

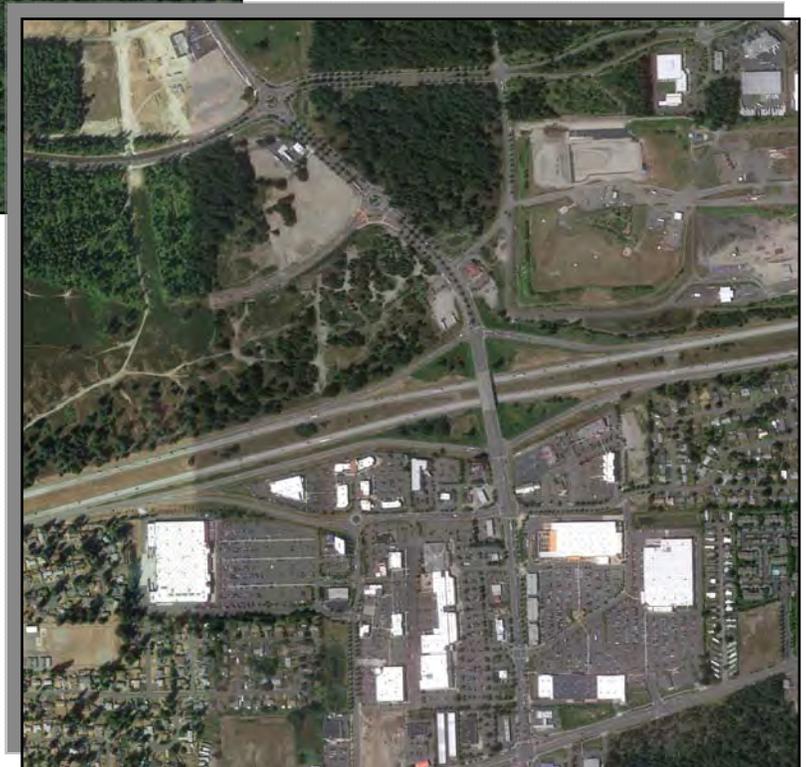
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# INTERCHANGE JUSTIFICATION REPORT

for

**I-5/MARTIN WAY INTERCHANGE and I-5/MARVIN ROAD INTERCHANGE**

**LACEY, WASHINGTON**



Prepared for: City of Lacey  
*In association with*  
FHWA & WSDOT

Prepared by: H. W. Lochner, Inc.  
*In association with*  
Shea Carr & Jewell, Inc.

APRIL 2015

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APRIL 2015

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# Interchange Justification Report

## I-5/Martin Way Interchange and I-5/Marvin Road Interchange MP 108 to MP113

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

<p><b>IJR Engineer of Record</b></p> 	<p>By: <u>Robert J. Munchinski</u> P.E. Project Engineer</p> <p>Date: <u>5-14-2015</u> 2015</p>
<p><b>Traffic Analysis Engineer</b></p> 	<p>By: <u>Yongliang Zhu</u> P.E. Project Engineer</p> <p>Date: <u>5-14-2015</u> 2015</p>
<p><b>Concurrence Region Traffic Engineer</b></p>	<p>By: <u>[Signature]</u> P.E.</p> <p>Date: <u>5-14-15</u> 2015</p>
<p><b>Concurrence Project Development Engineer</b></p>	<p>By: <u>[Signature]</u> P.E.</p> <p>Date: <u>5-14-15</u> 2015</p>
<p><b>WSDOT Approval Assistant State Design Engineer</b></p>	<p>By: <u>[Signature]</u> P.E.</p> <p>Date: <u>5-14-15</u> 2015</p>
<p><b>FHWA Approval FHWA Safety and Design Engineer</b></p>	<p>By: <u>Donald A. [Signature]</u> P.E.</p> <p>Date: <u>6/17/2015</u> 2015</p>

# Interchange Justification Report

I-5/Martin Way Interchange and I-5/Marvin Road Interchange  
MP 108 to MP114

## STAKEHOLDER ACCEPTANCE

### Signature Page

#### City of Lacey

Scott Gynn  
Signature

Title DPW

Date 5/14/15

#### WSDOT – Access and Hearing

Bark McSteen  
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Title Development Services & Access

Date 5/14/2015

#### Thurston County

Ronnie A. Caswell  
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Date 6/8/2015

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Date 5.15.15

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Date 6/17/2015

TABLE OF CONTENTS

	Page
<b>Executive Summary</b> .....	<b>ES-1</b>
<b>Project Description</b> .....	<b>PD-1</b>
WHAT IS THE PROJECT BACKGROUND? .....	PD-1
WHAT IMPROVEMENTS ARE PROPOSED AT THE I-5/MARTIN WAY INTERCHANGE? .....	PD-3
WHAT IMPROVEMENTS ARE PROPOSED AT THE I-5/MARVIN ROAD INTERCHANGE? .....	PD-3
WHAT LOCAL IMPROVEMENTS ARE PROPOSED WITH THESE INTERCHANGE IMPROVEMENTS? .....	PD-4
<b>Policy Point 1: Need for the Access Point Revision</b> .....	<b>PP1-1</b>
WHAT IS THE PURPOSE OF THE PROPOSED IMPROVEMENTS AND THIS INTERCHANGE JUSTIFICATION REPORT (IJR)? .....	PP1-1
WHAT IS THE STUDY AREA FOR THIS PROJECT? .....	PP1-1
WHAT IS THE IMPACT OF I-5 ON THE STUDY AREA? .....	PP1-2
WHAT IS THE CITY OF LACEY DOING TO IMPROVE LOCAL TRAVEL? .....	PP1-5
WHAT ARE OTHER LOCAL JURISDICTIONS DOING TO IMPROVE LOCAL TRANSPORTATION? .....	PP1-7
WHAT ARE THE CURRENT I-5 FEATURES? .....	PP1-7
HOW ARE I-5 AND THE INTERCHANGES ANALYZED? .....	PP1-12
WHAT ARE THE CURRENT AND EXPECTED BASELINE TRAFFIC CONDITIONS ALONG THE I-5 CORRIDOR? .....	PP1-12
WHAT WOULD HAPPEN TO THE MAINLINE OPERATIONS IF I-5 IS WIDENED TO FOUR CONTINUOUS THROUGH LANES IN EACH DIRECTION? .....	PP1-20
HOW MANY MARTIN WAY INTERCHANGE AND MARVIN ROAD INTERCHANGE TRIPS ARE EXPECTED TO USE I-5 FOR LOCAL TRIPS WITHIN THE STUDY AREA? .....	PP1-26
HOW MANY MARTIN WAY INTERCHANGE AND MARVIN ROAD INTERCHANGE TRIPS ARE EXPECTED TO USE I-5 FOR SHORT TRIP BETWEEN EXIT 105 (OLYMPIA) AND EXIT 114 (NISQUALLY)? .....	PP1-26
WHAT IS THE IMPACT OF THE OFF-RAMP BACK-UPS ON I-5 MAINLINE OPERATIONS? .....	PP1-27
WHAT ARE THE TRAFFIC OPERATIONAL CONDITIONS AT THE RAMP INTERSECTIONS WITH CROSS STREETS FOR THE EXISTING AND FUTURE BASE CONDITIONS? .....	PP1-29
WHAT ARE THE TRAFFIC OPERATIONAL CONDITIONS AT OTHER KEY INTERSECTIONS FOR THE EXISTING AND FUTURE BASE CONDITIONS? .....	PP1-32
WHAT ARE THE OVERALL TRAFFIC OPERATIONAL FINDINGS FOR THE EXISTING AND FUTURE BASE CONDITIONS? .....	PP1-32
WHAT IS THE COLLISION HISTORY ALONG I-5 WITHIN THE STUDY AREA? .....	PP1-34
WHAT ARE THE GEOMETRIC CONDITIONS OF THE EXISTING INTERCHANGES? .....	PP1-34
WHAT LOCAL (NON-INTERSTATE) IMPROVEMENTS ARE BEING CONSIDERED BY THE CITY OF LACEY TO RESOLVE THESE TRAFFIC ISSUES? .....	PP1-35
WHAT IS THE OVERALL EFFECT OF THE NON-INTERSTATE IMPROVEMENTS? .....	PP1-39

## Table of Contents

<b>Policy Point 2: Reasonable Alternatives</b> .....	PP2-1
HAVE REASONABLE ALTERNATIVES BEEN EVALUATED? .....	PP2-1
WHAT LOCAL (NON-INTERSTATE) IMPROVEMENTS WERE IDENTIFIED AND ANALYZED? .....	PP2-1
WHAT CONCLUSIONS DID THE STAKEHOLDERS COME TO REGARDING THE LOCAL STREET IMPROVEMENT ALTERNATIVES? .....	PP2-5
WHAT INTERSTATE IMPROVEMENTS WERE IDENTIFIED AS PART OF THE LTSAAE STUDY? .....	PP2-6
WHAT ADDITIONAL INTERSTATE IMPROVEMENTS WERE IDENTIFIED AS PART OF THIS IJR?.....	PP2-14
WHAT WERE THE ORIGINAL BUILD ALTERNATIVES APPROVED BY THE IJR STAKEHOLDERS?.....	PP2-16
WHAT WERE THE ADDITIONAL IMPROVEMENTS CONSIDERED AT THE MARTIN ROAD INTERCHANGE DURING THE ANALYSIS? .....	PP2-18
<b>Policy Point 3: Operational and Collision Analyses</b> .....	PP3-1
WHAT ACCESS MODIFICATIONS ARE BEING CONSIDERED?.....	PP3-1
WHAT ARE THE OPERATING ASSUMPTIONS FOR THE ACCESS MODIFICATIONS? .....	PP3-3
WHAT MODEL AND PROCESSES WERE USED TO FORECAST TRAVEL DEMAND FOR THE VARIOUS ACCESS MODIFICATIONS?.....	PP3-5
WHAT IS THE EXISTING INTERCHANGE SPACING ALONG THE I-5 CORRIDOR WITHIN THE STUDY AREA? .....	PP3-5
WHAT IS THE EXISTING AND FORECASTED DAILY TRAFFIC ALONG THE I-5 CORRIDOR WITHIN THE STUDY AREA?.....	PP3-6
HOW WAS THE INTERSTATE TRAFFIC ANALYSES CONDUCTED? .....	PP3-9
WHAT IS THE IMPACT OF THE ACCESS MODIFICATIONS ON INTERSTATE TRAVEL? .....	PP3-9
WHAT WERE THE RESULTS OF THE VISSIM ANALYSIS?.....	PP3-21
WHAT IS THE IMPACT OF THE BUILD ALTERNATIVES ON THE QUEUE BACKUPS ON THE OFF-RAMPS AT THE MARTIN WAY AND MARVIN ROAD INTERCHANGES? .....	PP3-24
WHAT EFFECT WILL THE BUILD ALTERNATIVES HAVE ON THE TRIP DISTRIBUTION ALONG I-5 BETWEEN THE OLYMPIA EXIT 105 AND THE THURSTON COUNTY/ PIERCE COUNTY LINE? .....	PP3-26
HOW WAS THE ANALYSES CONDUCTED FOR THE RAMP TERMINAL INTERSECTIONS? .....	PP3-28
WHAT WERE THE INTERSECTION ANALYSES FINDINGS?.....	PP3-28
HOW DOES THE SPUI AND DIVERGING DIAMOND OPERATE FOR THE MARVIN ROAD INTERCHANGE? .....	PP3 33
WHAT BUILD ALTERNATIVES ARE RECOMMENDED? .....	PP3-34
WHAT IS THE COLLISION HISTORY BETWEEN 2006 AND 2010 ALONG THE I-5 CORRIDOR?.....	PP3-34
WHAT ARE THE TYPES OF I-5 MAINLINE COLLISION?.....	PP3-35
WHAT WERE THE DRIVER CONTRIBUTING CIRCUMSTANCES FOR THESE COLLISIONS? .....	PP3-36
WHAT IS THE FREQUENCY OF COLLISIONS ALONG I-5 IN THE STUDY AREA? .....	PP3-36
HOW SEVERE WERE THE COLLISIONS AT I-5 INTERCHANGES WITHIN THE STUDY AREA? .....	PP3-36
HOW ARE THE COLLISION RATES ALONG I-5 EXPECTED TO CHANGE OVER THE NEXT 20 YEARS WITH NO CHANGES TO I-5? .....	PP3-40

HOW WILL THE INTERCHANGE MODIFICATIONS AFFECT THE COLLISION RATE IN THE FUTURE? ....PP3-40

**Policy Point 4: Access Connections and Design.....PP4-1**

WILL THE PROPOSAL PROVIDE FULLY DIRECTIONAL INTERCHANGES CONNECTED TO PUBLIC STREETS OR ROADS, SPACED APPROPRIATELY, AND DESIGNED TO FULL DESIGN LEVEL GEOMETRIC CONTROL CRITERIA?.....PP4-1

WHAT ARE THE MARTIN WAY INTERCHANGE MODIFICATIONS? .....PP4-1

WHAT ARE THE MARVIN ROAD INTERCHANGE MODIFICATIONS? .....PP4-2

WHAT ARE THE CONCEPTUAL LAYOUT AND SIGNING PLANS FOR THE MARTIN WAY AND MARVIN ROAD INTERCHANGES MODIFICATIONS? .....PP4-3

**Policy Point 5: Land Use and Transportation Plans.....PP5-1**

IS THE PROPOSED ACCESS POINT REVISION COMPATIBLE WITH LAND USES FOR THE AREA? .....PP5-1

IS THE PROPOSED ACCESS POINT REVISION COMPATIBLE WITH TRANSPORTATION PLANS FOR THE AREA?.....PP5-1

**Policy Point 6: Future Interchanges.....PP6-1**

IS THE PROPOSED ACCESS POINT REVISION COMPATIBLE WITH A COMPREHENSIVE NETWORK PLAN? .....PP6-1

ARE THE PROPOSED IMPROVEMENTS COMPATIBLE WITH OTHER KNOWN IMPROVEMENT PROJECTS ALONG I-5? .....PP6-4

**Policy Point 7: Coordination.....PP7-1**

ARE ALL COORDINATION PROJECTS AND ACTIONS PROGRAMMED AND FUNDED? .....PP7-1

**Policy Point 8: Environmental Processes .....PP8-1**

WHAT IS THE STATUS OF THE PROPOSAL’S ENVIRONMENTAL PROCESSES?.....PP8-1

WHAT IS THE ENVIRONMENTAL PROCESS FOR THIS IJR?.....PP8-4

WHAT ARE THE ENVIRONMENTAL PERMITS AND APPROVALS NEEDED FOR THESE INTERCHANGE IMPROVEMENT PROJECTS? .....PP8-4

WHAT IS THE PUBLIC INVOLVEMENT PROCESS FOR THE PROPOSED IMPROVEMENTS? .....PP8-5

**LIST OF FIGURES**

<b>Figure No.</b>		<b>Page</b>
<b>1</b>	Vicinity Map.....	PD-2
<b>1-1</b>	Study Area.....	PP1-3
<b>1-2</b>	I-5 Through Thurston County.....	PP1-2
<b>1-3</b>	City of Lacey Land Use Designations.....	PP1-4
<b>1-4</b>	Planned Intercity Transit Service.....	PP1-9
<b>1-5</b>	Regional Transportation Improvements.....	PP1-10
<b>1-6</b>	Pacific Avenue Interchange.....	PP1-8
<b>1-7</b>	Sleater-Kinney Road Interchange.....	PP1-8
<b>1-8</b>	Martin Way Interchange.....	PP1-11
<b>1-9</b>	Marvin Road Interchange.....	PP1-11
<b>1-10</b>	Nisqually Interchange.....	PP1-12
<b>1-11</b>	2011 Base Traffic Conditions - AM Peak Hour.....	PP1-13
<b>1-12</b>	2011 Base Traffic Conditions - PM Peak Hour.....	PP1-14
<b>1-13</b>	2020 Base Traffic Conditions - AM Peak Hour.....	PP1-15
<b>1-14</b>	2020 Base Traffic Conditions - PM Peak Hour.....	PP1-16
<b>1-15</b>	2040 Base Traffic Conditions - AM Peak Hour.....	PP1-17
<b>1-16</b>	2040 Base Traffic Conditions - PM Peak Hour.....	PP1-18
<b>1-17</b>	2020 Base Traffic Conditions with Widened I-5 - AM Peak Hour.....	PP1-21
<b>1-18</b>	2020 Base Traffic Conditions with Widened I-5 - PM Peak Hour.....	PP1-22
<b>1-19</b>	2040 Base Traffic Conditions with Widened I-5 - AM Peak Hour.....	PP1-23
<b>1-20</b>	2040 Base Traffic Conditions with Widened I-5 - PM Peak Hour.....	PP1-24
<b>1-21</b>	Destination of Trips using Martin Way ramps - Base Conditions.....	PP1-26
<b>1-22</b>	Destination of Trips using Marvin Road ramps - Base Conditions.....	PP1-26
<b>1-23</b>	Destination of Trips using Martin Way ramps - Base Conditions.....	PP1-27
<b>1-24</b>	Destination of Trips using Marvin Road ramps - Base Conditions.....	PP1-27
<b>1-25</b>	PM Peak Hour Off-ramp Queues at Martin Way & Marvin Road.....	PP1-28
<b>1-26</b>	Summary of AM Peak Hour Ramp Intersection Analysis.....	PP1-30
<b>1-27</b>	Summary of PM Peak Hour Ramp Intersection Analysis.....	PP1-31
<b>1-28</b>	Summary of AM & PM Peak Hour Traffic Analyses at Selected Interchanges.....	PP1-33
<b>1-29</b>	Number of I-5 Collisions by Year.....	PP1-34
<b>1-30</b>	I-5 Mainline Collisions by Type.....	PP1-34
<b>1-31</b>	Proposed Local Improvements	PP1-37

