER

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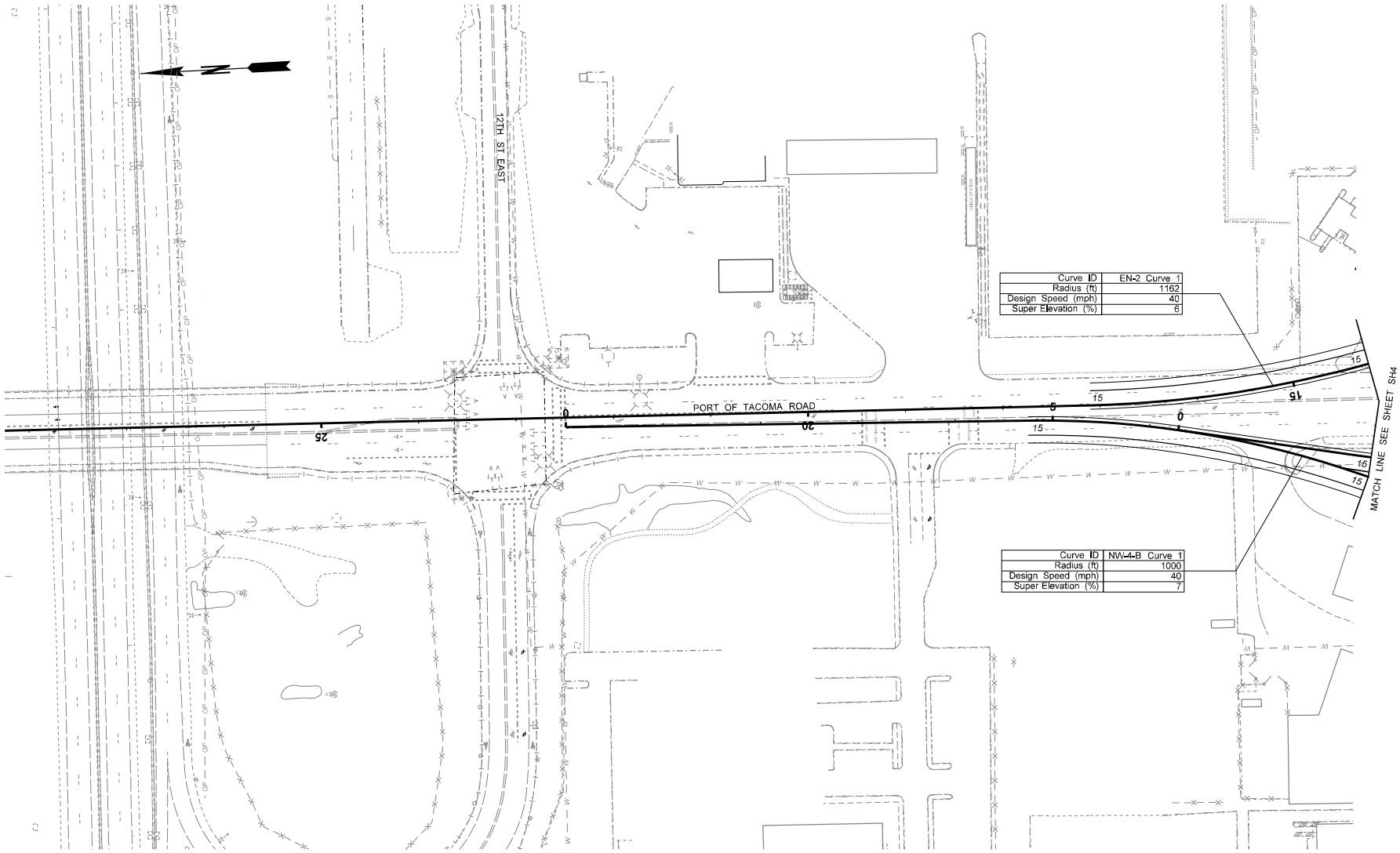
PORT OF TACOMA ROAD INTERCHANGE WITH I-5
ALTERNATIVE 5

DIRECTIONAL INTERCHANGE PLUS DIAMOND INTERCHANGE

Plot 4

PLAN REF NO 4

SHEET 4 OF 5 SHEETS



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PROJ. ENGR.					
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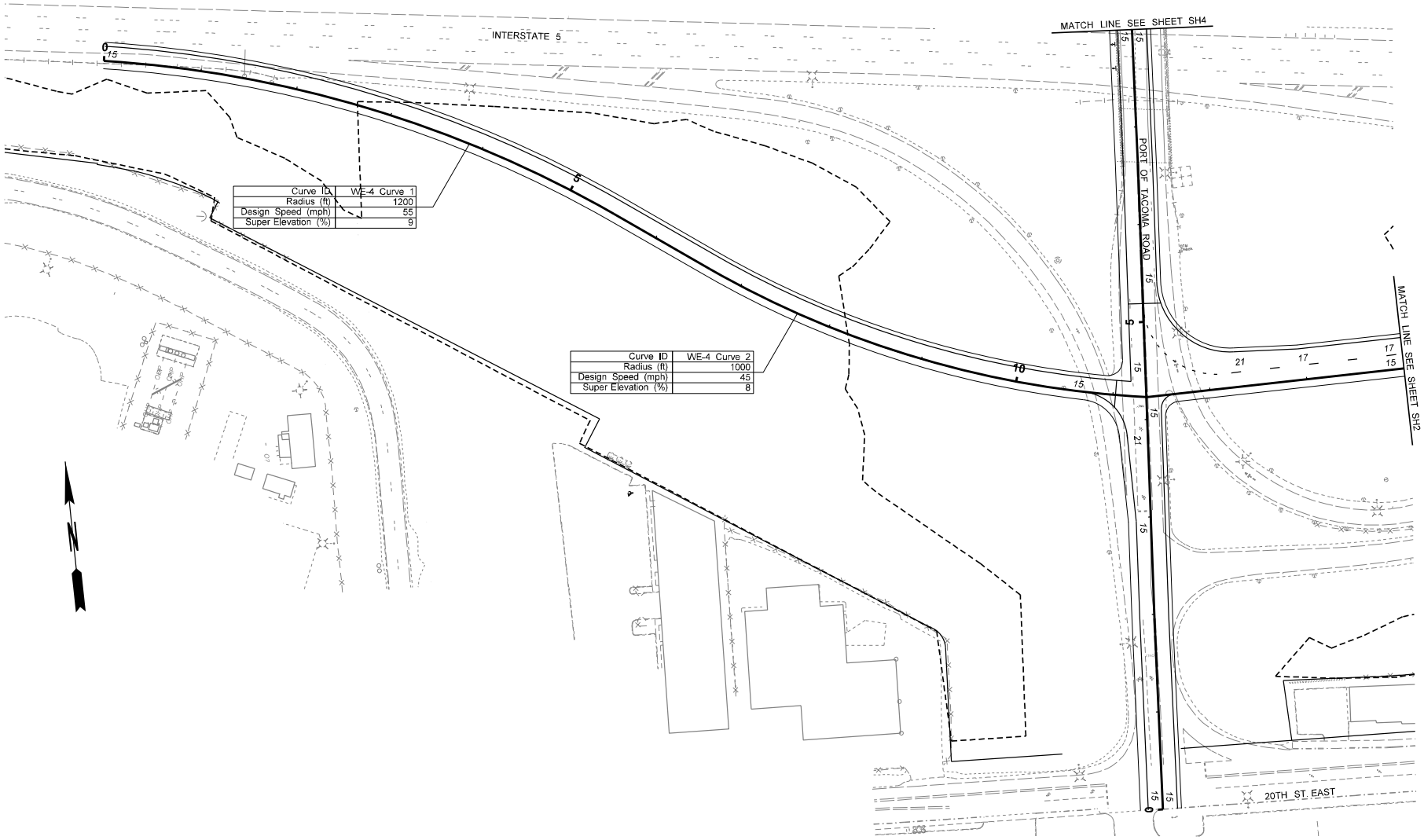
PORT OF TACOMA ROAD INTERCHANGE WITH I-5
ALTERNATIVE 5