## LIST OF FIGURES (cont.)

Figure No.		Page
2-1	Local Street Improvements.....	PP2-3
2-2	Recommended Local Street Improvements.....	PP2-5
2-3	Improvements Options at the Sleater-Kinney Road Interchange.....	PP2-7
2-4	Improvements Options at the Martin Way Interchange.....	PP2-8
2-5	Improvements Options at the Marvin Road Interchange	PP2-11
2-6	Martin Way Interchange.....	PP2-14
2-7	Marvin Road interchange.....	PP2-15
2-8	Partial Cloverleaf Concept – I-5/Marin Way Interchange.....	PP2-16
2-9	SPUI Concept with Frontage Road – I-5/Marvin Road Interchange.....	PP2-17
2-10	Diverging Diamond Concept with Frontage Road – I-5/Marvin Road Interchange.....	PP2-17
2-11	SPUI Concept with Collector/Distributor Road – I-5/Marvin Road Interchange.....	PP2-19
3-1	Partial Cloverleaf Concept – I-5/Marin Way Interchange.....	PP3-1
3-2	SPUI Concept with Frontage Road – I-5/Marvin Road Interchange.....	PP3-2
3-3	Diverging Diamond Concept with Frontage Road – I-5/Marvin Road Interchange.....	PP3-2
3-4	SPUI Concept with Collector/Distributor Road – I-5/Marvin Road Interchange.....	PP3-3
3-5	I-5 Interchange Spacing and 2020 Mainline Traffic Volumes Summary.....	PP3-7
3-6	I-5 Interchange Spacing and 2040 Mainline Traffic Volumes Summary.....	PP3-8
3-7	2020 Build 1 Alternative – AM Peak Hour Volumes, LOS & Densities (No I-5 Widening).....	PP3-11
3-8	2020 Build 1 Alternative – PM Peak Hour Volumes, LOS & Densities (No I-5 Widening).....	PP3-12
3-9	2020W Build 1 Alternative – AM Peak Hour Volumes, LOS & Densities (with I-5 Widening).....	PP3-13
3-10	2020W Build 1 Alternative – PM Peak Hour Volumes, LOS & Densities (with I-5 Widening).....	PP3-14
3-11	2020W Build 2 Alternative – AM Peak Hour Volumes, LOS & Densities (with I-5 Widening).....	PP3-15
3-12	2020W Build 2 Alternative – PM Peak Hour Volumes, LOS & Densities (with I-5 Widening).....	PP3-16
3-13	2040W Build 1 Alternative – AM Peak Hour Volumes, LOS & Densities (with I-5 Widening).....	PP3-17
3-16	2040W Build 2 Alternative – PM Peak Hour Volumes, LOS & Densities (with I-5 Widening).....	PP3-20

**LIST OF FIGURES (cont.)**

<b>Figure No.</b>		<b>Page</b>
<b>3-17</b>	I-5 Off-Ramp Queues at Martin Way	PP3-24
<b>3-18</b>	I-5 Off-Ramp Queues at Marvin Rd	PP3-25
<b>3-19</b>	Distribution of Trips using the I-5 Ramps at Martin Way and Marvin Road.....	PP3-27
<b>3-20</b>	Summary of the AM Peak Hour Intersection Analyses.....	PP3-29
<b>3-21</b>	Summary of the PM Peak Hour Intersection Analyses.....	PP3-30
<b>3-22</b>	I-5 Collision Summary.....	PP3-34
<b>3-23</b>	I-5 Collision Types.....	PP3-36
<b>3-24</b>	Contributing Circumstances for Collisions.....	PP3-36
<b>3-25</b>	Frequency of Collisions along I-5 from MP 106.60 to MP 114.61 (2006 to 2010).....	PP3-37
<b>3-26</b>	Summary of Collisions at Area Interchanges (2006 to 2010).....	PP3-38
<b>3-27</b>	Collisions by Type at the Martin Way & Marvin Road Interchanges.....	PP3-39
<b>4-1</b>	I-5/Marin Way Interchange - Partial Cloverleaf Interchange.....	PP4-1
<b>4-2</b>	I-5/Marvin Road Interchange – Single Point Urban Interchange (SPUI) Concept with new Collector/Distributor (C/D) Road.....	PP4-2
<b>4-3</b>	I-5/Martin Way Interchange – Partial Cloverleaf Interchange – Conceptual Signing Plan.....	PP4-5
<b>4-4</b>	I-5/Marvin Road Interchange – Single Point Urban (SPUI) Concept with new Collector/Distribution (C/D) Road - Conceptual Signing Plan.....	PP4-8
<b>5-1</b>	Project Map from Lacey’s 2030 Transportation Plan.....	PP5-2
<b>8-1</b>	I-5/Martin Way Interchange - Critical Area Indicators.....	PP8-1
<b>8-2</b>	I-5/Marvin Road Interchange - Critical Area Indicators.....	PP8-2

LIST OF TABLES

Table No.		Page
1-1	Summary of Interchange Ramp Lengths.....	PP1-35
3-1	Peak Hour Traffic Analysis Report from Vissim	PP3-23
3-2	Percentage of Trips to or from Outside the Lacey/Olympia (South of Exit 105 or North of the Nisqually River).....	PP3-27
3-3	Comparison of the Martin Way Intersections 2040 Widened Concept During the AM & PM Peak Hours.....	PP3-32
3-4	Comparison of the Marvin Road Intersections 2040 Widened Concept During the AM & PM Peak Hours.....	PP3-30
3-5	Comparison of Corridor Collision Rates.....	PP3-35
5-1	Local Improvements from Lacey’s 2030 Transportation Plan.....	PP5-3
6-1	Study Area Projects from WSDOT’s Highway System Plan.....	PP6-2

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## **Executive Summary**

The purpose of the Interchange Justification Report (IJR) is to assess the impacts associated with modifications at the I-5/Martin Way Interchange and I-5/Marvin Road Interchange in accordance with FHWA regulations. This IJR identified problems at these interchanges and analyzed solutions that improve traffic operations and safety for Interstate 5 (I-5), supports the adopted local and regional land use plans, encourages regional economic vitality, and enhances overall mobility of all users in the study area.

Key findings of the analyses conducted as part of this IJR show the following observations:

- The existing transportation system cannot provide adequate access nor satisfactorily accommodate the design year traffic demands.
- Non-interstate improvements added to the existing transportation system, while relieving some congestion and improving capacity, still fail to handle adequately the design year traffic.
- Reasonable alternatives have been considered and the impacts assessed to accommodate future need.
- The proposed partial cloverleaf interchange at I-5/Martin Way Interchange improves traffic and safety operations by reducing delays at the signalized intersections and reducing vehicle back-ups onto I-5. These improvements do not have a significant adverse impact on the safety and operation of I-5 and the new interchange will maintain or improve the design year traffic conditions.
- The proposed Single Point Urban Interchange (SPUI) design with a Collector/Distributor (C/D) Road for the I-5/Marvin Road Interchange improves traffic and safety operations by reducing delays at the signalized intersection and reducing vehicle back-ups onto I-5. These improvements do not have a significant adverse impact on the safety and operation of I-5 and the new interchange will maintain or improve design year traffic conditions.
- The modified interchanges will connect public roads to northbound and southbound I-5 and meet the criteria of connecting with a public road.
- The modified interchanges at Martin Way and Marvin Road with I-5 are consistent with regional, county and local plans.
- Improvements at the I-5/Martin Way and the I-5/Marvin Road Interchanges are consistent with the current WSDOT's *2007-2026 Highway System Plan*. This plan also states that additional studies be conducted to improve the Martin Way and Marvin Road interchanges. This IJR fulfills the additional study requirements.
- The modified interchanges at Martin Way and Marvin Road with I-5 are consistent with and would support the land use and development plans for the area.

## Executive Summary

- Based on the Environment Documentation prepared, no significant environmental constraints were identified that would prohibit or affect the implementation of these modifications at the I-5/Martin Way Interchange and the I-5/Marvin Road Interchange.
- A National Environmental Protection Act (NEPA) Documented Categorical Exclusion (DCE) was prepared and provides the appropriate documentation for this project.

The layout of this report was developed to display pertinent information in accordance with the federal and state requirements and criteria for the development of an IJR.

## Project Description

### WHAT IS THE PROJECT BACKGROUND?

The City of Lacey is a growing urbanized area in Thurston County with existing and new development planned on both sides of the Interstate 5 (I-5) corridor. The City of Lacey, as well as other neighboring cities and Thurston County, are encouraging new developments to come into the area to create jobs and improve the quality of life. This growth has been anticipated by the City of Lacey and other communities in Thurston County. Together, they have invested significant resources in planning and developing the local transportation infrastructure necessary to help accommodate this growth. Over the past ten years, traffic levels on both the local roads and on I-5 have grown. This growth trend is expected to continue in Lacey and throughout Thurston County.

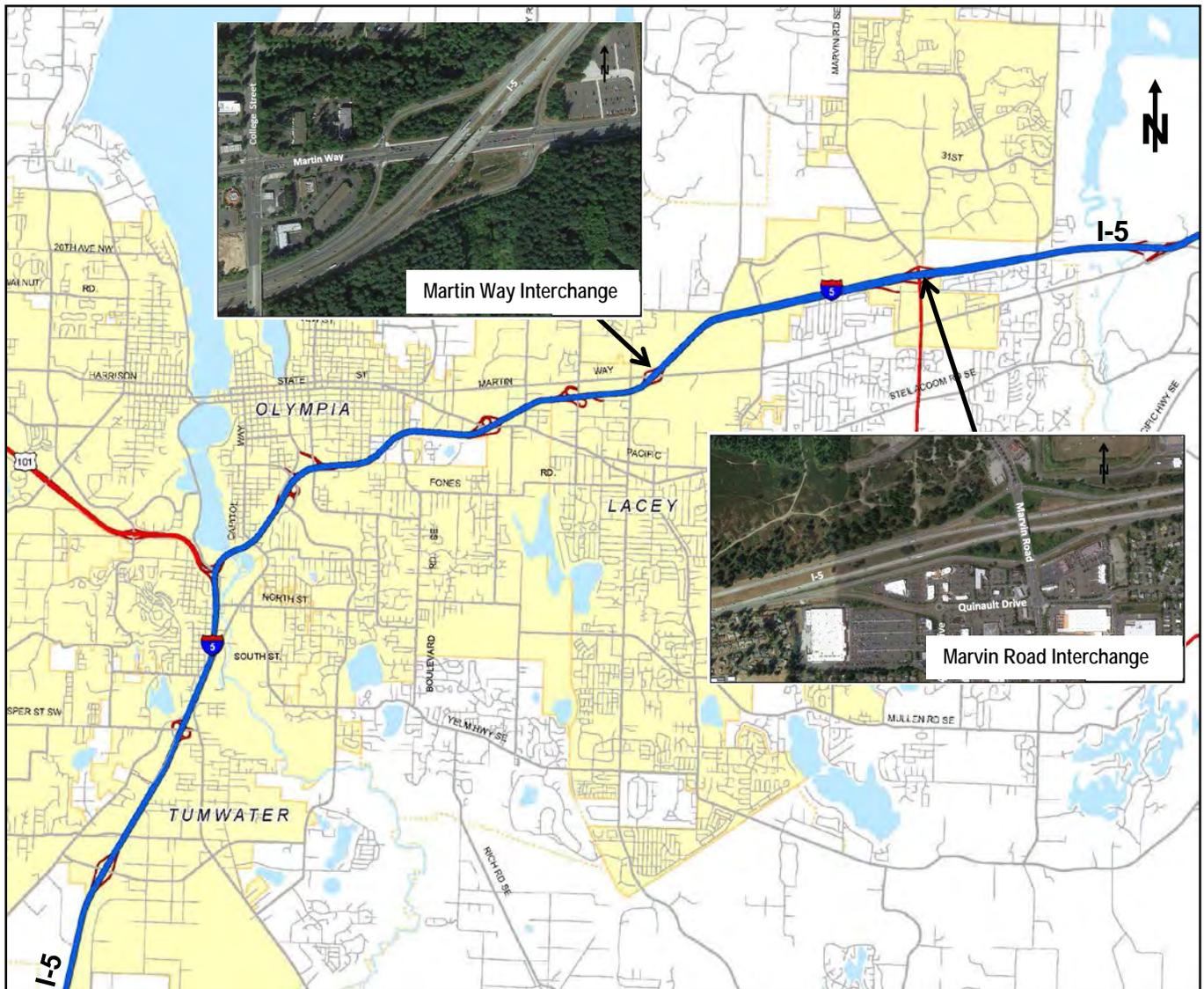
Because of the anticipated increases in traffic over the next twenty years, the City of Lacey, in conjunction with the Federal Highway Administration (FHWA), the Washington State Department of Transportation (WSDOT), Thurston County, Thurston Regional Planning Council (TRPC), and Intercity Transit, are identifying improvements to the I-5/Martin Way Interchange and the I-5/Marvin Road Interchange to:

- Improve traffic operations and safety for I-5 at:
  - Martin Way Interchange,
  - Marvin Road Interchange,
  - Along the mainline and local arterials in the vicinity of these interchanges,
- Support the adopted local and regional land use plans and policies,
- Support regional economic vitality, and
- Enhance overall mobility of all users in the study area.

A vicinity map, Figure 1, shows the location of the I-5/Martin Way and the I-5/Marvin Road interchanges. Both of these interchanges are listed in WSDOT's *2007-2026 Highway System Plan*, as needing further study to identify recommended improvements to meet current and future travel demands. This Interstate Justification Report (IJR) is intended to fulfill these study needs.

Currently, I-5 is a divided 6 or 8-lane highway in the vicinity of the Martin Way and Marvin Road interchanges. The I-5/Martin Way Interchange is a traditional diamond interchange with I-5 crossing over Martin Way. Martin Way is generally a five-lane street but has parallel left-turn lanes between the northbound (NB) and southbound (SB) I-5 ramp intersections. The I-5 NB off-ramp has an exclusive right turn lane on Martin Way that extends east to Desmond Drive.

FIGURE 1: Vicinity Map



The Marvin Road Interchange is also a traditional diamond interchange with a two-lane NB off-ramp which has a secondary off-ramp to the roundabout with Quinault Drive and Galaxy Drive. Marvin Road is a generally five-lane street but has back to back double left-turn lanes over I-5. There also exists an exclusive right-turn lane onto the SB I-5 on-ramp.

There is one interchange concept being considered to modify the I-5/Martin Way Interchange and three interchange concepts being considered for the I-5/Marvin Road Interchange.

## WHAT IMPROVEMENTS ARE PROPOSED AT THE I-5/MARTIN WAY INTERCHANGE?

**I-5/Martin Way Interchange:** The proposed improvement recommended for the I-5/Martin Way Interchange consists of a partial cloverleaf interchange with loop on-ramps added in the northwest and southeast quadrants.

These loop on-ramps are added to allow free right-turn movements onto I-5 from both directions of Martin Way and remove the left-turn movements from Martin Way onto I-5. This will allow more green time for the heavy traffic travelling along Martin Way and for the off-ramp traffic turning onto Martin Way. These improvements will increase the overall level of service at the intersections.

All ramps will be redesigned to meet current acceleration and deceleration requirements. Off-ramps will be designed to allow diverging traffic to exit I-5 without drivers slowing down on I-5 and able to smoothly stop behind traffic queues.

## WHAT IMPROVEMENTS ARE PROPOSED AT THE I-5/MARVIN ROAD INTERCHANGE?

Three interchange concepts were considered for improvement at the I-5/Marvin Road Interchange. These were a Single Point Urban Interchange (SPUI) concept with a Frontage Road, a Diverging Diamond Interchange concept with a Frontage Road, and a SPUI concept with a Collector/Distributor (C/D) Road.

The proposed improvement recommended for the I-5/ Marvin Road Interchange is the SPUI with a C/D Road alternative.

**I-5/Marvin Road Interchange – SPUI with C/D Road:** The modified interchange will include:

- The existing NB off-ramp to Quinault Drive/Galaxy Drive;
- A two-lane SB off-ramp to a new C/D road that extends along I-5 and re-joins I-5 with a two-lane on-ramp near Carpenter Road
- A SB off-ramp from the C/D road to Marvin Road
- A SB on-ramp to the C/D road from Marvin Road
- The SB off-ramp will also have double right-turn lanes with one lane being extended along Marvin Road to become a right-turn lane to Hogum Bay Road.
- A new access road to and from the Hawks Prairie Development area with the C/D Road will also be added.

The SPUI concept shows better traffic operations than the traditional diamond interchange or a Diverging Diamond interchange concept. To reduce the traffic impact on Marvin Road, the new C/D road provides better circulation than the frontage road option and meets current interstate guidelines.

### **WHAT LOCAL IMPROVEMENTS ARE PROPOSED WITH THESE INTERCHANGE IMPROVEMENTS?**

The proposed interchange improvement project assumes that several local improvements will be constructed as area development occurs and funds become available to improve local mobility and safety.

- Widening Carpenter Road from 2 to 4 lanes – Britton Parkway to Pacific Avenue;
- Constructing College Street Extension (1 lane each direction) from 6th Ave NE to 15th Ave NE;
- Completing the widening of Britton Parkway from 2 to 4 lanes, Gateway Boulevard to Carpenter Road; and
- Widening 15th Avenue to complete a 4/5 lane corridor generally parallel to and north of Interstate 5 between Orion Drive and Sleater-Kinney Road.

In addition to these local street improvements, the roadway grid in Hawks Prairie Business District will be completed as development occurs. Within this area, Central Boulevard will be constructed from the C/D road to Britton Parkway. Access to the C/D road will not be permitted until the completion of Central Boulevard.