DIRECTIONAL INTERCHANGE PLUS DIAMOND INTERCHANGE

Plot 5

PLAN REF NO 5

SHEET 5 OF 5 SHEETS



Curve ID	WE-4 Curve 1
Radius (ft)	1200
Design Speed (mph)	55
Super Elevation (%)	9

Curve ID	WE-4 Curve 2
Radius (ft)	1000
Design Speed (mph)	45
Super Elevation (%)	8

FILE NAME	Q:\Seattle\2009\SAPWT-09-139\CADD\Design\RS\IJR\Alternative 6.dgn					
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PROJ. ENGR.						
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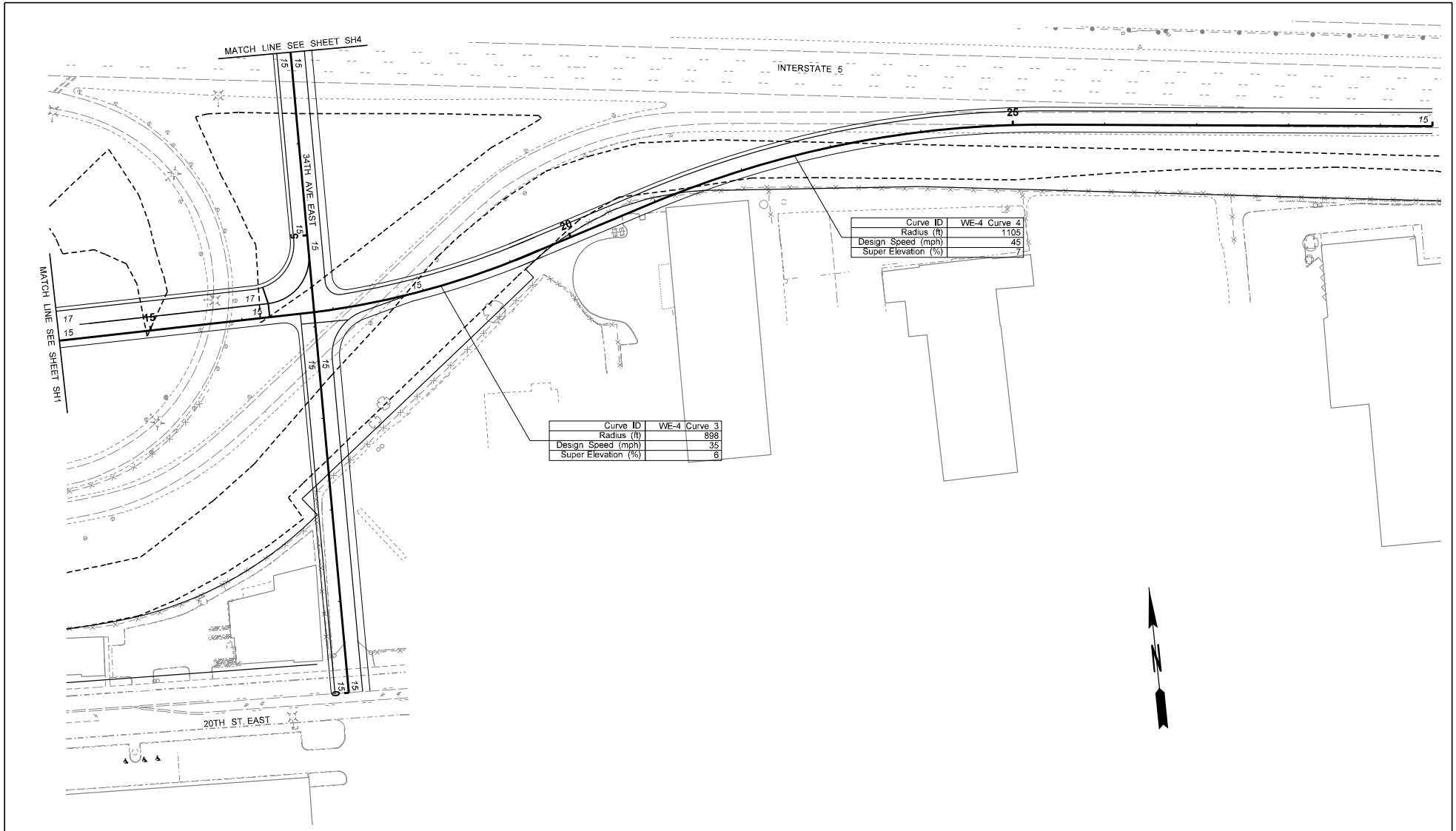
CITY OF FIFE

PORT OF TACOMA ROAD INTERCHANGE WITH I-5
ALTERNATIVE 6

DIAMOND INTERCHANGE WITH COUPLET

Plot 1
PLAN REF NO 1
SHEET 1 OF 5 SHEETS



Curve ID	WE-4 Curve 4
Radius (ft)	1105
Design Speed (mph)	45
Super Elevation (%)	7