## **Policy Point 1: Need for the Access Point Revision**

The traffic operation analyses of the existing transportation network of I-5 and local streets in the corridor cannot provide adequate access and area mobility without modifications to the existing interchanges to meet design year traffic demands.

### **WHAT IS THE PURPOSE OF THE PROPOSED IMPROVEMENTS AND THIS INTERCHANGE JUSTIFICATION REPORT (IJR)?**

The purpose of the I-5/Martin Way and I-5/Marvin Road Interchange Justification Report is to identify the problem areas and develop a solution for each interchange area within the City of Lacey that:

- Improves traffic operations and safety for Interstate 5 (I-5) at the:
  - Martin Way Interchange
  - Marvin Road Interchange
  - Along the mainline and local arterials in the vicinity of these interchanges
- Supports the adopted local and regional land use plans and policies
- Supports regional economic vitality
- Enhances overall mobility of all users in the study area

### **WHAT IS THE STUDY AREA FOR THIS PROJECT?**

The study area extends along I-5 from the Pacific Avenue Interchange (Exit 107) on the south to the Nisqually Interchange (Exit 114) on the north, as documented in the Methods and Assumptions document in Appendix A for this IJR. The study area is illustrated in Figure 1-1, and includes the following five interchanges:

- Exit 107 - I-5/Pacific Avenue Interchange
- Exit 108 - I-5/Sleater-Kinney Road Interchange
- Exit 109 - I-5/Martin Way Interchange
- Exit 111 - I-5/Marvin Road Interchange
- Exit 114 - I-5/Martin Way - Nisqually Interchange

Engineers included Thurston County in their traffic forecasting and analysis, as defined by the TRPC travel demand model. The project study area encompasses an area a half-mile on both sides of I-5, and includes the following major streets:

- |                       |                    |                              |
|-----------------------|--------------------|------------------------------|
| • Martin Way          | • Pacific Avenue   | • Draham Road                |
| • Marvin Road         | • Britton Parkway  | • 15 <sup>th</sup> Avenue NE |
| • Carpenter Road      | • Meridian Road    | • 3 <sup>rd</sup> Avenue SE  |
| • College Street      | • Orion Drive      | • 6 <sup>th</sup> Avenue SE  |
| • Sleater-Kinney Road | • Willamette Drive | • Quinault Drive             |
| • Lilly Road          | • Hogum Bay Road   | • Galaxy Drive               |

Finally, as the Lacey Gateway Town Center develops, additional new arterial roads will include Gateway Drive and Main Street.

## WHAT IS THE IMPACT OF I-5 ON THE STUDY AREA?

I-5 extends from Mexico to Canada and is the main north-south route through western Washington. In Thurston County, I-5 bisects the metropolitan area and divides Lacey, Olympia, and Tumwater into different areas, creating a barrier within the cities, and limiting internal traffic circulation, as shown on Figure 1-2. As a result, traffic crossing from one area to the other areas must crossover I-5 on one of several bridges or underpasses, thus concentrating traffic on these roads.

Within the study area for this project there are nine crossings of I-5, including five interchanges at:

- Pacific Avenue
- Sleater-Kinney Road
- Martin Way
- Marvin Road
- Nisqually Cut-off Road

Other roadway crossings over I-5 include: Lilly Road, College Street, Carpenter Road, and Meridian Road.

With I-5 located in the center of the urban areas of Thurston County and splitting the key cities and growth areas, drivers are naturally attracted to use I-5 for some intercity trips between these areas.

To address these traffic circulation issues, local jurisdictions within the Thurston County area have a long history of coordination that predates requirements imposed by the Growth Management Act (GMA) of 1990. These efforts include coordinating activities between the transportation system, land use planning, and development. Through the efforts of TRPC and its partners, land use planning is integral to transportation planning for all jurisdictions in the Thurston County area and follows GMA requirements.

Local Comprehensive Plans form the basis for transportation planning, including multi-modal elements of highways, transit, bicycle and pedestrian facilities. These coordinated planning efforts have resulted in steady increases in residential density thus improving transit opportunities in Thurston County. Figure 1-3 shows Lacey's land use designations, developed under GMA guidelines.

See Appendix B for more detailed review of the history of the I-5 corridor development and the coordination of growth within Thurston County.

**FIGURE: 1-2: I-5 Through Thurston County**



FIGURE 1-1: Study Area

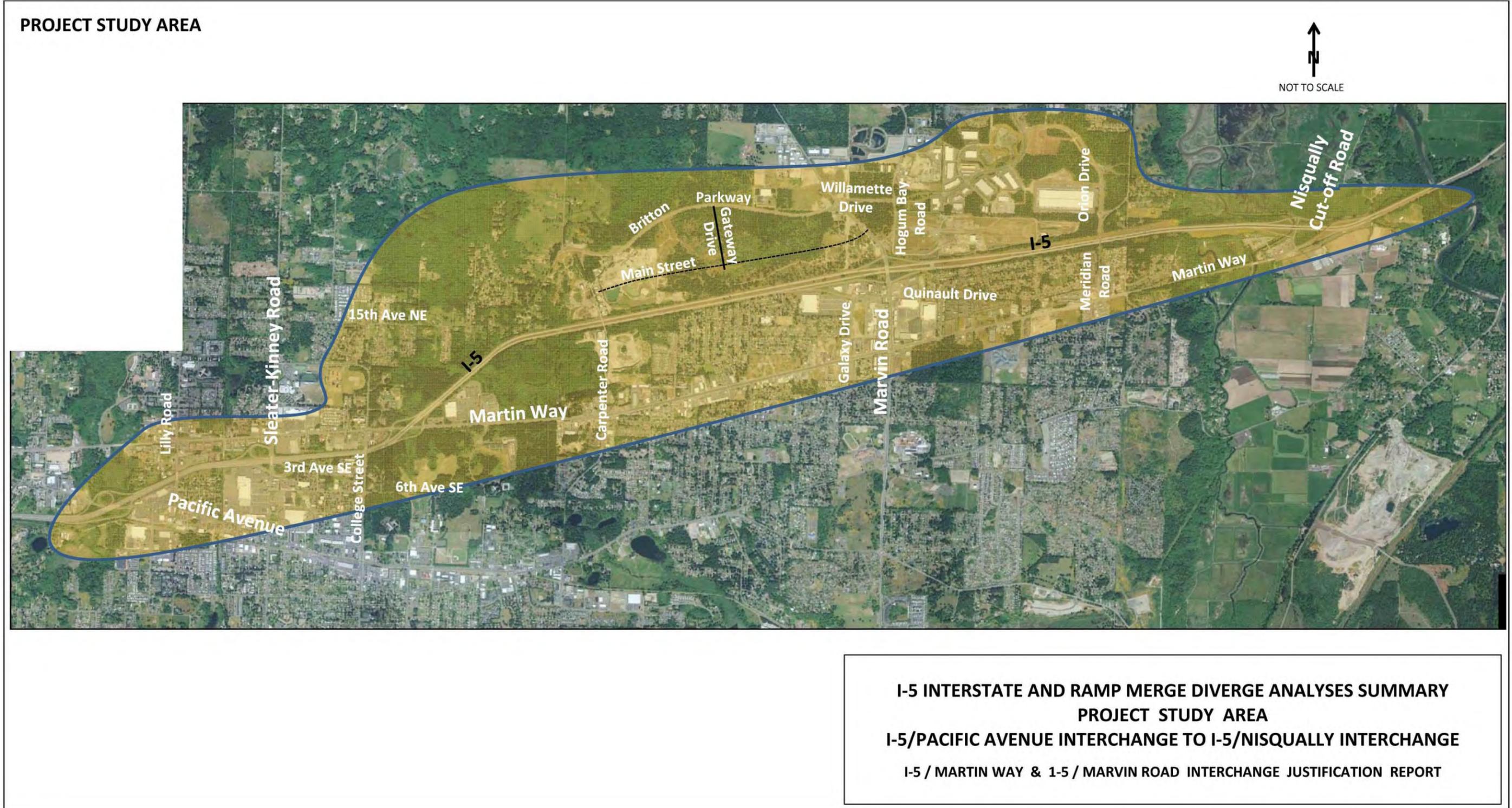
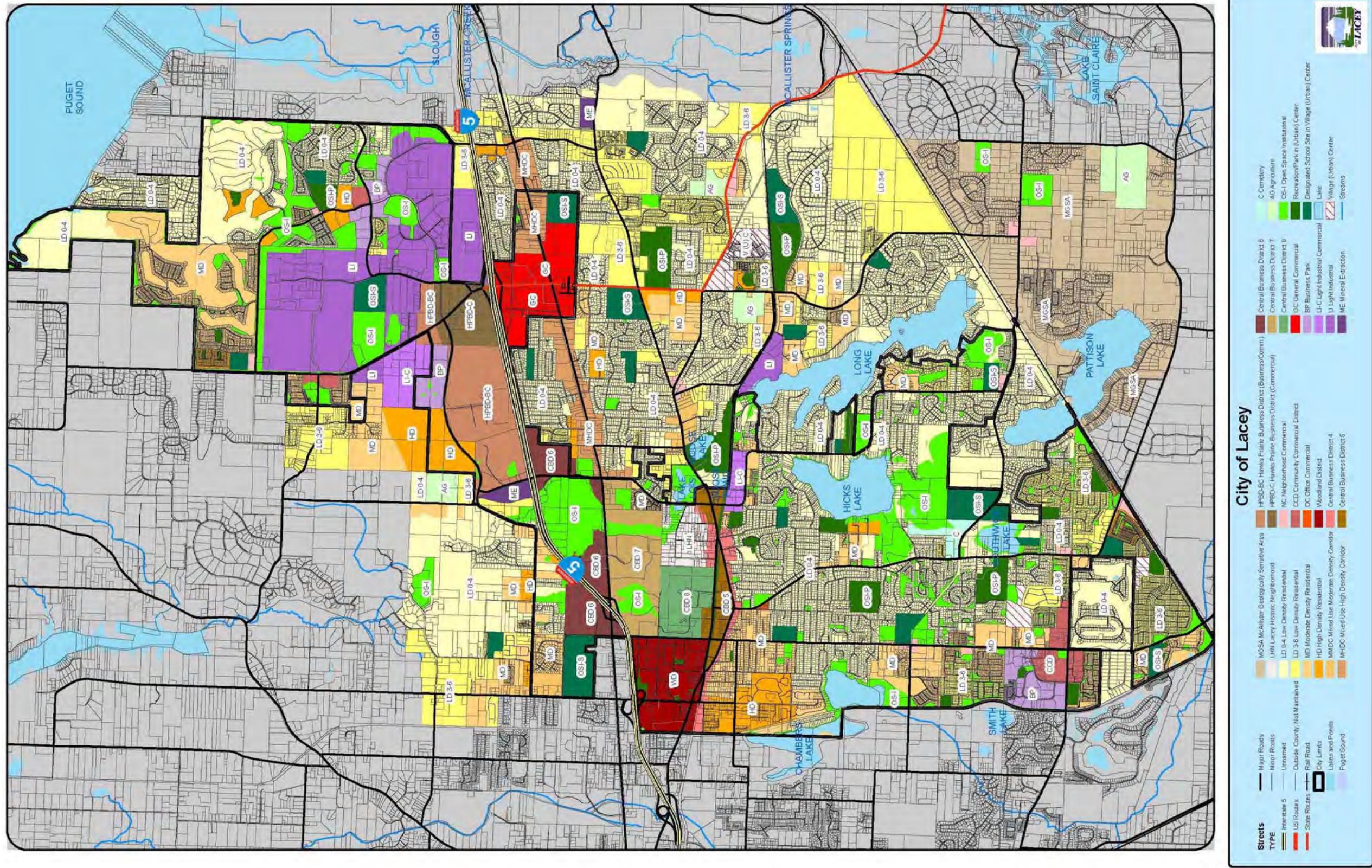


FIGURE 1-3: City of Lacey Land Use Designations



### WHAT IS THE CITY OF LACEY DOING TO IMPROVE LOCAL TRAVEL?

The City of Lacey is a growing community in Thurston County with existing and new developments planned on each side of I-5. Over the past ten years, current traffic levels on both the local roads and on I-5 have grown. As the economic situation improves, this growth trend is expected to continue in Lacey and throughout Thurston County.

The City of Lacey has been planning for this industrial, commercial, and residential growth since the early 1980s. The City has established new land use designations, as shown on Figure 1-3, and identified the needed transportation facilities in its Comprehensive Plan.

Preliminary travel forecasts indicate that drivers on several of the primary arterials in the project area will experience an increase in traffic congestion on selected roadway segments by 2040. Drivers on segments of Martin Way are expected to see increases in traffic of more than twice the current traffic levels. Drivers on segments of Marvin Road can see a tripling of traffic volumes. Even higher increases in traffic are expected on Carpenter Road.

These projected traffic levels will severely affect I-5. Forecasters show a 50 percent to 75 percent increase in traffic volumes on various interstate segments with similar increases in on-ramp and off-ramp traffic at most interchanges serving the Lacey area.

This growth has been anticipated for more than 20 years. The City, in cooperation with the Thurston Regional Planning Council (TRPC), has invested significant resources in planning and developing the local transportation infrastructure and services to help accommodate this growth. Most of the following projects were completed in the early 2000's with the Carpenter Road widening completed in 2010:

- Widening of Marvin Road to a four/five-lane section between Willamette Parkway and Pacific Avenue, including installation of three, multi-lane roundabouts;
- Improving College Street via several projects to improve capacity and operations between Martin Way and Lacey Boulevard;
- Constructing Britton Parkway, a new east-west arterial between Marvin Road and Carpenter Road north of I-5;
- Improving Sleater-Kinney Road via several projects to improve capacity and operations between I-5 and Pacific Avenue;
- Rebuilding and widening the Marvin Road/I-5 diamond interchange;
- Constructing the Pacific Avenue/Lacey Boulevard one-way couplet between Golf Club Road and Homann Drive; and
- Carpenter Road widening from Pacific Avenue to Martin Way.

## Policy Point 1: Need for Access Point Revision

These improvements are expected to reach the design-year traffic levels within the next five to six years.

The City plans to improve several other arterials and intersections to help improve the current traffic conditions on local roadways, based on the anticipated near-term growth patterns. In addition to improvements at the I-5/Martin Way Interchange and the I-5/Marvin Road Interchange, the City of Lacey's 2030 Transportation Plan includes the following local improvements that support local circulation off the interstate:

- Carpenter Road widening from Martin Way to Britton Parkway
- Carpenter Road widening from Pacific Avenue to Shady Lane
- Marvin Road widening from Britton Parkway to Columbia Way
- College Street extension from Martin Way to 15<sup>th</sup> Avenue
- Desmond Road extension from Martin Way to Pacific Avenue
- 15<sup>th</sup> Avenue NE/ Draham Road widening from Carpenter Road to Sleater-Kinney Road
- Marvin Road widening from Union Mills Road to Mullen Road
- Pacific Avenue widening from Union Mills Road to Marvin Road
- Marvin Road extension from Mullen Road to Yelm Highway
- 26<sup>th</sup> Avenue extension from Hogum Bay Road to Sleater-Kinney Road
- College Street extension from 15<sup>th</sup> Avenue to 26<sup>th</sup> Avenue
- Britton Parkway extension from Gateway Blvd to Carpenter Road
- Hogum Bay Road from I-5 to Hawks Prairie Road
- Lacey / Hawks Prairie Business District Commercial corridor improvements
- Various other roadway and intersection improvements

Lacey is committed to a well-connected, multi-modal transportation system. Projects listed above include sidewalks and bike lanes, creating a network of "complete streets." Sidewalks connect residential neighborhoods to these bigger facilities and to neighborhood commercial centers. Connected streets policies enhance efficiency of the local system.

The City constructed the Woodland Trail, a Class 1 trail facility within the Lacey Boulevard-Pacific Avenue one-way couplet corridor that extends into downtown Olympia. Lacey requires new development to install transit shelters and bus turnouts where directed by Intercity Transit. The City recently secured funding to upgrade its entire signal system and enhance its capacity for timing, signal coordination, and Transit Signal Priority.

### **WHAT ARE OTHER LOCAL JURISDICTIONS DOING TO IMPROVE LOCAL TRANSPORTATION?**

In its commitment to a multi-modal transportation system, this region has built an award-winning transit system. Intercity Transit provides 15-minute transit service the entire length of the Martin Way corridor and into downtown Olympia. The rest of the study area south of I-5 is served by 30- and 60-minute service intersecting with the high-frequency corridor. One of the region's main transit transfer centers is located in the Woodland district, within a regional retail/commercial/civic complex. Both of the region's major park-and-ride lots are on this corridor, one at the Martin Way interchange and the other at the Marvin Road interchange. These support inter-regional express transit service between Thurston and Pierce Counties as well as vanpool and carpool connections.

Intercity Transit provides 18 round trips per day between the two counties and maintains about 220 active vanpools. Figure 1-4 shows the primary flows of transit service, as depicted in TRPC's Regional Transportation Plan.

In addition to transportation infrastructure and services, local transportation measures include comprehensive Commute Trip Reduction and other travel demand management strategies, as well as innovative on-line ridesharing and travel option services.

Finally, jurisdictions in the Thurston region are committed to integrated transportation / land use decision-making, recognizing that travel alternatives need supporting land use patterns if they are to replace driving trips. Like Lacey, the other cities are working to achieve compact, walkable urban land use patterns that enable more people to reduce their reliance on driving and well-designed residential neighborhoods with retail and commercial services nearby. While it takes many years for these changes to take place, the effects can be seen in steady reductions of per capita vehicle miles traveled since 1990.

Figure 1-5 illustrates regionally-significant project locations by project type throughout the metropolitan area. These completed and planned projects are also listed in Appendix B.