Curve ID	WE-4 Curve 3
Radius (ft)	898
Design Speed (mph)	35
Super Elevation (%)	6

FILE NAME	Q:\Seattle\2009\SAPWT-09-139\CADD\Design\RS\IJR\Alternative 6.dgn			REGION NO. 10	STATE WASH	FED.AID PROJ.NO.
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PROJ. ENGR.						
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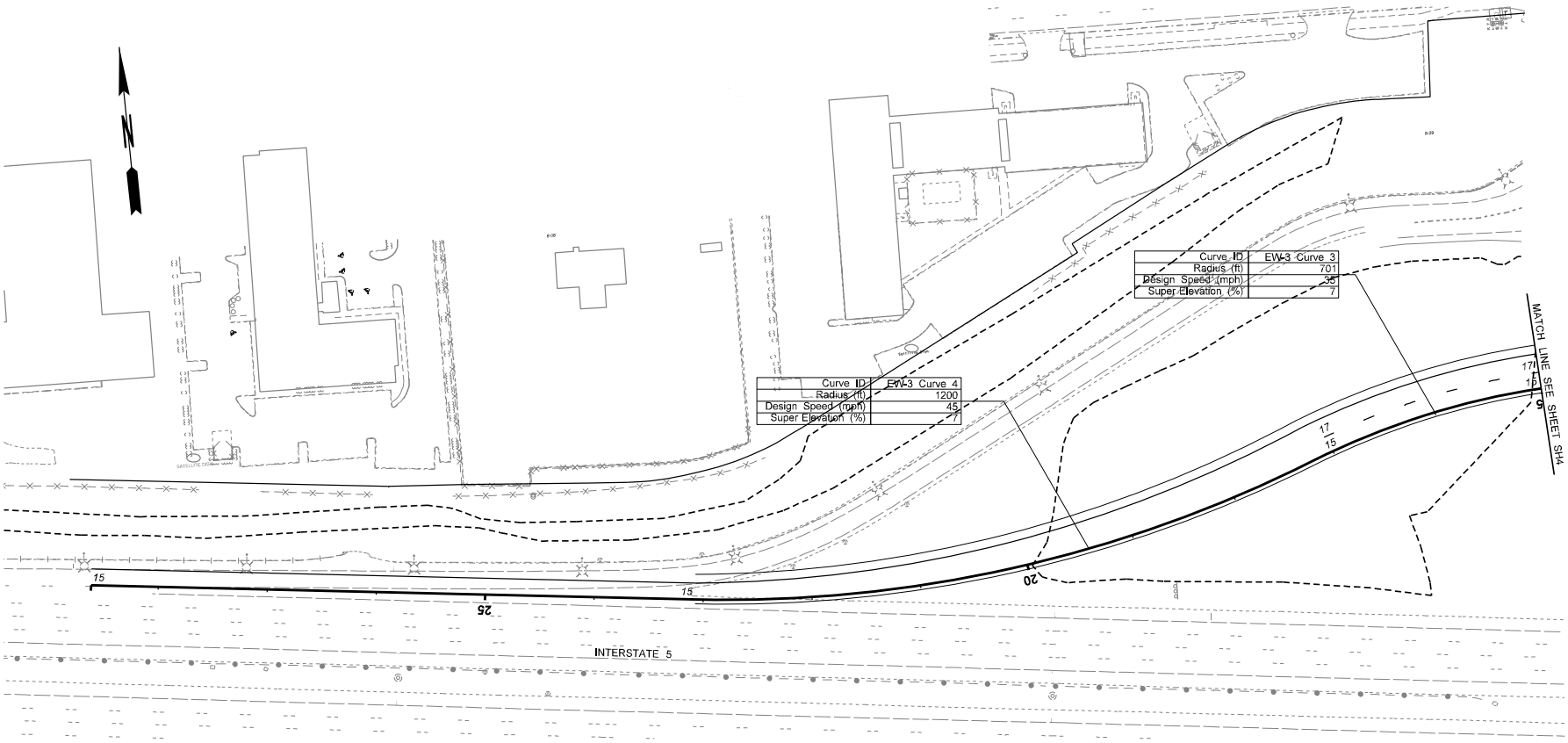
PORT OF TACOMA ROAD INTERCHANGE WITH I-5
ALTERNATIVE 6