### **WHAT ARE THE CURRENT I-5 FEATURES?**

I-5 is a divided highway with three through lanes in each direction through the study area except for the northbound (NB) segment from Pacific Avenue to Sleater-Kinney Road and for the southbound (SB) direction from Martin Way to Pacific Avenue where I-5 is four lanes in each direction. The study area includes I-5 crossings at Meridian Road, Carpenter Road, College Street, and Lilly Road, as well as the following five interchanges:

## Policy Point 1: Need for Access Point Revision

### Pacific Avenue Interchange

**(Exit 107)** - The Pacific Avenue Interchange is a modified diamond interchange with an additional cloverleaf loop ramp to access SB I-5 from westbound (WB) Pacific Avenue. Pacific Avenue is a four-lane roadway crossing under I-5. Both ramp terminals at Pacific Avenue are signalized. The NB off-ramp has an exclusive right turn lane on Pacific Avenue that extends east to Fones Road.

**FIGURE: 1-6: Pacific Avenue Interchange**



**Sleater-Kinney Road Interchange (Exit 108)** - The Sleater-Kinney Road Interchange is a partial cloverleaf with a six-lane under-crossing. Both ramp terminals at Sleater-Kinney Road are unsignalized. The NB off-ramp provides three exit options, including:

**FIGURE: 1-7: Sleater-Kinney Road Interchange**

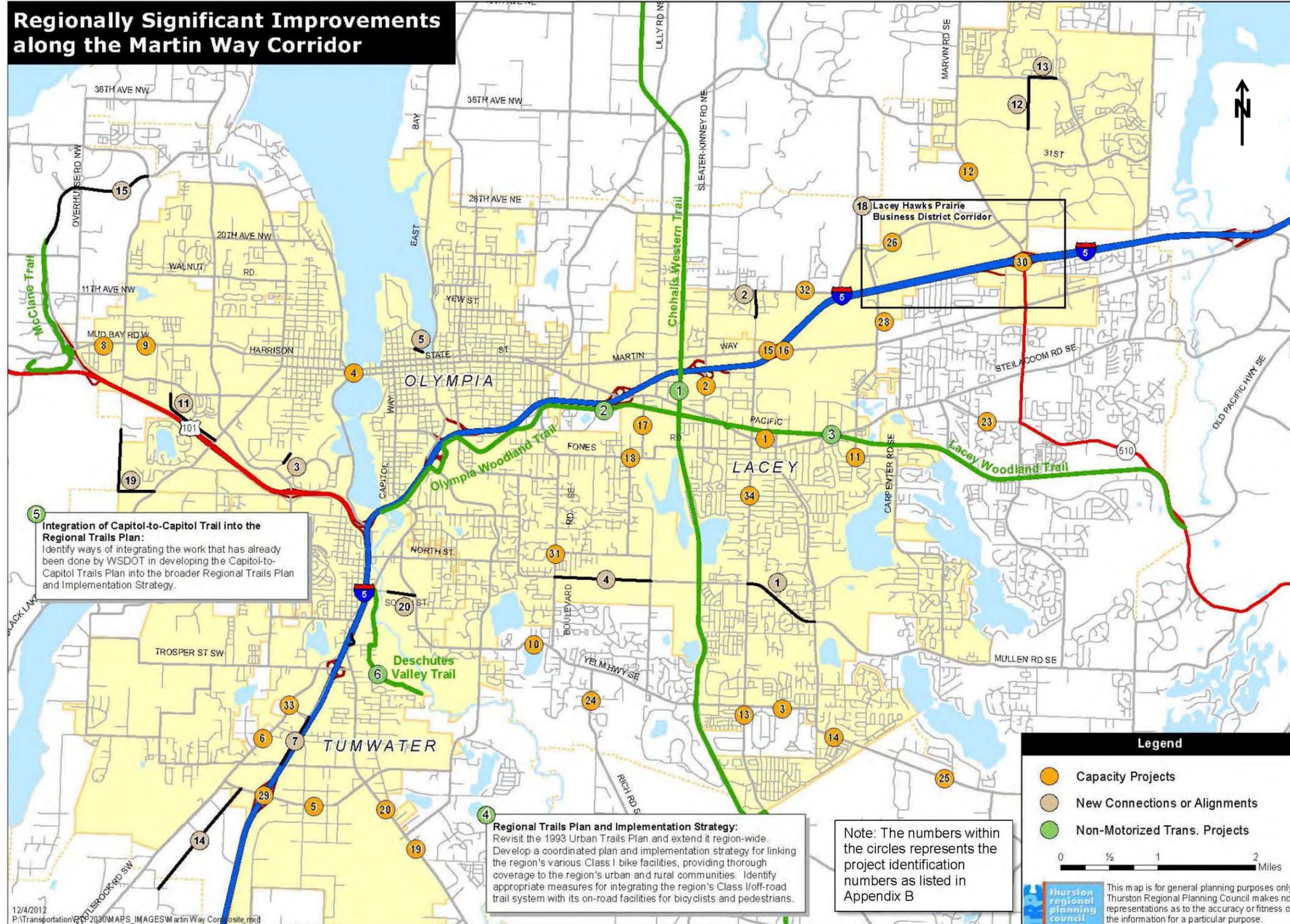
- A normal diamond ramp exit to SB Sleater-Kinney Road,
- A loop ramp exit to NB Sleater-Kinney Road, and
- An extended diamond ramp to 3<sup>rd</sup> Avenue SE which also provides access to College Street.



There is no on-ramp access to NB I-5 from Sleater-Kinney Road. The SB loop off-ramp provides access to SB Sleater-Kinney Road but no access to NB Sleater-Kinney Road.



FIGURE 1-5: Regional Transportation Improvements



**Martin Way Interchange (Exit 109)**

- The Martin Way Interchange is a traditional diamond interchange. Martin Way has six-lanes crossing under I-5 with traffic signals for the NB and SB ramps terminals. Martin Way has two lanes in each direction and parallel left-turn lanes, one in each direction, to allow side-by-side storage for the left-turning traffic entering the NB and SB on-ramps. The NB off-ramp has an exclusive right turn lane on Martin Way that extends east to Desmond Drive.

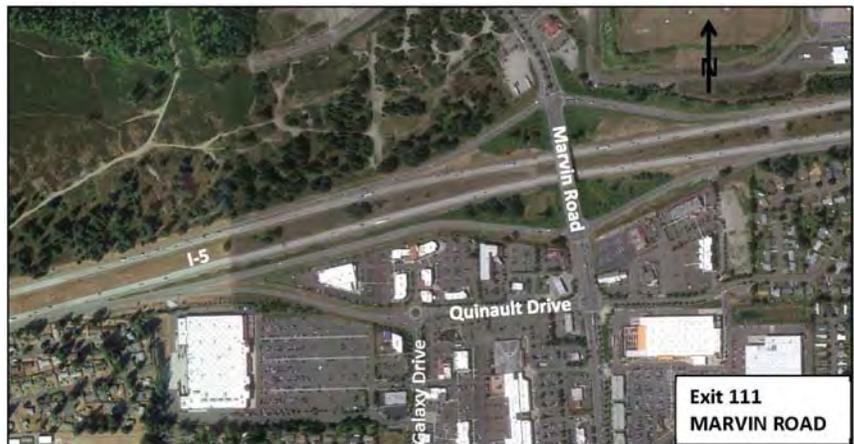
**FIGURE: 1-8: Martin Way Interchange**



**Marvin Road Interchange (Exit 111)**

- The Marvin Road Interchange is a traditional diamond interchange with a two-lane NB off-ramp which has a secondary off-ramp to the roundabout with Quinault Drive and Galaxy Drive. Marvin Road has six-lanes over I-5 with signalized ramp terminals for the NB and SB ramps.

**FIGURE: 1-9: Marvin Road Interchange**



Engineers designed the Marvin Road/I-5 interchange to be constructed in phases. Phase One improvements resulted in the current diamond configuration. Phase Two includes future conversion on the interchange into a Single Point Urban Interchange (SPUI). No schedule has been established for completion of Phase Two. Ramp metering was added to the I-5 northbound on-ramp in 2013 particularly for morning peak period congestion.

**Nisqually (Martin Way) Interchange (Exit 114)**

- The Nisqually Interchange operates as a modified diamond interchange. The SB on-ramp from Nisqually Cut-off Road operates as an unsignalized tee intersection. The SB off-ramp is a flyover ramp that intersects Martin Way at a four-way signalized intersection that also serves Nisqually Cut-off Road and the NB on-ramp.

## Policy Point 1: Need for Access Point Revision

The NB off-ramp intersects Nisqually Cut-off Road at an unsignalized intersection located between Martin Way and the I-5 mainline. Ramp metering was added to the I-5 northbound on-ramp in 2013 particularly for morning peak period congestion.

**FIGURE: 1-10: Nisqually Interchange**



### HOW ARE I-5 AND THE INTERCHANGES ANALYZED?

The I-5 mainline sections and interchange ramps merge and diverge areas within the study area were analyzed using the 2000 Highway Capacity Manual (HCM). The results are presented in terms of Level of Service (LOS) and are based on

the density of vehicles using the highways. It is important to note that the Highway Capacity Software (HCS) analysis does not consider ramp back-ups in its LOS analysis. Long lines of vehicles at off-ramp junctions can significantly affect traffic flow on I-5 by causing drivers to slowdown or stop on the I-5 mainlines, but is not included in the HCS analyses.

### WHAT ARE THE CURRENT AND EXPECTED BASELINE TRAFFIC CONDITIONS ALONG THE I-5 CORRIDOR?

I-5 mainline and ramp merge/diverge traffic analyses use the interstate configuration described above for the base conditions in 2011, 2020 and 2040. The existing 2011 and projected 2020 and 2040 interstate mainline and ramp merge/diverge volumes, density and LOS and off-ramp queue lengths are shown on Figures 1-11 thru 1-16 for the AM peak hour and PM peak hour conditions. Summary volumes, densities and LOS tables for the Base Conditions are contained in Appendix C.

The following is a summary of the findings for the base conditions:

- All mainline LOS estimates were LOS D or better for the AM peak hours for both 2011 and 2020.
- During the 2011 PM Peak Hour, the following areas are below LOS D:
  - SB mainline operations north of the Nisqually Interchange LOS E
  - SB Off-ramp at the Nisqually Interchange (Diverge) LOS E
  - NB Off-ramp at the Pacific Avenue Interchange (Diverge) LOS E

Traffic back-ups in lengths of 900 feet to more than 1,000 feet are estimated for the SB off-ramp at Martin Way, and the SB off-ramp at the Nisqually Interchange.

FIGURE 1-11: 2011 Base Traffic Conditions – AM Peak Hour

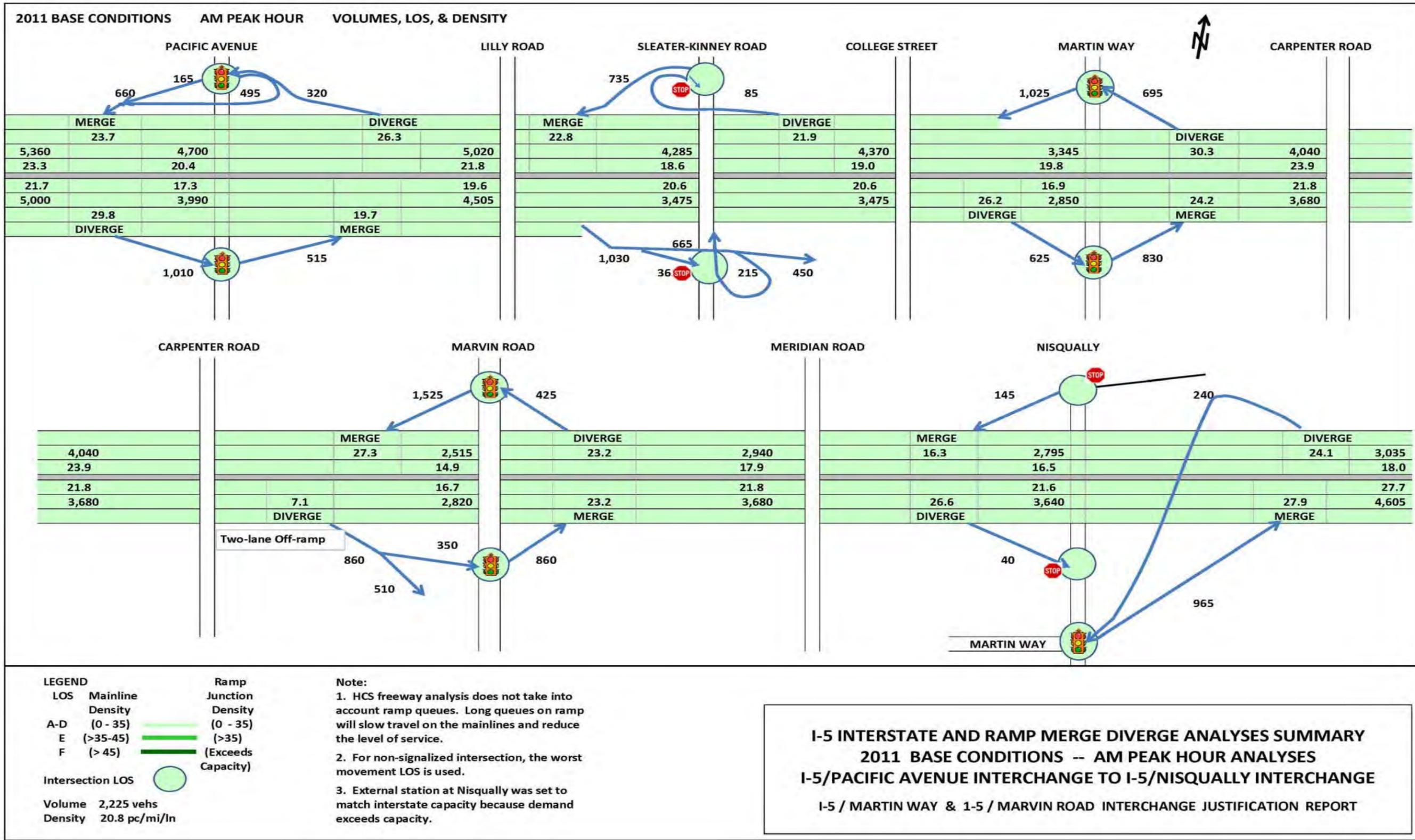


FIGURE 1-12: 2011 Base Traffic Conditions – PM Peak Hour

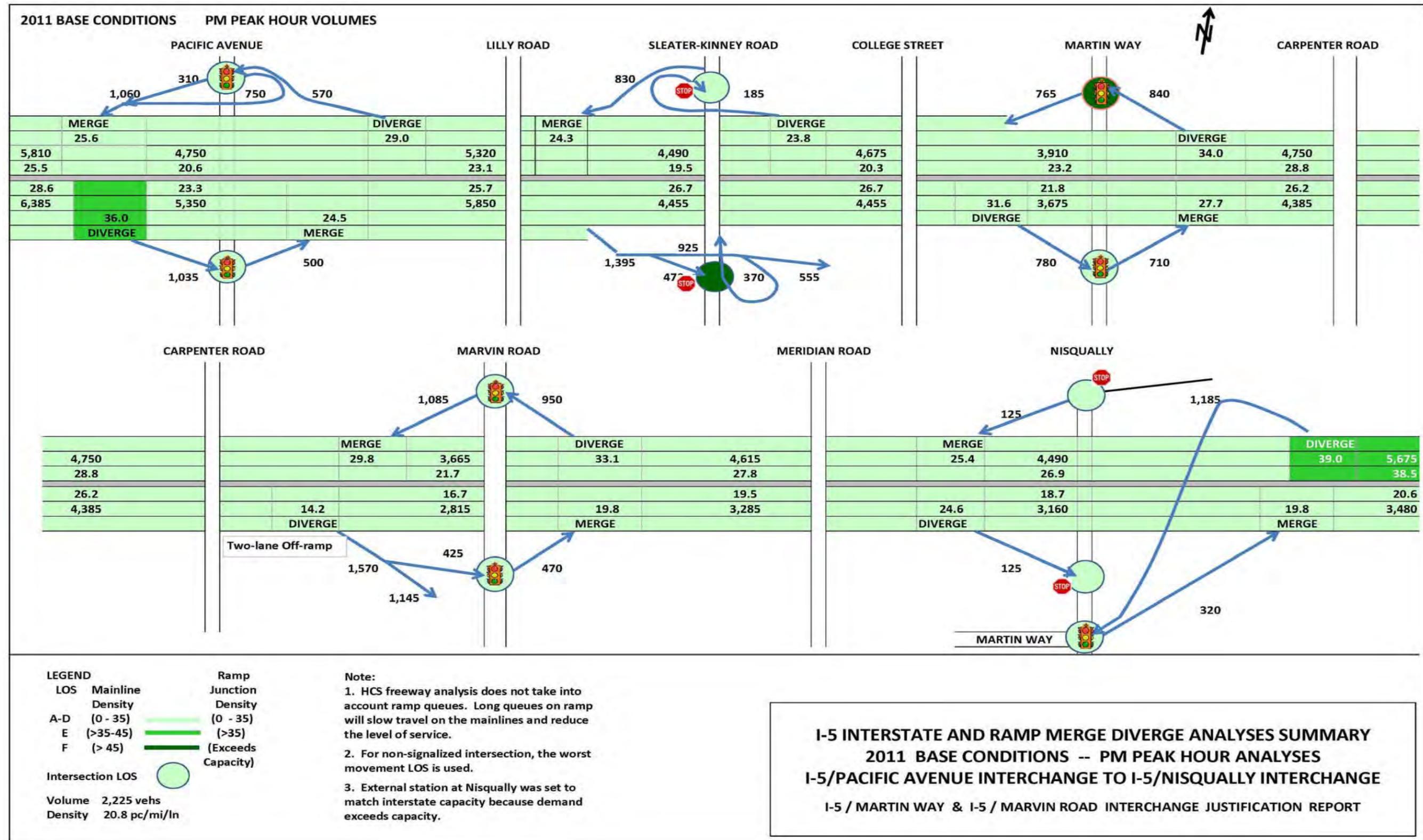


FIGURE 1-13: 2020 Base Traffic Conditions – AM Peak Hour

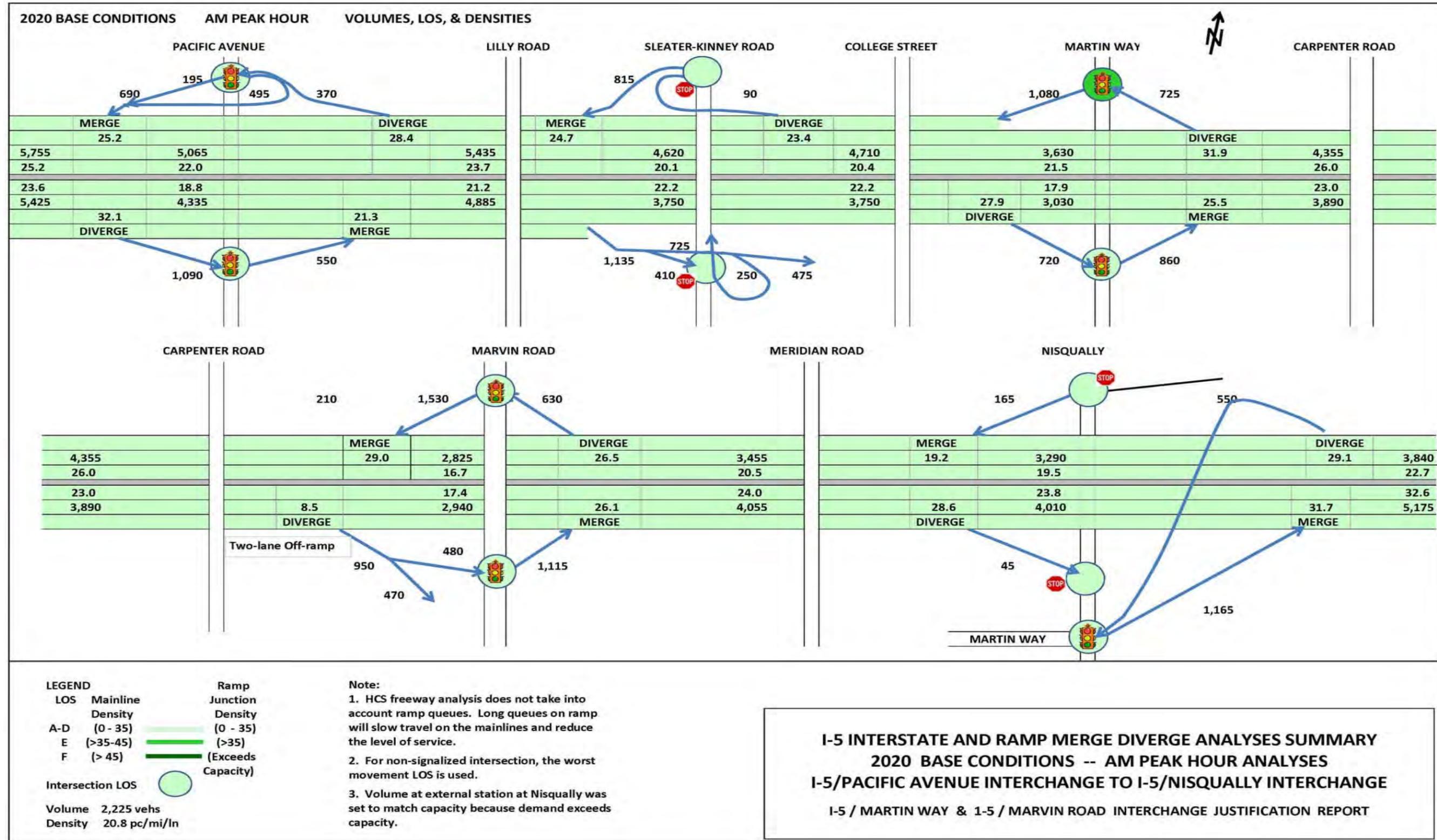


FIGURE 1-14: 2020 Base Traffic Conditions – PM Peak Hour

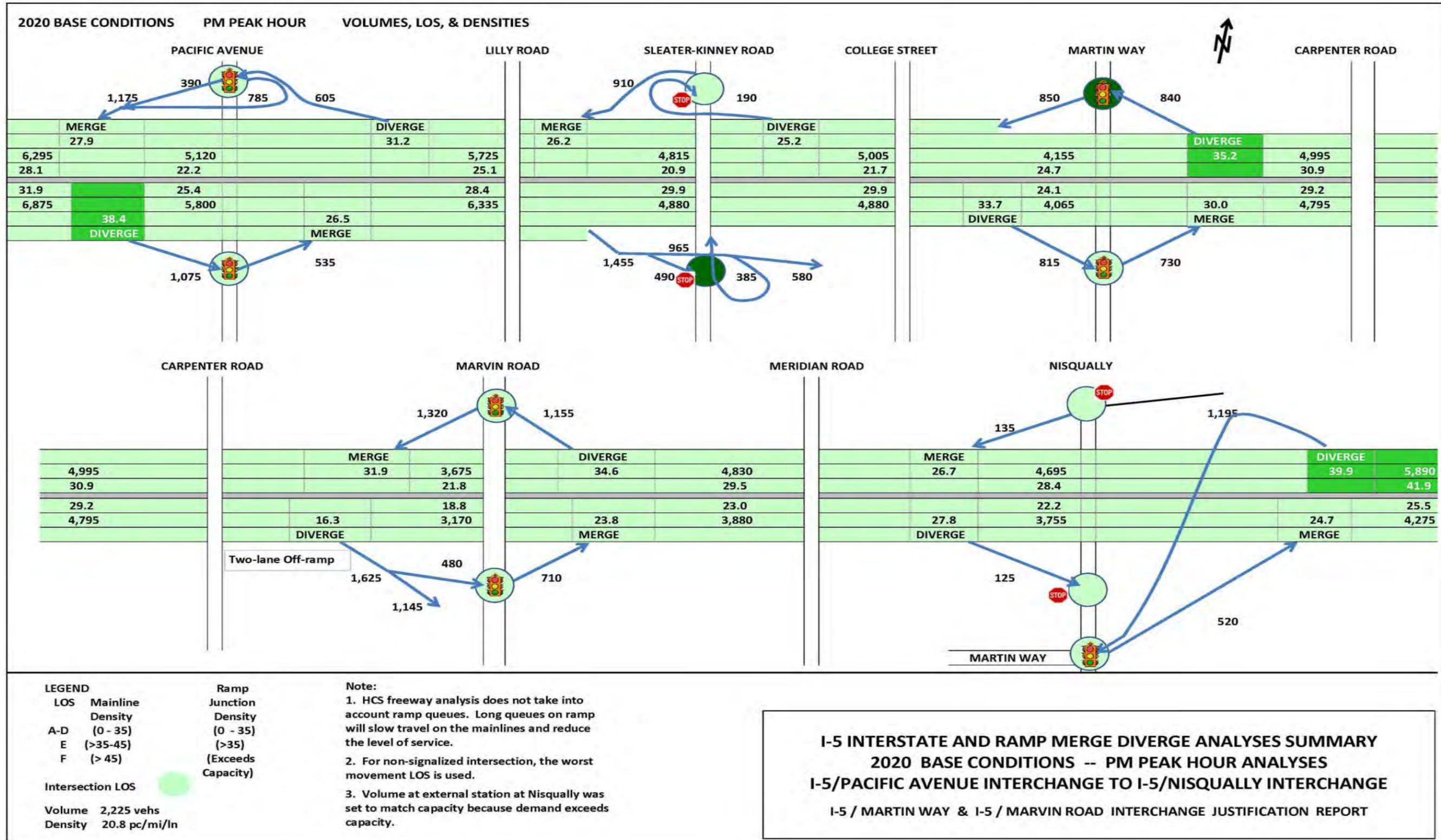
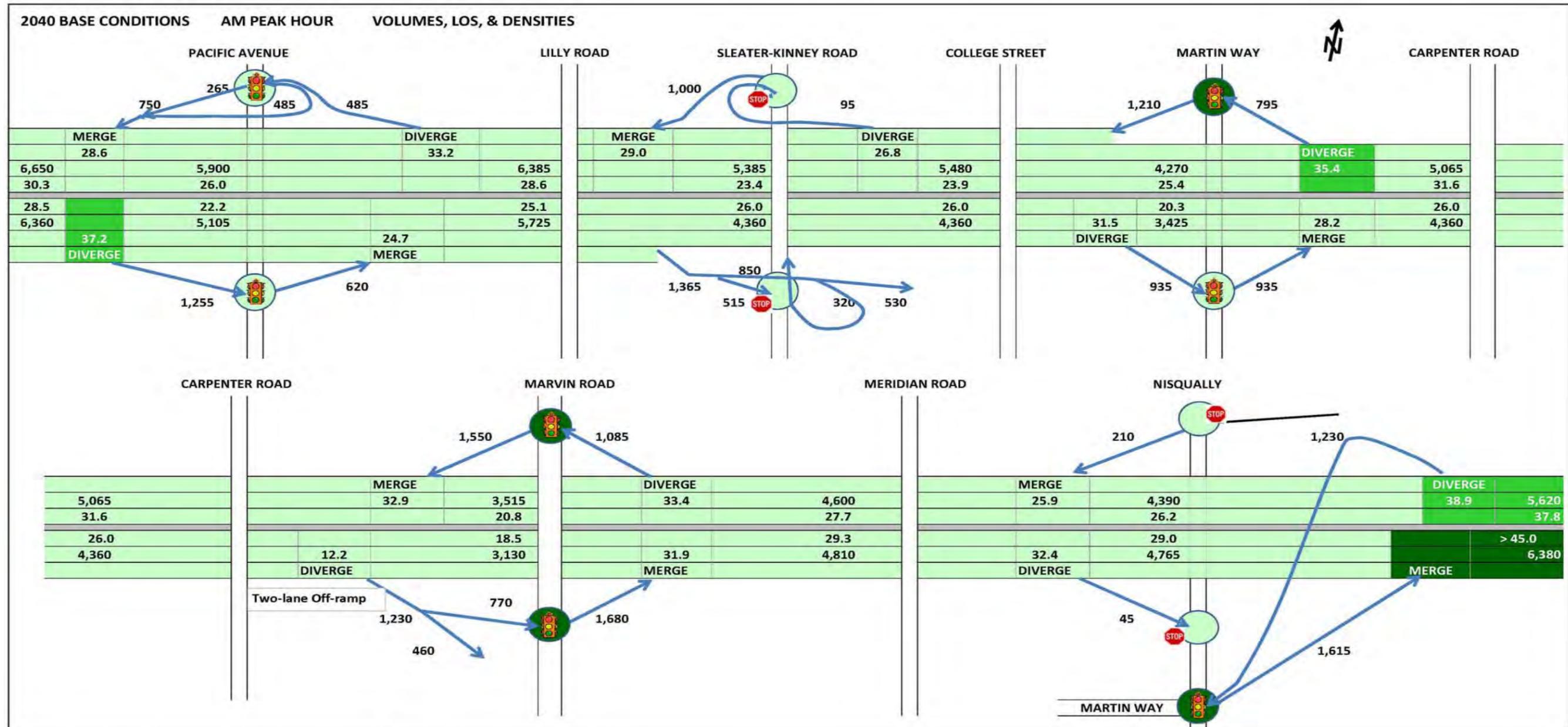


FIGURE 1-15: 2040 Base Traffic Conditions – AM Peak Hour



**LEGEND**

LOS Mainline Density  
 A-D (0 - 35)  
 E (>35-45)  
 F (> 45)

Ramp Junction Density  
 (0 - 35)  
 (>35)  
 (Exceeds Capacity)

Intersection LOS

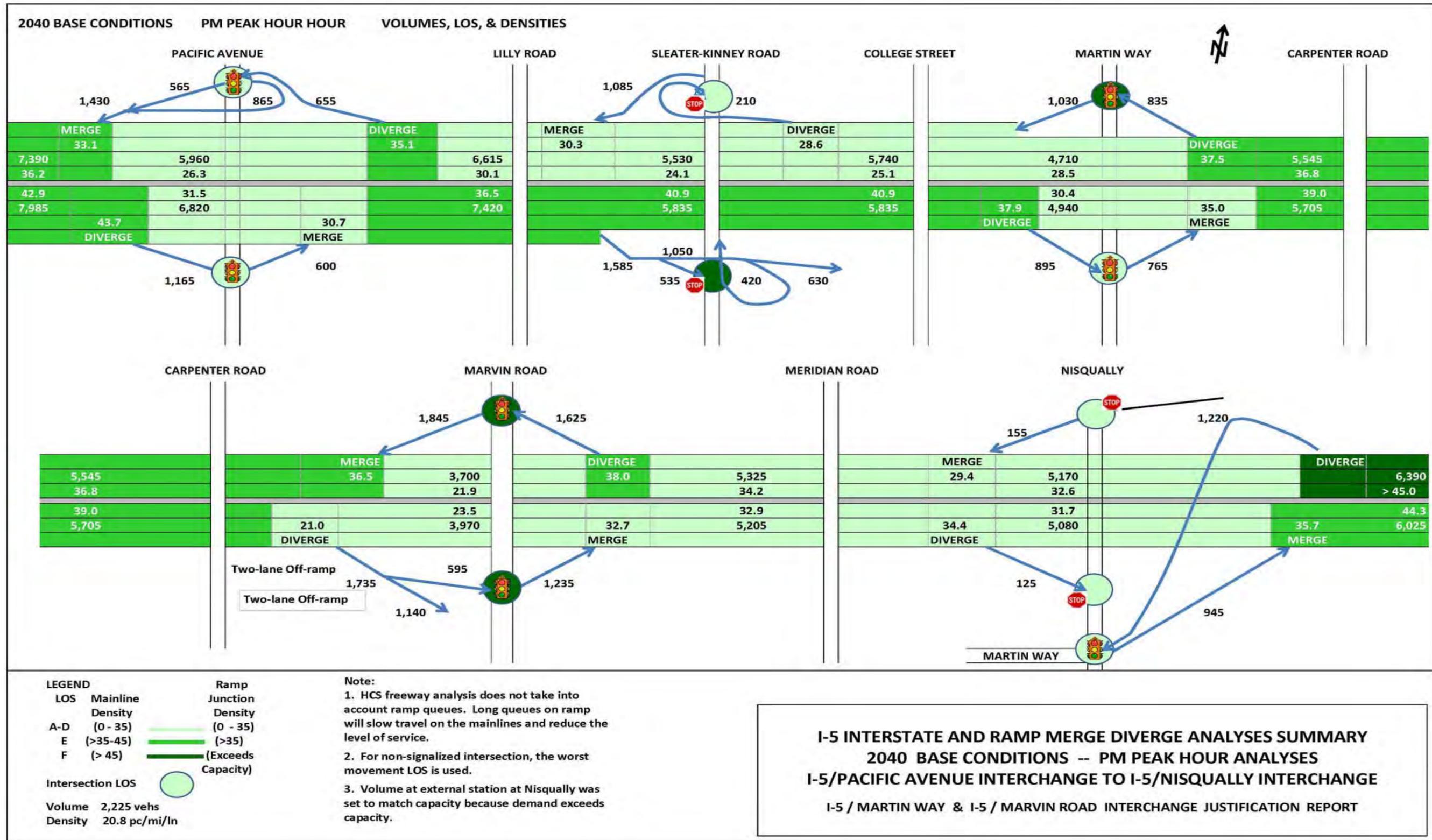
Volume 2,225 vehs  
 Density 20.8 pc/mi/ln

**Note:**

- HCS freeway analysis does not take into account ramp queues. Long queues on ramp will slow travel on the mainlines and reduce the level of service.
- For non-signalized intersection, the worst movement LOS is used.
- Volume at external station at Nisqually was set to match capacity because demand exceeds capacity.

**I-5 INTERSTATE AND RAMP MERGE DIVERGE ANALYSES SUMMARY**  
**2040 BASE CONDITIONS -- AM PEAK HOUR ANALYSES**  
**I-5/PACIFIC AVENUE INTERCHANGE TO I-5/NISQUALLY INTERCHANGE**  
**I-5 / MARTIN WAY & I-5 / MARVIN ROAD INTERCHANGE JUSTIFICATION REPORT**

FIGURE 1-16: 2040 Base Traffic Conditions – PM Peak Hour



- During the 2020 PM Peak Hour, the following areas are below LOS D:
  - SB mainline operations north of the Nisqually Interchange LOS E
  - SB Off-ramp at the Nisqually Interchange (Diverge) LOS E
  - SB Off-ramp at the Martin Way Interchange (Diverge) LOS E
  - NB Off-ramp at the Pacific Avenue Interchange (Diverge) LOS E

Traffic back-ups in lengths of 450 feet to more than 1,000 feet are estimated for the SB off-ramp at Martin Way, the NB and SB off-ramp at Marvin Road, and the SB off-ramp at the Nisqually Interchange.