DIAMOND INTERCHANGE WITH COUPLET

Plot 2

PLAN REF NO 2

SHEET 2 OF 5 SHEETS



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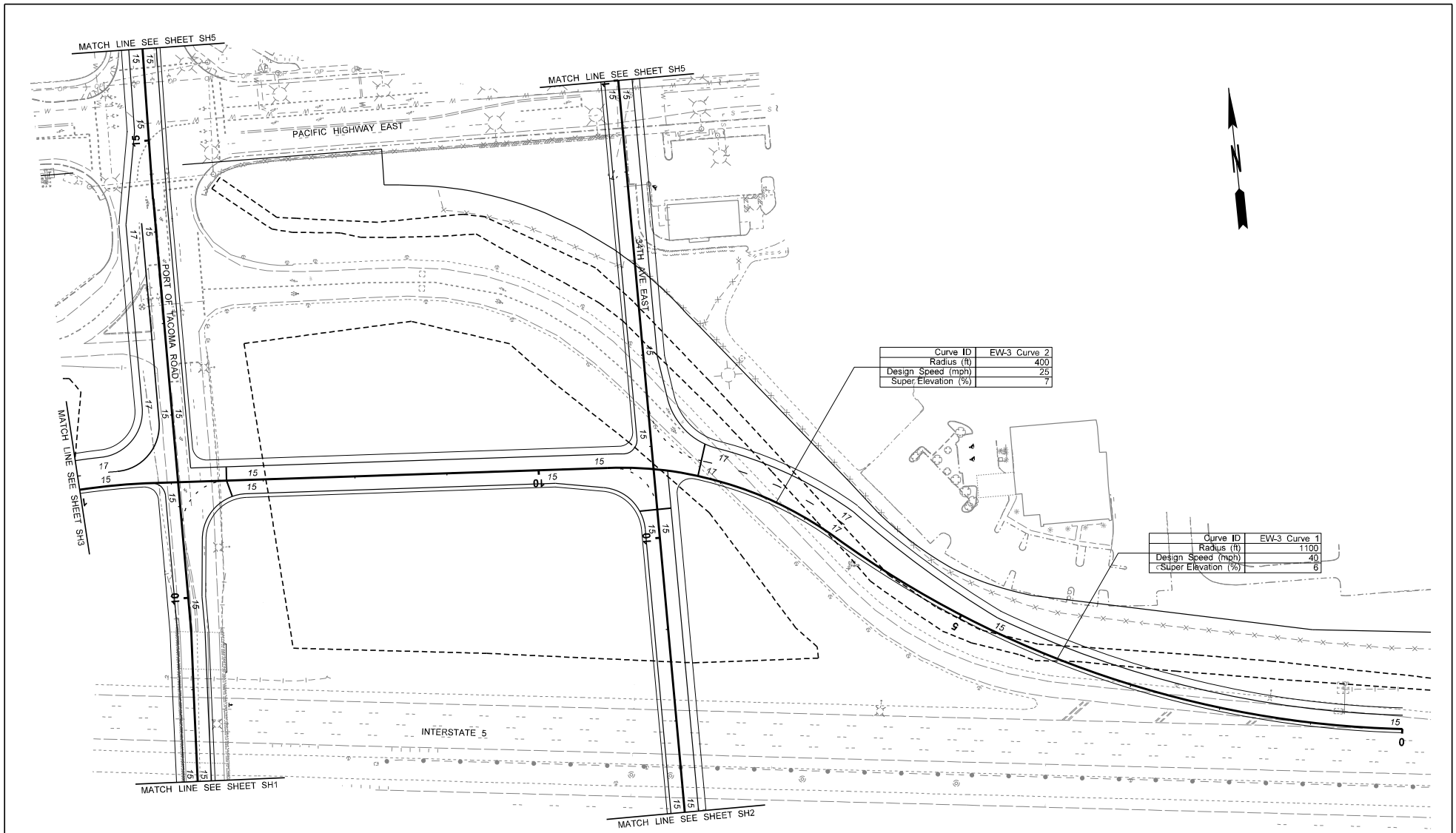
PORT OF TACOMA ROAD INTERCHANGE WITH I-5
ALTERNATIVE 6

DIAMOND INTERCHANGE WITH COUPLET

Plot 3

PLAN REF NO 3

SHEET 3 OF 5 SHEETS



Curve ID	EW-3 Curve 2
Radius (ft)	400
Design Speed (mph)	25
Super Elevation (%)	7

Curve ID	EW-3 Curve 1
Radius (ft)	1100
Design Speed (mph)	40
Super Elevation (%)	6

FILE NAME	Q:\Seattle\2009\SAPWT-09-139\CADD\Design\RS\IJR\Alternative 6.dgn					
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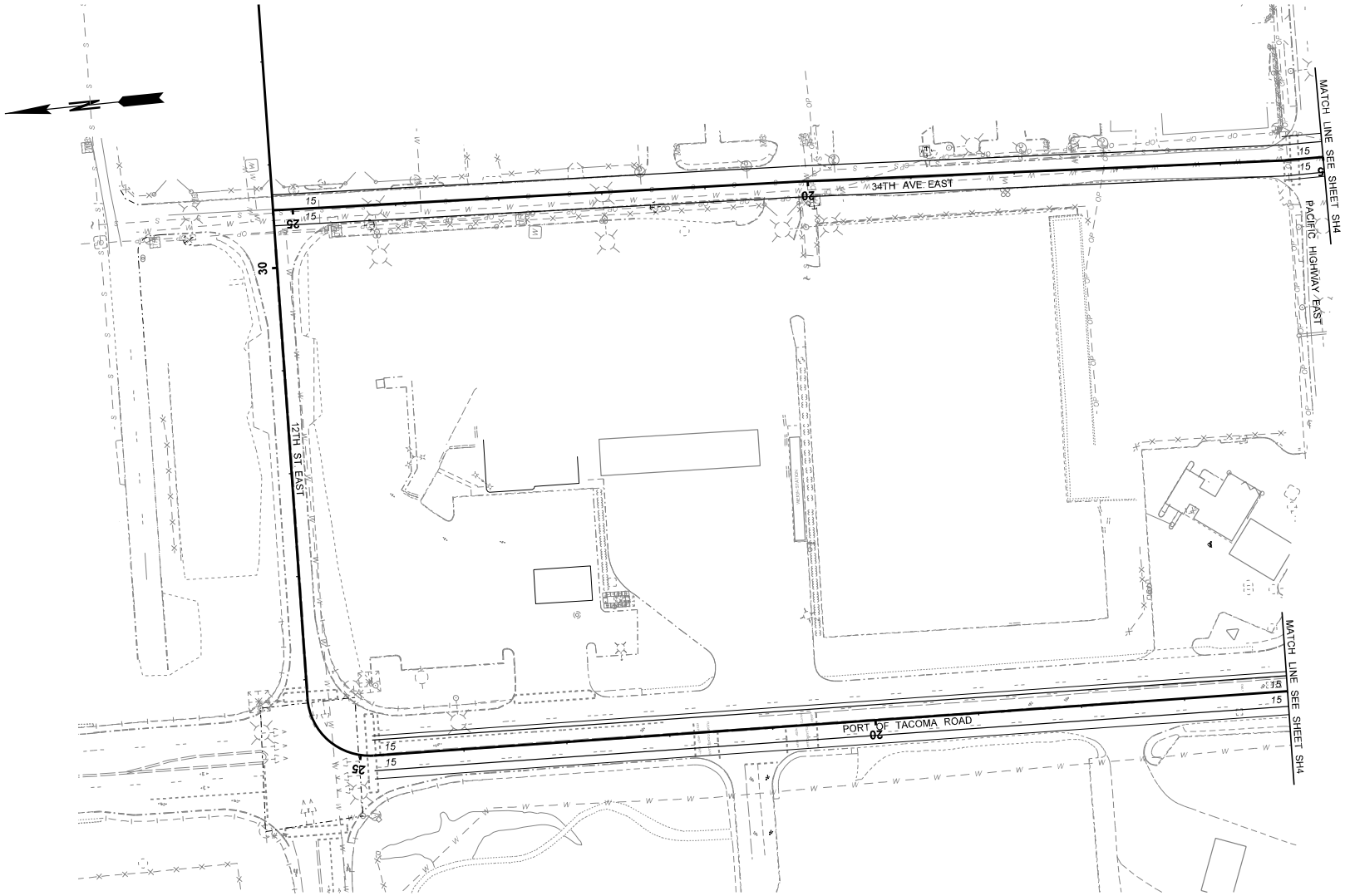
PORT OF TACOMA ROAD INTERCHANGE WITH I-5
ALTERNATIVE 6

DIAMOND INTERCHANGE WITH COUPLET

Plot 4
PLAN REF NO 4
SHEET 4 OF 5 SHEETS



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PROJ. ENGR.						
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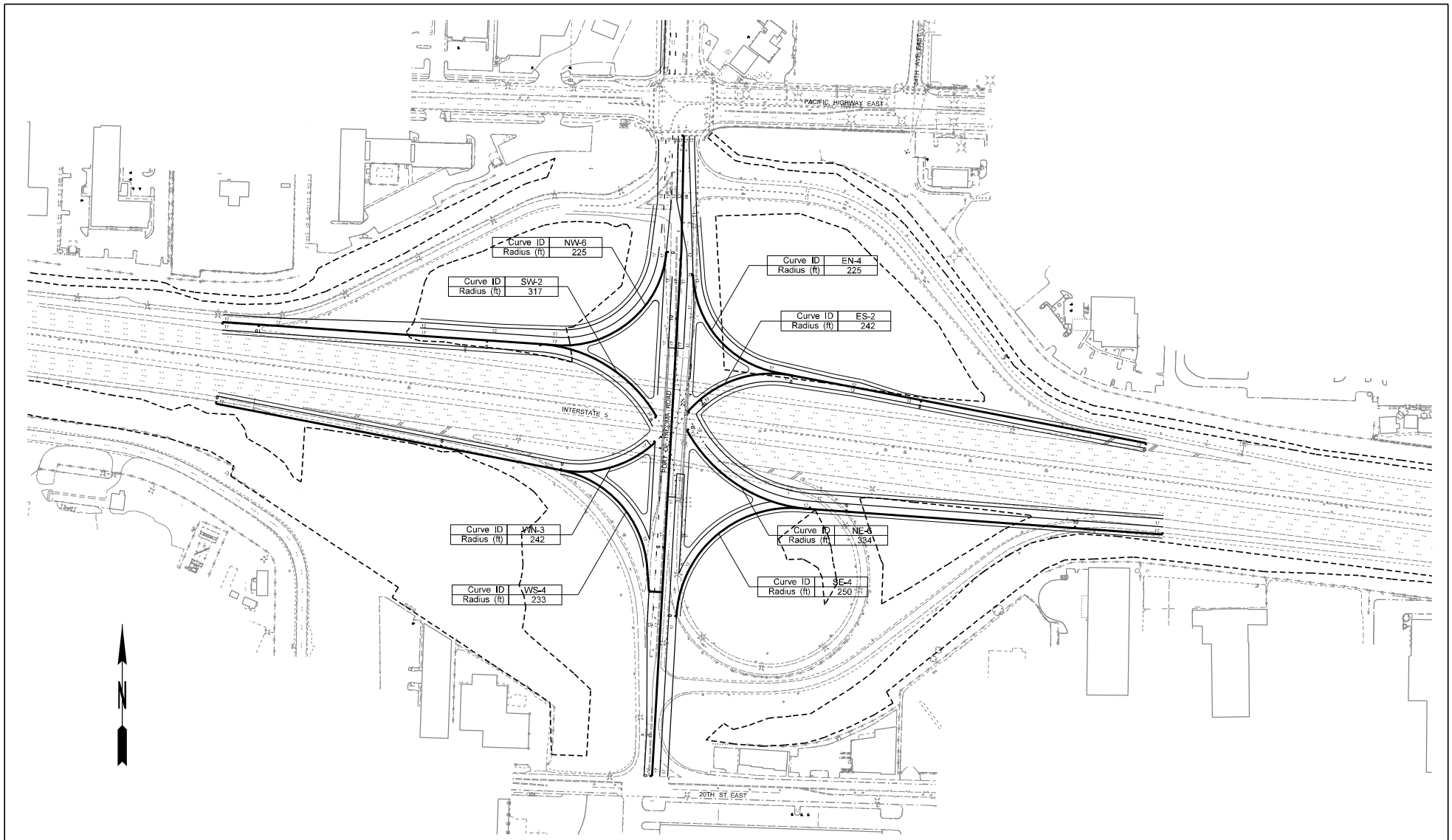
PORT OF TACOMA ROAD INTERCHANGE WITH I-5
ALTERNATIVE 6

DIAMOND INTERCHANGE WITH COUPLET

Plot 5

PLAN REF NO 5

SHEET 5 OF 5 SHEETS



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PORT OF TACOMA ROAD INTERCHANGE WITH I-5
ALTERNATIVE 8

SPUI

Plot 1
PLAN REF NO 1
SHEET 1 OF 1 SHEETS

Interchange Justification Report
Port of Tacoma Interchange with I-5
City of Fife, Washington

Appendix D
Final Technical Advisory Committee Recommendation Memorandum

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Memorandum

Date: 20 January 2010
Revised: 12 February 2010

Subject: Port of Tacoma Road Interchange with I-5 – Final Technical Advisory Committee Recommendation Memorandum

From: Jilma Jiménez, PE – BergerABAM
Rob Schurman, PE – BergerABAM

To: Russ Blount, PE – City of Fife
Ken Gill, PE – City of Fife
Port of Tacoma Road Interchange with I-5 Technical Advisory Committee

Route to: Project File

INTRODUCTION

The interchange of Port of Tacoma Road (POT Road) with Interstate 5 (I-5) is located just east of the Puyallup River Bridge in the City of Fife (City). This interchange is an integral element of the freight and truck operations of both the City and the Port of Tacoma (Port). As inferred by its name the POT Road is the main access between the Port and I-5 and it is also a connector to major arterials such as State Route (SR) 509 (South Frontage Road) and SR 99 (Pacific Highway East). The existing interchange of POT Road with I-5 is a One Quad Parclo B interchange, with a single loop ramp in the southeast quadrant; which serves the northbound I-5 to northbound POT Road.

Problems with the current configuration include closely spaced intersections and heavy congestion. The area is also a high accident location, with one fatality between 2001 and 2005 on the southbound off ramp. High truck volumes coupled with very closely spaced intersections make it difficult for vehicles and freight to access this area.