- During the 2040 AM Peak Hour, the following areas are below LOS D:
  - SB mainline operations north of the Nisqually Interchange LOS E
  - SB Off-ramp at the Nisqually Interchange (Diverge) LOS E
  - SB Off-ramp at the Martin Way Interchange (Diverge) LOS E
  - NB Off-ramp at the Pacific Avenue Interchange (Diverge) LOS E
  - NB On-ramp at the Nisqually Interchange (Merge) LOS F
  - NB mainline north of the Nisqually Interchange LOS F

Traffic back-ups in lengths of 1,000 feet to nearly 1,800 feet are estimated for the SB off-ramp at Martin Way, the NB and SB off-ramps at Marvin Road, and the SB off-ramp at the Nisqually Interchange. Some of the traffic will backup onto the I-5 mainline stopping traffic completely in some lanes.

- During the 2040 PM Peak Hour, the following areas are below LOS D:
  - SB mainline operations north of the Nisqually Interchange LOS F
  - SB Off-ramp at the Nisqually Interchange (Diverge) LOS F
  - SB Off-ramp at the Marvin Road Interchange (Diverge) LOS E
  - SB On-ramp at the Marvin Road Interchange (Merge) LOS E
  - SB mainline operations Marvin Road to Martin Way LOS E
  - SB Off-ramp at the Martin Way Interchange (Diverge) LOS E
  - SB Off-ramp at the Pacific Avenue Interchange (Diverge) LOS E
  - SB On-ramp at the Pacific Avenue Interchange (Merge) LOS E
  - SB mainline operations south of the Pacific Avenue Interchange LOS E
  - NB mainline operations south of the Pacific Avenue Interchange LOS E
  - NB Off-ramp at the Pacific Avenue Interchange (Diverge) LOS E
  - NB mainline operations Pacific Avenue to Martin Way LOS E
  - NB Off-ramp at the Martin Way Interchange (Diverge) LOS E
  - NB mainline operations Martin Way to Marvin Road LOS E
  - NB On-ramp at the Nisqually Interchange (Merge) LOS E
  - NB mainline operations north of the Nisqually Interchange LOS E

## Policy Point 1: Need for Access Point Revision

Traffic back-ups in lengths of 1,000 feet to over 2,000 feet are estimated for the SB off-ramp at Martin Way, the NB and SB off-ramps at Marvin Road, and the SB off-ramp at the Nisqually Interchange. Some of the traffic will backup onto the I-5 mainline travel lane or shoulder, causing traffic to slowdown or stop completely in some lanes.

### **WHAT WOULD HAPPEN TO THE MAINLINE TRAFFIC OPERATIONS IF I-5 IS WIDENED TO FOUR CONTINUOUS THROUGH LANES IN EACH DIRECTION?**

For the previous existing conditions analyses, traffic entering and passing through the project area was controlled by the capacity of the existing Nisqually River bridges, resulting in SB I-5 traffic back-ups into Pierce County and NB back-ups through the City of Lacey. Because of this high traffic demand for travel on I-5, engineers developed a second set of base conditions for 2020 and 2040 that considers adding one general-purpose lane in each direction. This modification still limits traffic on I-5 below the projected demand levels.

By assuming that the I-5 bridges over the Nisqually River will be widened sometime in the future to two four-lane bridges, more (but not all) of the constrained traffic would be allowed to enter and pass through the project area. With the addition of an extra NB and SB lane, more traffic will be on I-5 going to or coming from Pierce County. As a result, the LOS along I-5 and at the interchanges would change, but with the many choke points within the study area already at capacity in the base conditions, the additional traffic at these locations would keep I-5 at capacity and continue to create traffic back-ups that will reduce traffic operations on I-5.

A summary of the expected 2020 and 2040 traffic levels and LOS are illustrated in Figures 1-17 through 1-20 for both AM peak hour and PM peak hour conditions. Summary tables for the interstate operations for the widened base conditions showing traffic volumes, densities and LOS for 2020 and 2040 are also contained in Appendix C.

The following is a summary of the findings for the widened I-5 mainline operations:

- All mainline LOS estimates were LOS D or better for the AM peak hours for the widened 2020 base condition.
- During the 2020 PM Peak Hour, the following areas are below LOS D:
  - NB mainline operations south of the Pacific Avenue Interchange LOS E
  - NB Off-ramp at the Pacific Avenue Interchange (Diverge) LOS E

Traffic back-ups in lengths of 600 feet to more than 1,300 feet are estimated for the SB off-ramp to Martin Way, NB and SB off-ramps to Marvin Road, and SB off-ramp at the Nisqually Interchange.

- During the 2040 AM Peak Hour, the following areas are below LOS D:
  - SB mainline operations from Sleater-Kinney Road to Pacific Avenue LOS E
  - SB mainline operations south of Pacific Avenue LOS E

FIGURE 1-17: 2020 Base Traffic Conditions with Widened I-5 – AM Peak Hour

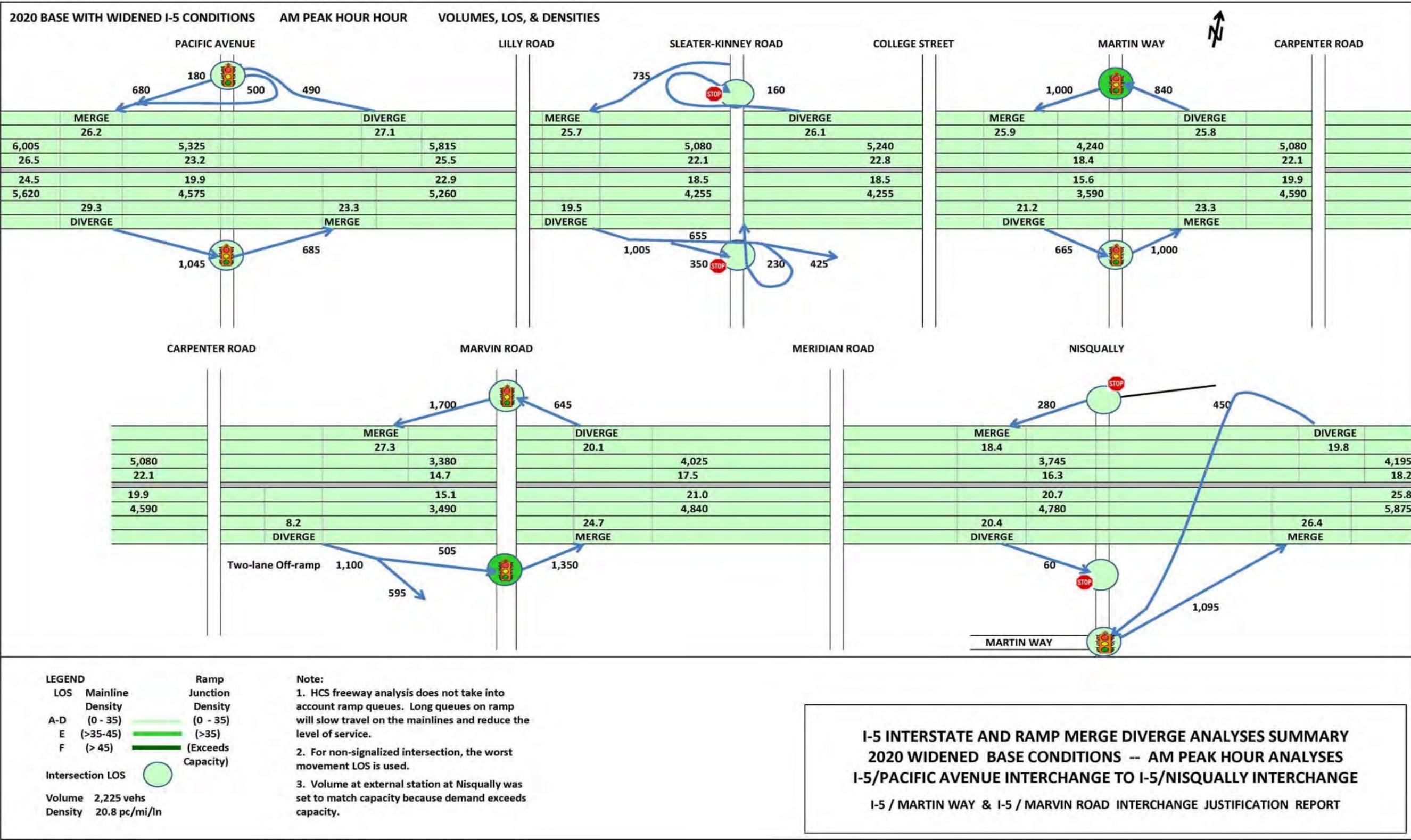


FIGURE 1-18: 2020 Base Traffic Conditions with Widened I-5 – PM Peak Hour

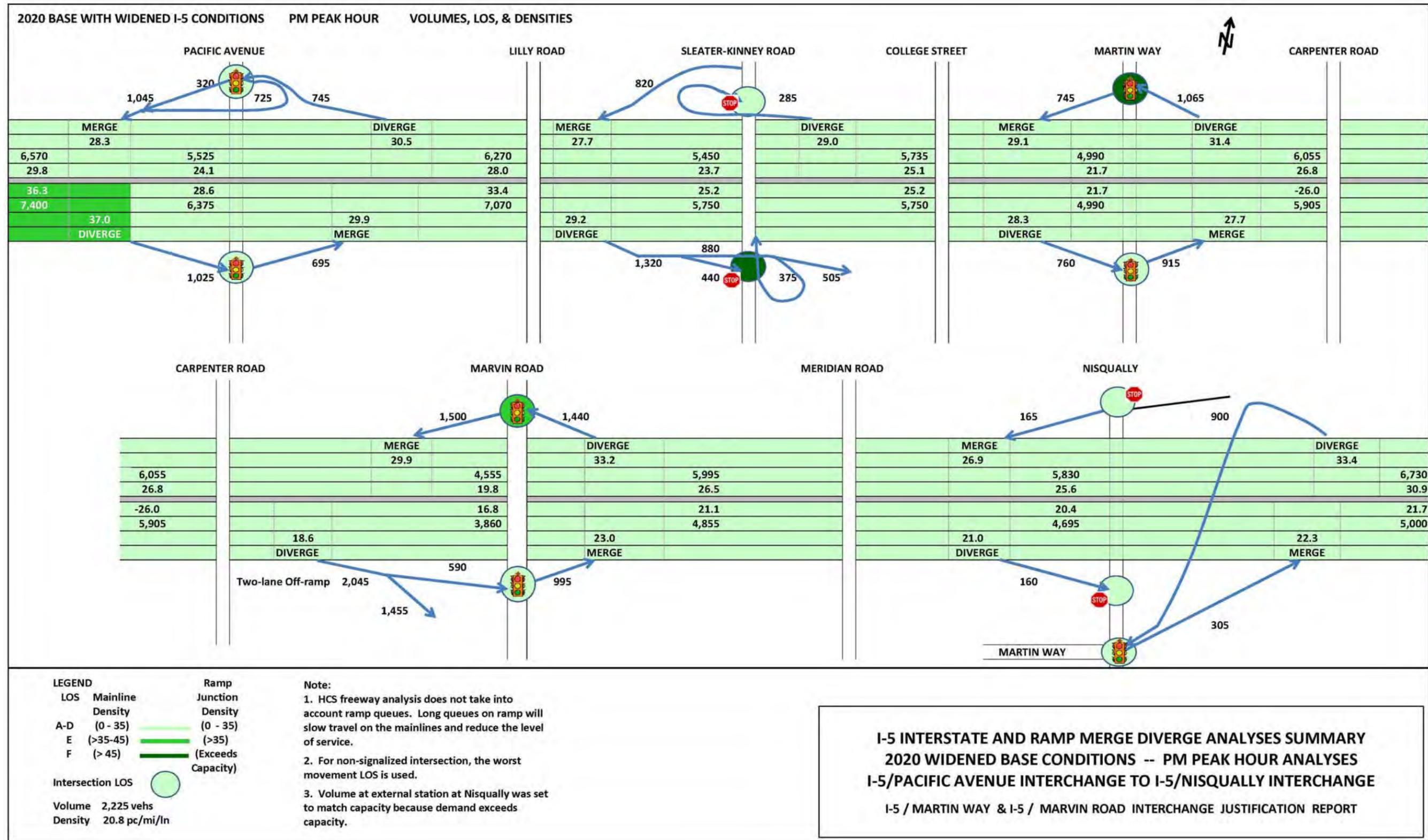
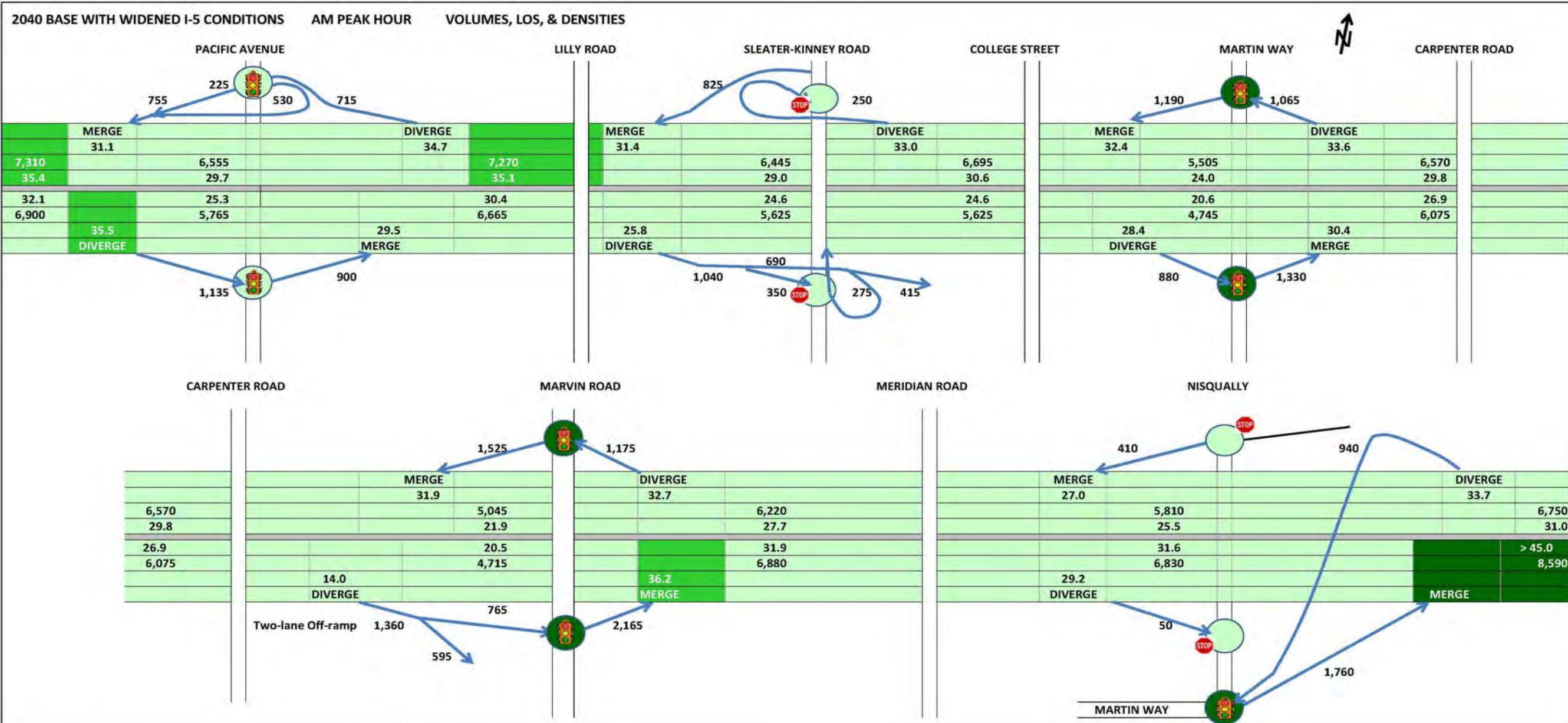


FIGURE 1-19: 2040 Base Traffic Conditions with Widened I-5 – AM Peak Hour

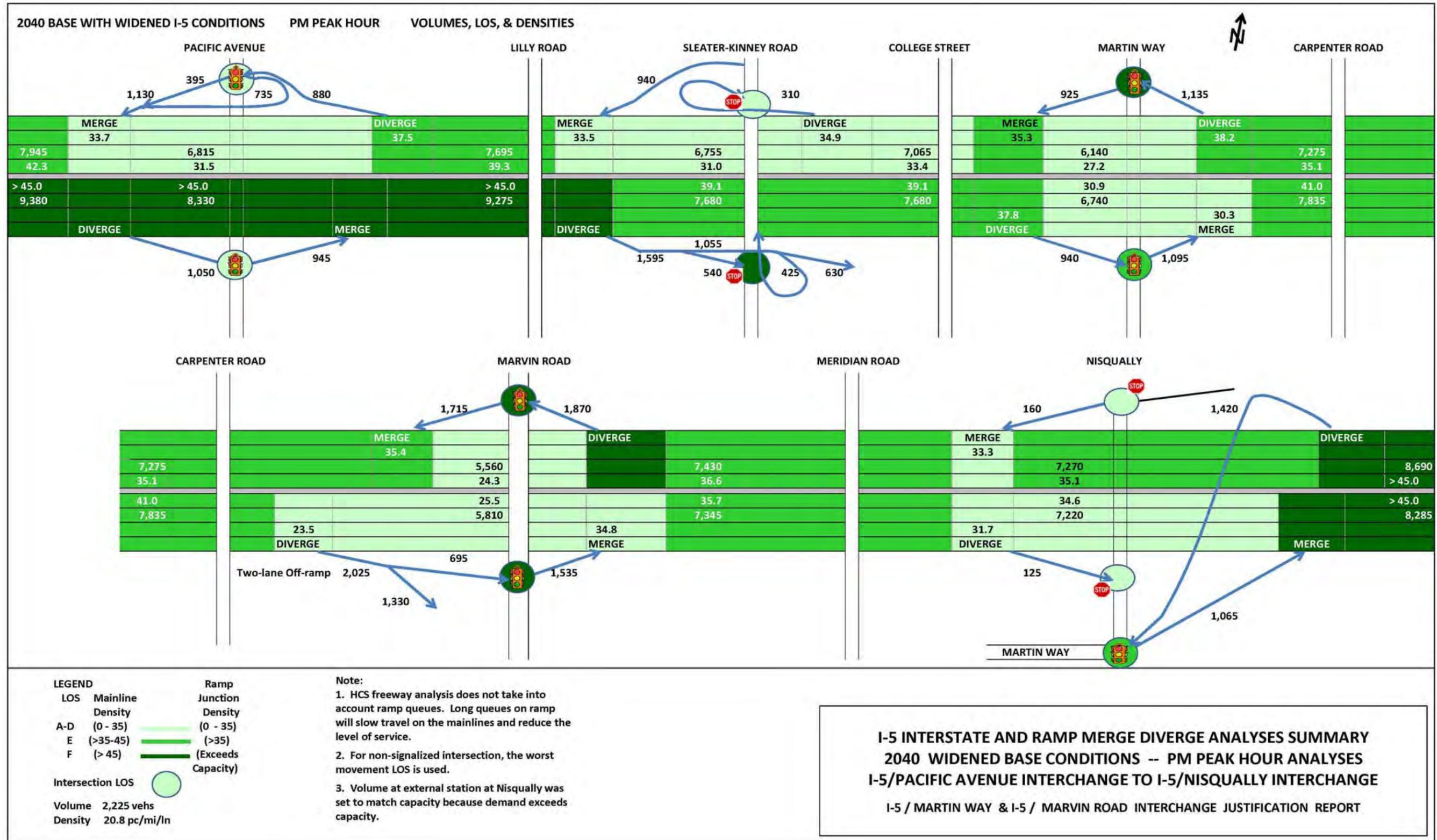


**LEGEND**  
 LOS Mainline Density (0 - 35) A-D  
 (>35-45) E  
 (> 45) F  
 Ramp Junction Density (0 - 35) (>35) (Exceeds Capacity)  
 Intersection LOS  
 Volume 2,225 vehs  
 Density 20.8 pc/mi/ln

**Note:**  
 1. HCS freeway analysis does not take into account ramp queues. Long queues on ramp will slow travel on the mainlines and reduce the level of service.  
 2. For non-signalized intersection, the worst movement LOS is used.  
 3. Volume at external station at Nisqually was set to match capacity because demand exceeds capacity.