This memorandum summarizes the alternatives development, screening and selection process for interchange revisions at the POT Road and I-5 interchange. It also captures recommendations for the project formulated by the Technical Advisory Committee (TAC). Lastly, this memorandum documents the TAC's endorsement of a Recommended Configuration. Endorsement of the Recommended Configuration does not constitute approval

of the proposed action; rather it recommends further study and analysis of a specific alternative through the development of the IJR and environmental documentation process.

PROJECT OBJECTIVES

The following project objective statement was developed by the City in conjunction with the TAC.

> *"To provide efficient movement of traffic into and out of the Port of Tacoma and surrounding areas (especially for trucks); and to improve safety and reliability of access to local and area businesses; while balancing effects to the natural and community environments."*

ALTERNATIVES CONSIDERED

Three separate alternative development sessions were conducted to develop alternatives to meet the project's objective and goals. These sessions yielded a total of twelve alternatives. Alternatives developed were grouped in three major categories:

1. Alternatives that "fix" or revise the existing interchange
2. Alternatives that improve the configuration of the local roadway network
3. Alternatives that redesign the interchange (Blank Slate approach)

THREE-TIERED SCREEING PROCESS

A three-tiered screening process was implemented to analyze the benefits and viability of each alternative. The Level I screening identified and eliminated those alternatives that were fatally flawed. The Level II screening evaluated the remaining alternatives on geometrics and environmental issues. Finally, the Level III screening considered the alternative's ability to serve projected traffic volumes obtained from the PSRC travel demand forecasting effort. Table 1 below shows all twelve alternatives that were considered for improving the POT Road interchange and, in all but two alternatives, the reason they were eliminated.

Table 1 – Three-Tiered Screening Results

Alternative	Concept/Description	Stage of Elimination	Reason for Elimination
1	Revised Southbound Off Ramp	Level I	Does not meet project goals and possible IJR approval issues
1b	Parclo B with 34th Off Ramp	Level I	Does not meet project goals and possible IJR approval issues
2	Capacity Widening	Level III	Traffic modeling results did not meet future demand
3	Reconstructed Port of Tacoma Southbound Off Ramp	Level I	Too many restrictions (no left or right turns from POT Road onto Pacific Highway East.

Alternative	Concept/Description	Stage of Elimination	Reason for Elimination
4	Ramps at 34th Avenue East with a Revised Intersection at 20th Street East	Level III	Traffic modeling results did not meet future demand
4a	Parclo A/B	Level III	Traffic modeling results did not meet future demand
5	Directional Interchange plus Diamond Interchange	Level II	Exceeds the geometric requirements for maximum grade.
6	Diamond Couplet Interchange		
7	Left Exit	Level I	Does not meet project goals and possible IJR approval issues
8	SPUI		
8a	SPUI with 34th Ramps	Level I	Similar to Alternative 8 and could be revisited if needed
9	Revised Ramp at POT Road Plus Ramps at 34th Avenue East	Level I	Key elements included in Alternative 4

The three-tiered screening process identified two alternatives – Alternative 6 and 8 – as viable alternatives to improve the interchange and meet the stated project objectives. Screening results were validated through WSDOT's Value Matrix Analysis process; which also concluded that Alternatives 6 and 8 provided the greatest benefit to cost ratio of all the alternatives evaluated in the Level III screening process.

At the request of the TAC operational attributes of these two alternatives were analyzed through detailed VISSIM modeling. The VISSIM results showed that both Alternative 6 and 8 provided desired operational improvements for the interchange; however Alternative 6, provided slightly greater improvements over Alternative 8. An ensuing re-evaluation of the two alternatives through the refining of the Value Matrix Analysis showed that Alternative 6's ability to be constructed in phases coupled with the limited amount of ROW needed to widen POT Road and SR 99 (compared to Alternative 8) made it the alternative with the highest benefit to cost ratio.

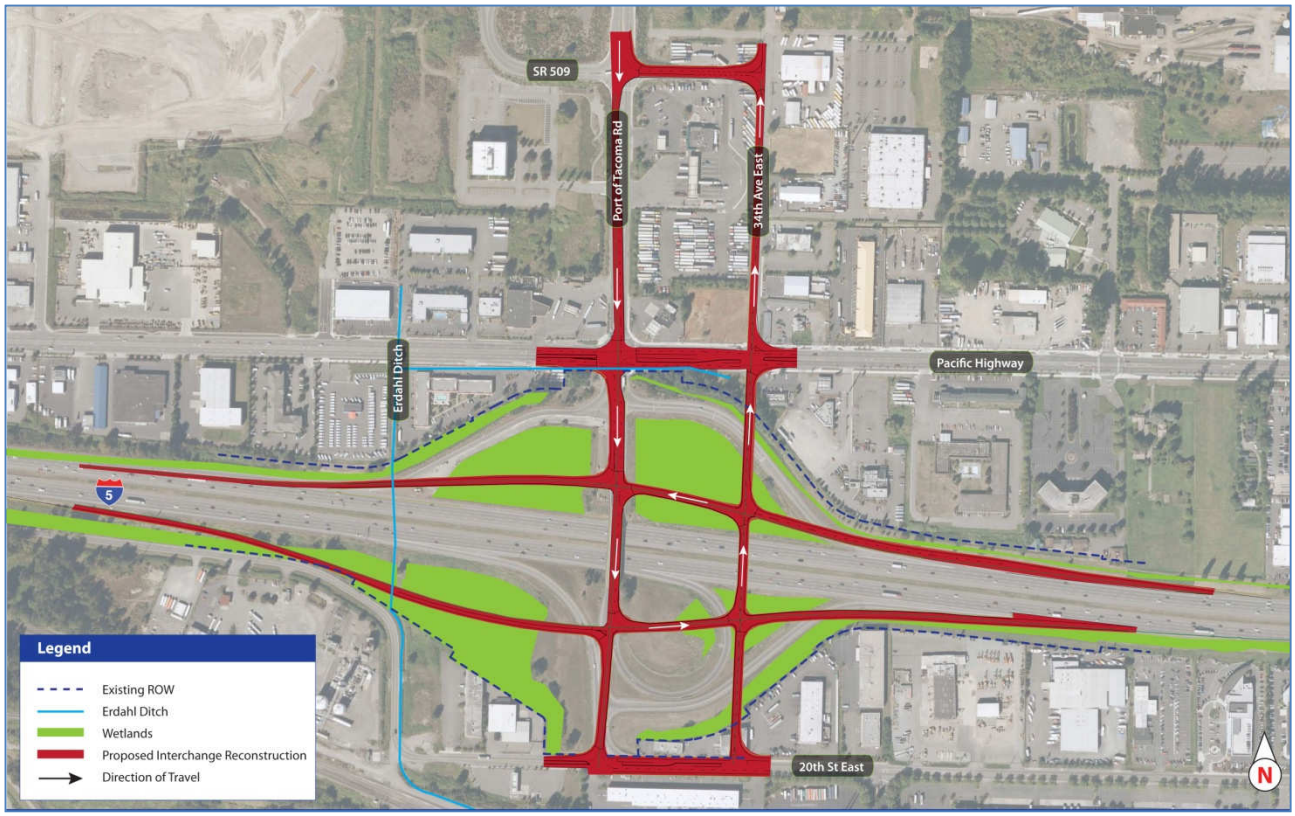
RECOMMENDED ALTERNATIVE

Figure 1 shows the proposed Alternative 6 – Diamond Couplet Interchange reconfiguration. As seen in the figure, this alternative proposes the reconfiguration of the existing 1-Quad Parclo B interchange to a split diamond configuration with the Port of Tacoma Road and 34th Avenue East operating as a one-way couplet. Other alternative attributes include:

- Ability to construct in multiple phases

- Ability to construct under traffic
- No widening necessary on POT Road
- Minimal widening on SR 99 (eastbound right turn pocket at POT Road intersection)
- Minimal length of queuing of all alternatives
- Increased spacing between the POT Road intersections with I-5 and SR 99
- Signalization and increased capacity for vehicles traveling southbound POT Road to northbound I-5

Figure 1 - Alternative 6 - Diamond Couplet



POTENTIAL IMPACTS AND MITIGATION

Construction of the new on and off ramps along with the new overcrossing of I-5 will affect approximately seven to nine acres of wetlands. Effects to wetlands and wetland buffers will be mitigated offsite.

Effects to noise and air quality are currently being studied and will be completed as part of the environmental documentation. Additionally, a right-of-way (ROW) analysis will be developed to determine the required ROW and access control needed to construct the recommended operational alternative.

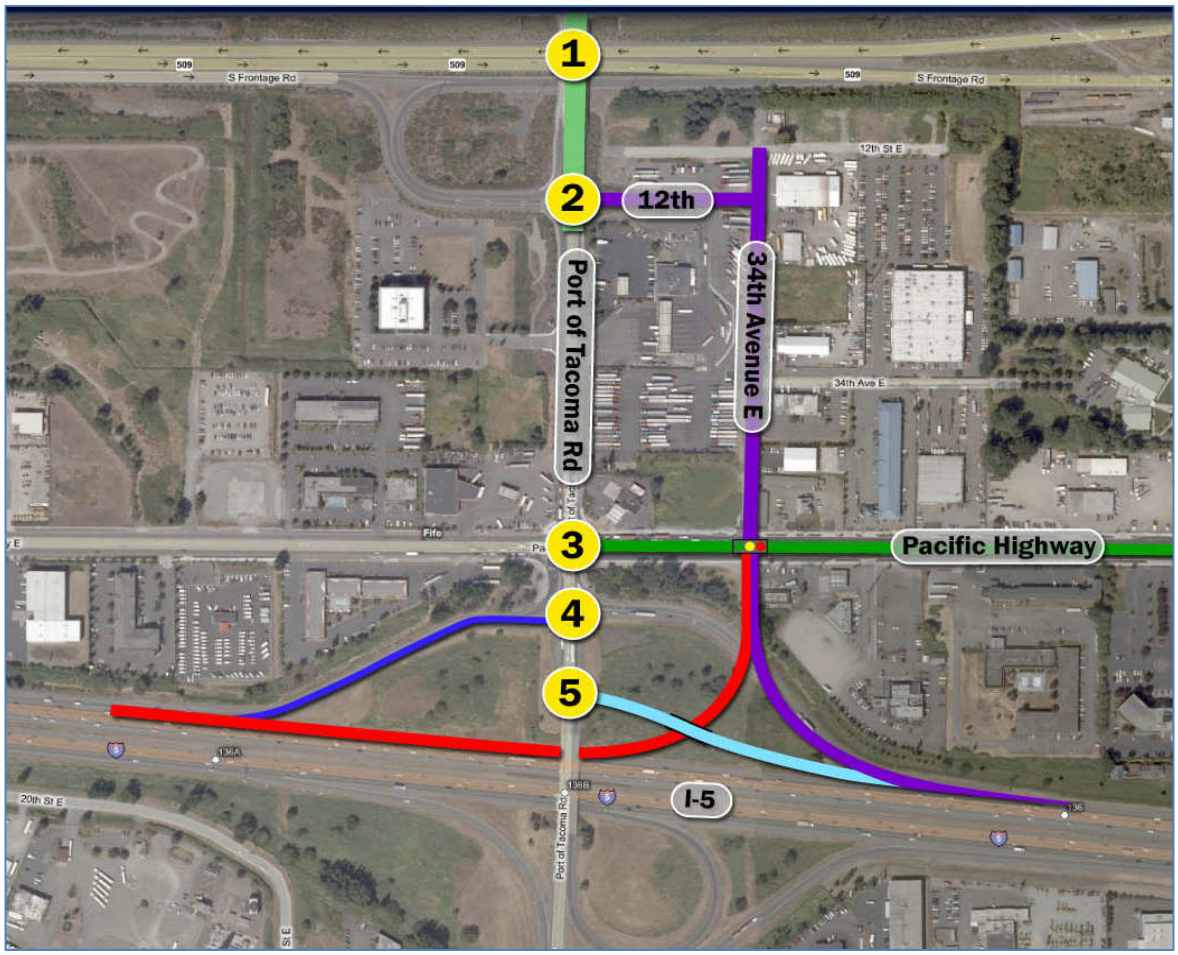
CONTROVERSIAL AREAS AND COORDINATION

There are no known controversial areas at this time.

CHANGES FROM ORIGINAL PROPOSAL

A design charrette and value engineering study in May 2003 recommended a phased approach to the reconfiguration of the POT Road interchange with I-5. Figure 2 shows the May 2003 recommendation; which served as the baseline alternative or "original proposal" for the current work. This alternative was included in the current study (Alternative 9) and was evaluated through the same screening process as the new alternatives considered.