**I-5 INTERSTATE AND RAMP MERGE DIVERGE ANALYSES SUMMARY**  
 2040 WIDENED BASE CONDITIONS -- AM PEAK HOUR ANALYSES  
 I-5/PACIFIC AVENUE INTERCHANGE TO I-5/NISQUALLY INTERCHANGE  
 I-5 / MARTIN WAY & I-5 / MARVIN ROAD INTERCHANGE JUSTIFICATION REPORT

FIGURE 1-20: 2040 Base Traffic Conditions with Widened I-5 – PM Peak Hour



- NB Off-ramp at the Pacific Avenue Interchange (Diverge) LOS E
- NB On-ramp at the Marvin Road Interchange (Merge) LOS E
- NB On-ramp at the Nisqually Interchange (Merge) LOS F
- NB mainline operations north of the Nisqually Interchange LOS F
- During the 2040 PM Peak Hour, the following areas are below LOS D:
  - SB mainline operations north of the Nisqually Interchange LOS F
  - SB Off-ramp at the Nisqually Interchange (Diverge) LOS F
  - SB mainline operations between Nisqually Interchange ramps LOS E
  - SB mainline operations Nisqually Interchange to Marvin Road LOS E
  - SB Off-ramp at the Marvin Road Interchange (Diverge) LOS F
  - SB On-ramp at the Marvin Road Interchange (Merge) LOS E
  - SB mainline operations Marvin Road to Martin Way LOS E
  - SB Off-ramp at the Martin Way Interchange (Diverge) LOS E
  - SB On-ramp at the Martin Way Interchange (Merge) LOS E
  - SB mainline operations Sleater-Kinney Road to Pacific Avenue LOS E
  - SB Off-ramp at the Pacific Avenue Interchange (Diverge) LOS E
  - SB mainline operations south of the Pacific Avenue Interchange LOS E
  - NB mainline operations south of the Pacific Avenue Interchange LOS F
  - NB Off-ramp at the Pacific Avenue Interchange (Diverge) LOS F
  - NB mainline operations between Pacific Avenue interchange ramps LOS F
  - NB On-ramp at the Pacific Avenue Interchange (Merge) LOS F
  - NB mainline operations Pacific Avenue to Sleater-Kinney Road LOS F
  - NB Off-ramp at the Sleater-Kinney Road Interchange (Diverge) LOS F
  - NB mainline operations Sleater-Kinney Road to Martin Way LOS E
  - NB Off-ramp at the Martin Way Interchange (Diverge) LOS E
  - NB mainline operations Martin Way to Marvin Road LOS E
  - NB mainline operations Marvin Road to Nisqually Interchange LOS E
  - NB On-ramp at the Nisqually Interchange (Merge) LOS F
  - NB mainline north of the Nisqually Interchange LOS F

Traffic back-ups in lengths of 1,000 feet to more than 1,800 feet are estimated for the SB off-ramp at Martin Way, the NB and SB off-ramps at Marvin Road, and the SB ramp at the Nisqually Interchange. Some of the traffic will backup onto the I-5 mainline travel lane or shoulder, causing traffic to slowdown or stop completely in some lanes.

**HOW MANY MARTIN WAY INTERCHANGE AND MARVIN ROAD INTERCHANGE TRIPS ARE EXPECTED TO USE I-5 FOR LOCAL TRIPS WITHIN THE STUDY AREA?**

Selected link analyses were conducted on the Martin Way and Marvin Road on- and off-ramps for the 2040 I-5 Widened alternative PM peak hour forecast to show the origins and destinations for vehicle trips using these ramps. Figure 1-21 shows that at the Martin Way Interchange, 93 percent of the trips on the four ramps had trips that either started or ended outside the Lacey study area with only seven percent of these trips using other study area ramps for local trips.

At the Marvin Road Interchange, 88 percent of the trips on the four ramps had trips that either started or ended outside the Lacey study area with only twelve percent of these trips using other study area ramps for local trips, as shown on Figure 1-22.

Overall, less than 10 percent of the vehicle trips on these ramps are considered local trips within the study area.

FIGURE: 1-21: DESTINATION OF TRIPS USING MARTIN WAY RAMPS – BASE CONDITIONS

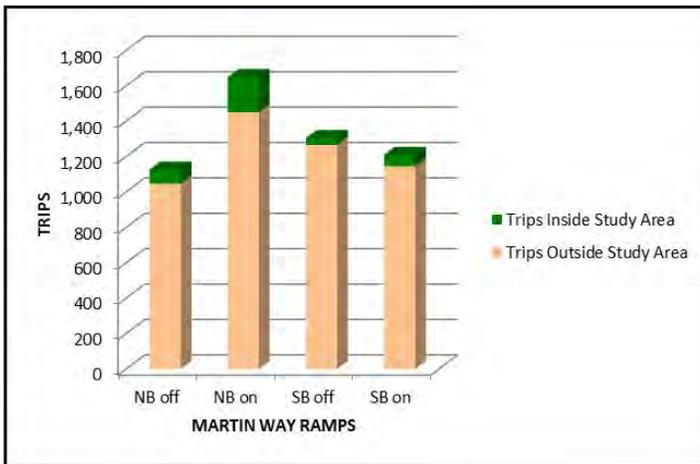
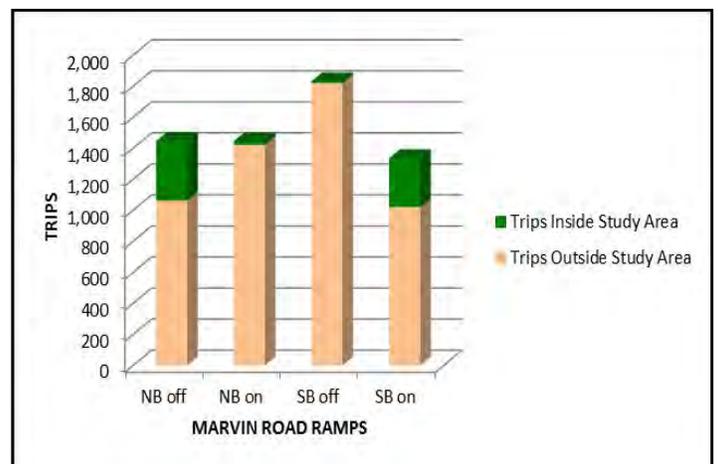


FIGURE: 1-22: DESTINATION OF TRIPS USING MARVIN ROAD RAMPS – BASE CONDITIONS



**HOW MANY MARTIN WAY AND MARVIN ROAD INTERCHANGE TRIPS ARE EXPECTED TO USE I-5 FOR SHORT TRIPS BETWEEN EXIT 105 (OLYMPIA) AND EXIT 114 (NISQUALLY)?**

Selected link analyses were also conducted on the Martin Way and Marvin Road on- and off-ramps for the 2040 I-5 Widened alternative PM peak hour forecast to show the origins and destinations for vehicle trips using these ramps. Figure 1-23 shows that at the Martin Way Interchange, 83 percent of the trips on the four ramps had trips that either started or ended south of Exit 105 or north of Exit 114 with 17 percent of these trips using Olympia or Lacey ramps for local trips.

At the Marvin Road Interchange, 80 percent of the trips on the four ramps had trips that either started or ended south of Exit 105 or north of Exit 114 with only 20 percent of these trips using Olympia or Lacey ramps for local trips, as shown on Figure 1-24.

Overall, less than 19 percent of the vehicle trips on the Martin Way and Marvin Road ramps are considered local trips within this Olympia/Lacey area.

FIGURE: 1-23: DESTINATION OF TRIPS USING MARTIN WAY RAMPS – BASE CONDITIONS

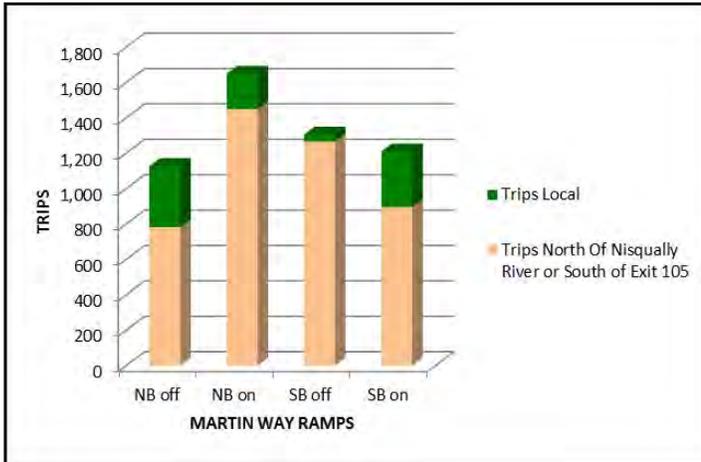
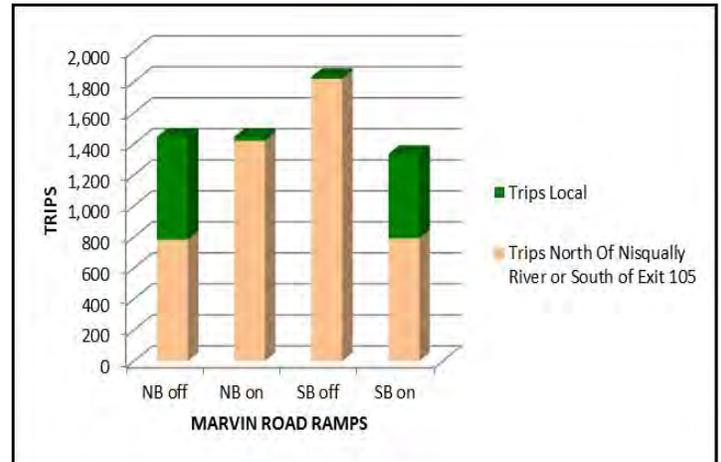


FIGURE: 1-24: DESTINATION OF TRIPS USING MARVIN ROAD RAMPS – BASE CONDITIONS



**WHAT IS THE IMPACT OF THE OFF-RAMP BACK-UPS ON I-5 MAINLINE OPERATIONS?**

The ramp back-ups were analyzed using Synchro software to analyze level of service and queues. Simtraffic was also used to simulate queue lengths. Figure 1-25 illustrates the length of traffic back-ups during the PM peak hour from the off-ramp intersections at Martin Way and Marvin Road to the point where the ramp merges with I-5.

Vehicle back-ups on the SB single lane, off-ramp at Martin Way extend nearly the entire length of the ramp and have traffic stopping on the I-5 travel lanes, increasing traffic congestion. Many drivers will then try to change lanes to avoid stopping, causing more friction on I-5.

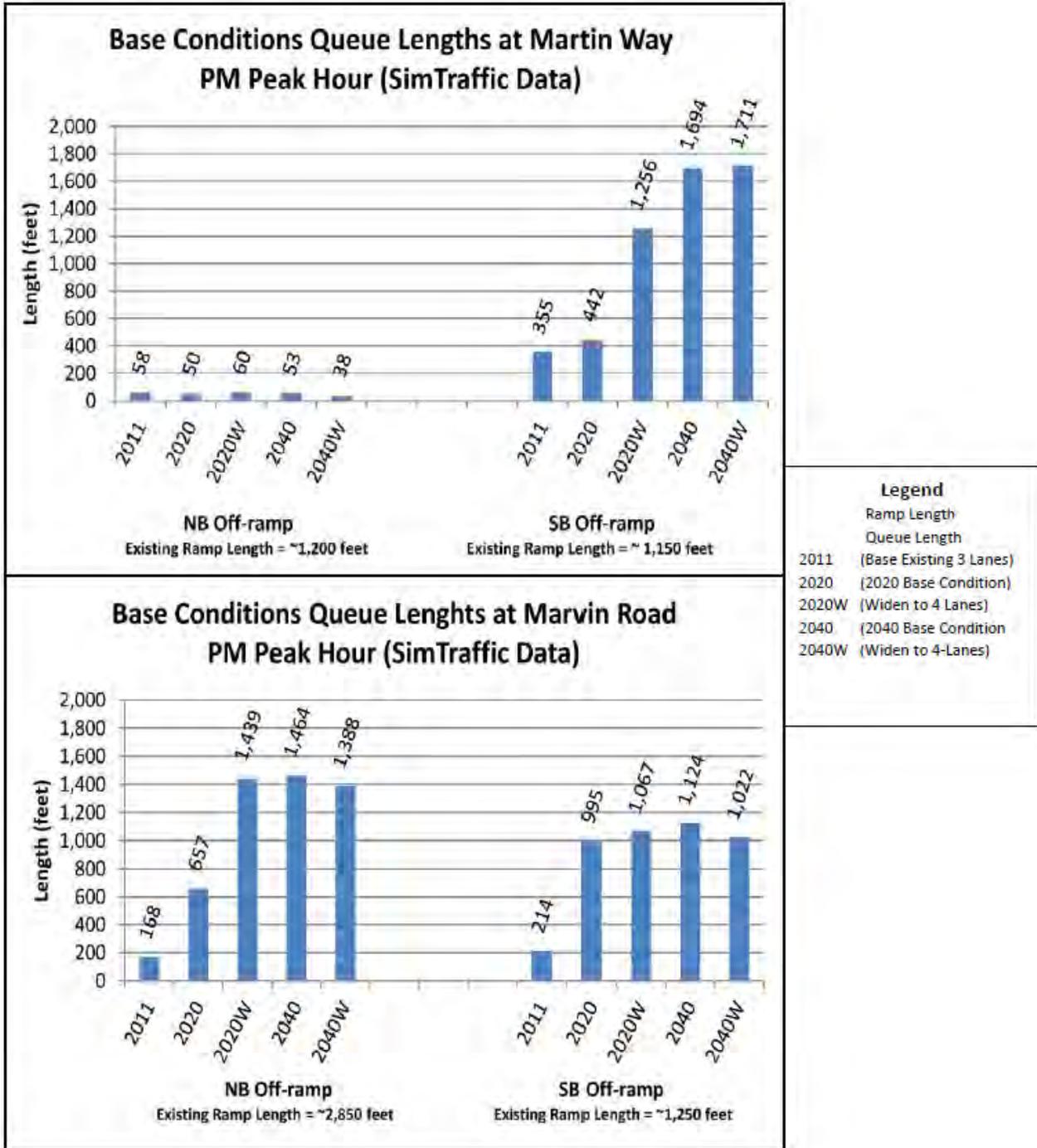
Because the NB two-lane off-ramp at Marvin Road is almost three times longer than the ramps at Martin Way, vehicle back-ups are not expected to extend onto the I-5 mainline but may extend nearly halfway back to the mainline in 2040.

For the SB single lane off-ramp at Marvin Road, vehicle back-ups are expected to extend nearly the full length of the ramp in both 2020 and 2040 widened scenarios.

The average stopping distances for vehicles travelling at speeds of 60 mph and 70 mph are 570 feet and 730 feet, respectively. As a result, even if the vehicle back-ups only extend part way down the ramp, drivers will likely slow down on I-5 to provide sufficient stopping distance from the back of the queuing traffic. These types of slowdowns on I-5 will severely impact the overall operations and efficiency of I-5.