Figure 2 – Original Proposal



Alternative 9 was eliminated during the first stage of screening. However it should be noted that several of its main components – new southbound I-5 exit at 34th Avenue East,

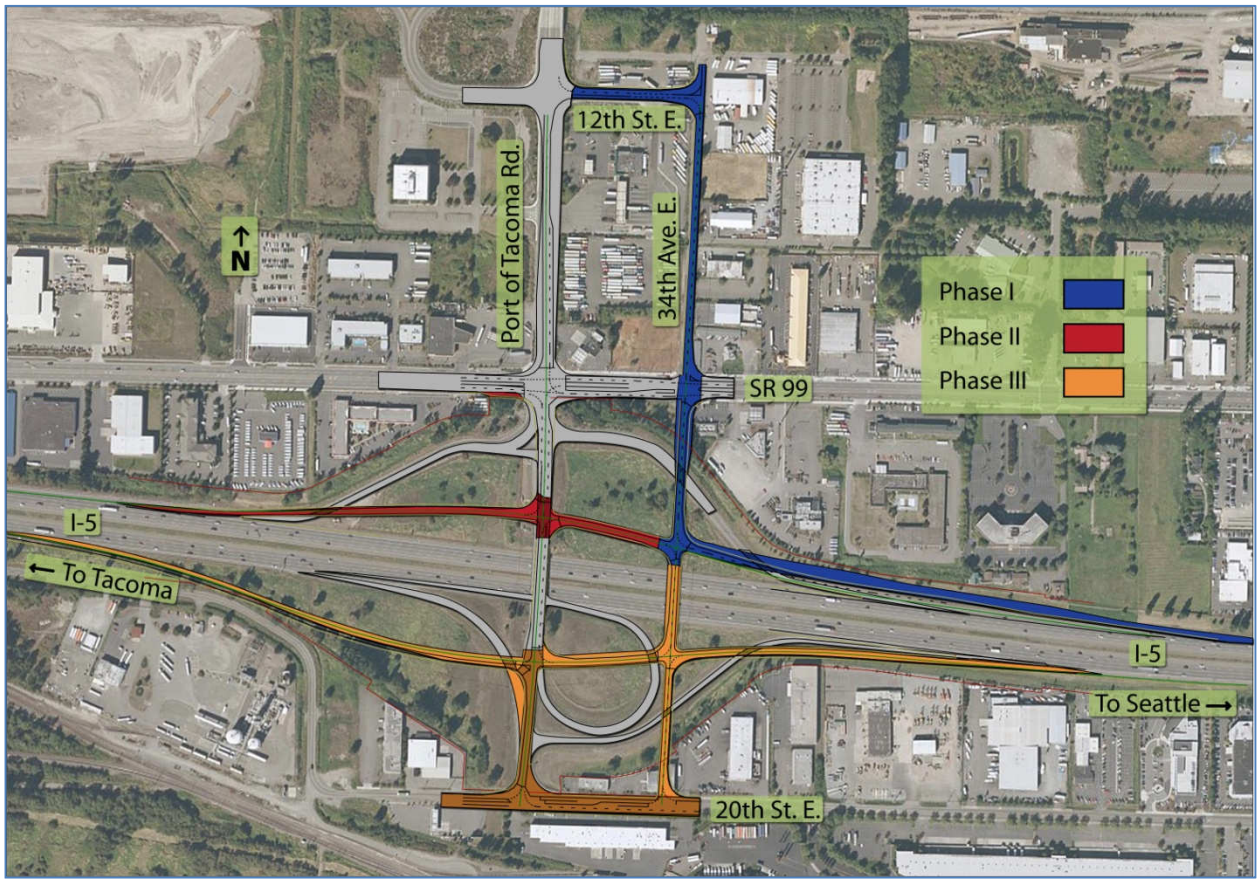
reconstruction of 34th Avenue East, reconstruction of 12th Street East, and a signal at the intersection of 34th Avenue East and Pacific Highway East – are all incorporated into the Alternative 6 – Diamond Couplet alternative.

NEXT STEPS

The next step for the POT Road interchange with I-5 project is to prepare an Interchange Justification Report (IJR) for WSDOT and FHWA approval. Additionally, the National Environmental Policy Act (NEPA) and State Environmental Policy Act (SEPA) environmental documentation will be completed with a Documented Categorical Exclusion (DCE).

ADDITIONAL TAC RECOMMENDATIONS

The TAC also analyzed several potential phasing plans for the reconstruction of the interchange with Alternative 6's Diamond Couplet configuration. Figure 3 below shows a potential phasing plan developed by the TAC.



TAC ENDORSEMENT

At its 10 November 2009 meeting the TAC authorized conditional selection of Alternative 6 – Diamond Couplet as the Recommended Configuration for this project. The authorization was conditioned on the review of the VISSIM simulation files by the Washington State Department of Transportation and on a presentation/concurrence meeting with FHWA. Both conditions were met favorably on 23 November 2009.

By signing the document below each TAC member indicates concurrence on the Recommended Configuration for the Port of Tacoma Road Interchange with I-5 project. Endorsement of this configuration does not constitute approval of the proposed action; rather it recommends further study and analysis of this configuration through the development of the IJR and environmental documentation process.

Russell Blount, City of Fife	Ken Gill, City of Fife
Dean Moberg, FHWA	Karen Schmidt, FMSIB
Brian Mannelly, Port of Tacoma	Dick Egolf, WSDOT
Steve Kim, WSDOT	Barb De Ste. Croix, WSDOT
JoAnne Schueler, WSDOT	Mike Fleming, WSDOT
Michael Villnave, WSDOT	Jim Tutton, Washington Trucking Assoc.
Raul Ramos, Puyallup Nation	Chad Wright, Marine View Ventures
Ari Steinberg, Meridian Engineers	

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Appendix E
NEPA DCE Email

Aguilar, Jessica

Subject: FW: Port of Tacoma Road I-5 Interchange

--- On **Wed, 2/22/12, Egolf, Richard <*EgolfR@wsdot.wa.gov*>** wrote:

From: Egolf, Richard <EgolfR@wsdot.wa.gov>
Subject: FW: Port of Tacoma Road I-5 Interchange
To: rblount@cityoffife.org, "Ross Widener" <rwidener@prodigy.net>
Date: Wednesday, February 22, 2012, 8:51 AM

Russ,

As you are aware, we have reviewed your project in the field, and have directed you to prepare the necessary discipline reports per our environmental coordination meeting. Once those reports are approved we anticipate processing the project as a NEPA DCE. This direction is based on our current understanding of the project and the lack of identifiable impacts, including the results of the public outreach which was completed by the City.

Thanks

Dick Egolf