# Policy Point 1: Need for Access Point Revision

FIGURE: 1-25: PM PEAK HOUR OFF-RAMP QUEUES AT MARTIN WAY & MARVIN ROAD



**WHAT ARE THE TRAFFIC OPERATIONAL CONDITIONS AT THE RAMP INTERSECTIONS WITH CROSS STREETS FOR THE EXISTING AND FUTURE BASE CONDITIONS?**

Traffic engineers have performed intersection analyses of the ramp terminals with the cross streets, using the HCM version of Synchro software for signalized and non-signalized intersections and Sidra software for roundabouts. Sim Traffic was used to verify queue lengths. A summary of the overall ramp terminal intersection LOS and average intersection delays are shown on Figure 1-26 for the AM base conditions and on Figure 1-27 for the PM base conditions. The LOS for the ramp terminal intersections were also shown on the previous figures for the mainline traffic analysis summaries. Detailed intersection analysis results showing level of service and delay for all movements can be found in Appendix D.

In 2011 at the Martin Way ramp intersections, the heavy vehicle left-turning volumes and through vehicle traffic volumes cause excessive delays and backups on the SB off-ramp and along Martin Way affecting local and regional travel. This trend is expected to continue through 2040 without improvements to the

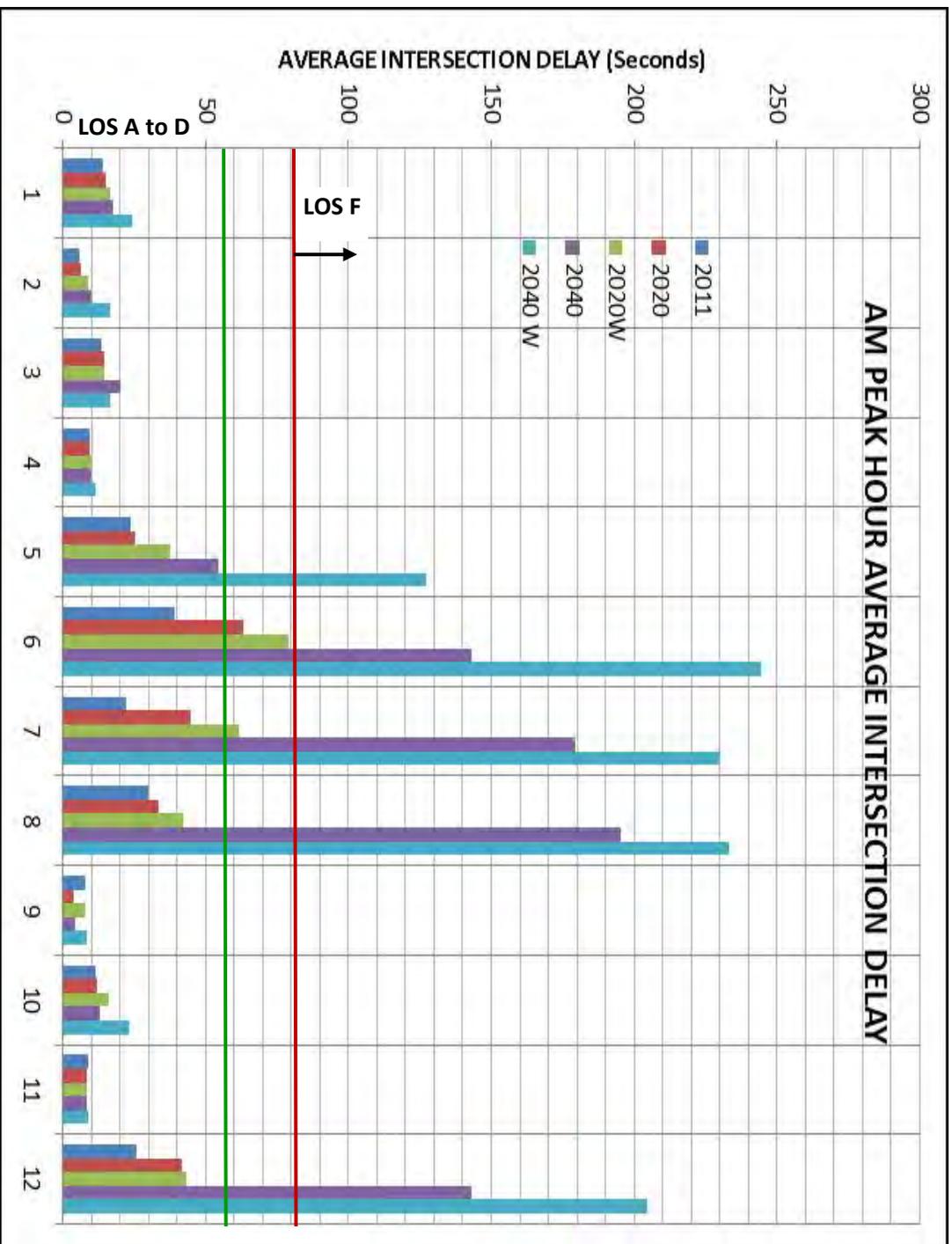
intersections. Average delays at this intersection are estimated from about one minute today, to more than four minutes per vehicle by 2040. Resulting queue back-ups are expected to reach a quarter mile to nearly a half mile along Martin Way during the morning and afternoon peak hours. The back-ups will reduce operations at nearby intersections, such as College Street and eventually Sleater-Kinney Road. Along the SB I-5 off-ramps at Martin Way, queues are expected to continue

to extend onto the mainline lanes causing traffic to come to a stop.

Martin Way Interchange



FIGURE 1-26: Summary of AM Peak Hour Ramp Intersection Analysis

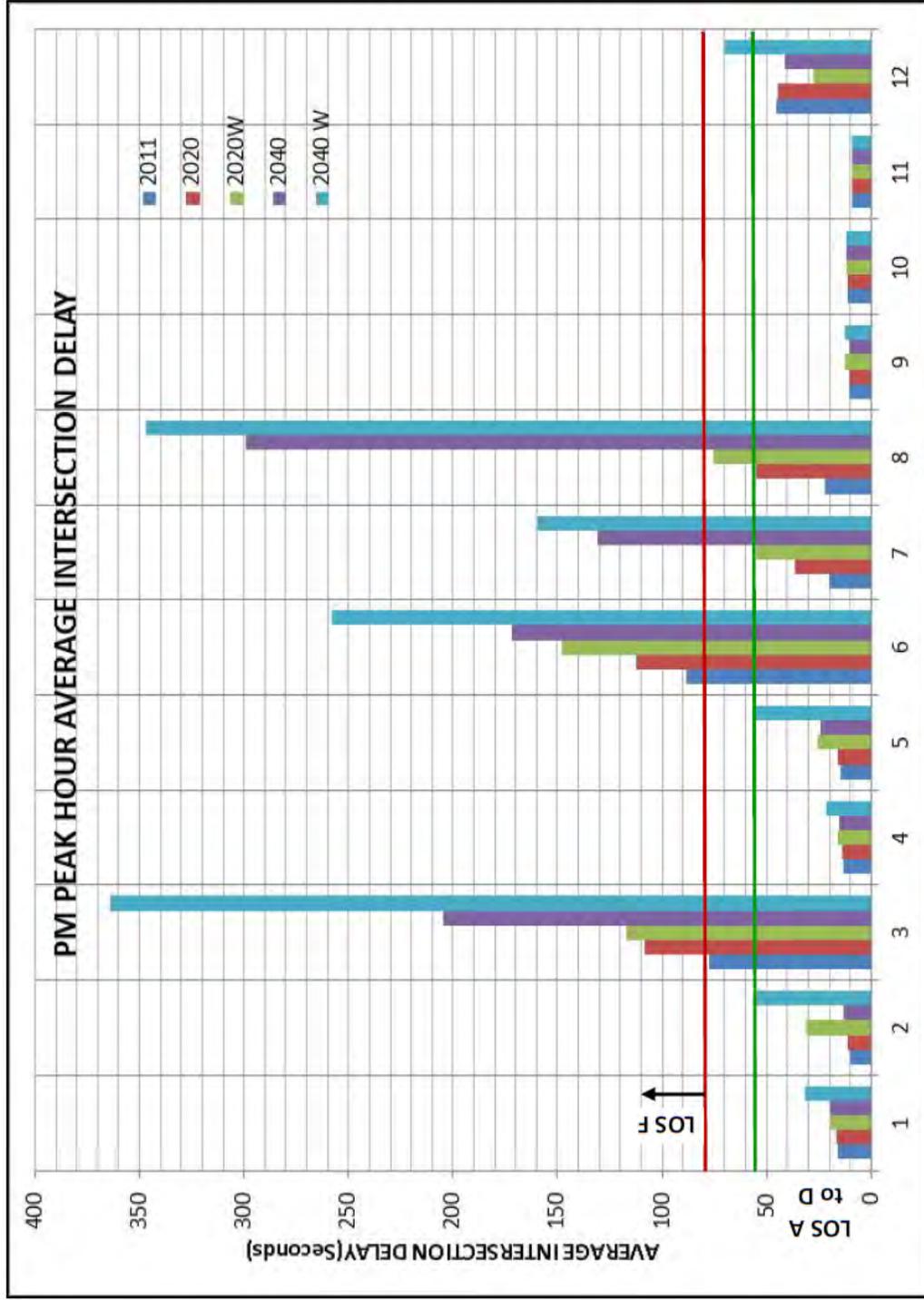


Note: From HCM for signalized intersections

LOS A – D = average delay < 55 seconds  
 LOS F = average delay > 80 seconds

- Intersections**
1. I-5 NB Ramps Pacific Ave.
  2. I-5 SB Ramps/Pacific Ave.
  3. I-5 NB Ramps/Sleater-Kinney Rd.
  4. I-5 SB Ramps/Sleater Kinney Rd.
  5. I-5 NB Ramps/Martin Way
  6. I-5 SB Ramps/Martin Way
  7. I-5 NB Ramps/Marvin Rd.
  8. I-5 SB Ramps/Marvin Rd.
  9. I-5 NB Off-ramp/Quinault Dr./Galaxy Dr.
  10. I-5 SB On-ramp/Nisqually Cut-Off Rd./Brown Farm Rd.
  11. I-5 NB Off-ramp/Nisqually Cut-Off Rd.
  12. I-5 NB On-ramp/SB Off-ramp/Nisqually Cut-Off Rd./Martin Way

FIGURE 1-27: Summary of PM Peak Hour Ramp Intersection Analysis



- Intersections**
- 1-5 NB Ramps Pacific Ave.
  - 1-5 SB Ramps/Pacific Ave.
  - 1-5 NB Ramps/Sleater-Kinney Rd.
  - 1-5 SB Ramps/Sleater Kinney Rd.
  - 1-5 NB Ramps/Martin Way
  - 1-5 SB Ramps/Martin Way
  - 1-5 NB Ramps/Marvin Rd.
  - 1-5 SB Ramps/Marvin Rd.
  - 1-5 NB Off-ramp/Quinault Dr./Galaxy Dr.
  - 1-5 SB On-ramp/Nisqually Cut-Off Rd./Brown Farm Rd.
  - 1-5 NB Off-ramp/Nisqually Cut-Off Rd.
  - 1-5 NB On-ramp/SB Off-ramp/Nisqually Cut-Off Rd./Martin Way

Note: From HCM for signalized intersections  
 LOS A – D = average delay < 55 seconds  
 LOS F = average delay > 80 seconds

## Policy Point 1: Need for Access Point Revision

The Marvin Road ramp intersections are expected to begin failing by 2020, especially with the widening of I-5 to meet forecasted travel demands. By 2040, the average delays at the ramp terminal intersections are expected to range from two minutes per vehicle to nearly six minutes per vehicle, causing significant congestion along the corridor and the SB off-ramp. The NB off-ramp is currently a two-lane ramp with direct connections to Quinault Drive and Marvin Road, and is approximately a half mile long with an associated half-mile auxiliary lane. This design allows some of the traffic to exit at Quinault Drive and Galaxy Drive instead of all traffic exiting at Marvin Road.

Marvin Road Interchange



### **WHAT ARE THE TRAFFIC OPERATIONAL CONDITIONS AT OTHER KEY INTERSECTIONS FOR THE EXISTING AND FUTURE BASE CONDITIONS?**

Other key intersection levels of service and average delays are listed in Figure 1-28. Many of these key intersections along Martin Way and Marvin Road are also expected to fail by 2040 with Marvin Road and Quinault Drive showing some failures by 2020.

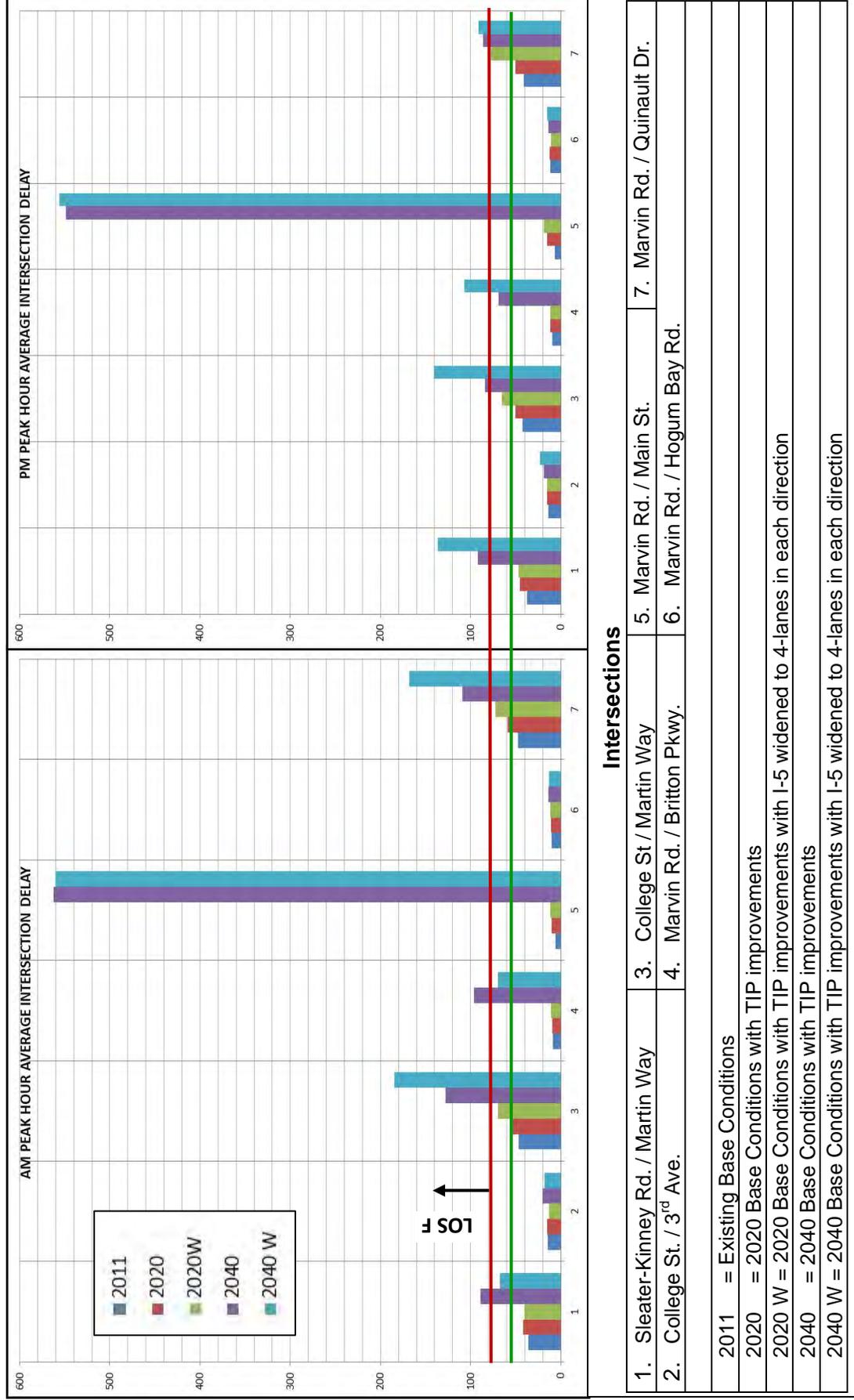
Likewise, at the Martin Way and College Street intersection with the 2020 widened scenario, it is expected to be below LOS D. These intersections will also be affected by the traffic back-up at the ramp terminals, and may reduce the level of service even more with greater average delays.

### **WHAT ARE THE OVERALL TRAFFIC OPERATIONAL FINDINGS FOR THE EXISTING AND FUTURE BASE CONDITIONS?**

Overall, these analyses show that there will be severe congestion issues along the I-5 corridor and specifically at the Martin Way and Marvin Road interchanges, as well as at the Sleater-Kinney Road Interchange and the Nisqually Interchange ramp terminals in future years. The number of failing I-5 mainline sections and intersections is expected to increase over the next ten to thirty years.

As part of the City of Lacey's policy, decision-makers and staff feel it is prudent to continue planning to resolve these issues. Part of this planning effort is to identify other local transportation system improvements to provide adequate regional and local operations.

FIGURE 1-28: Summary of AM & PM Peak Hour Traffic Analyses at Selected Intersections



Note: From HCM for signalized intersections      LOS A – D = average delay < 55 seconds  
 LOS F = average delay > 80 seconds

## Policy Point 1: Need for Access Point Revision

### WHAT IS THE COLLISION HISTORY ALONG I-5 WITHIN THE STUDY AREA?

A five-year collision analysis was conducted along I-5 from south of the I-5/Pacific Avenue interchange at MP 106.60 to the Nisqually Bridge at MP 114.61, including ramps and cross streets within the limited access area, as illustrated in Figures 1-29 and 1-30. Collisions varied throughout the corridor, with causes ranging from driver inattention, to speeding, following too closely, and other factors. The safety analysis used collision data and classified the collisions by type and severity. A detailed review of the collision data is provided under Policy Point 3.

Overall, the estimated collision rates on I-5 through the project area are well below the statewide and Olympic Region averages for urban areas. Based on WSDOT's safety assessment, there are no Collision Analysis Corridors (CACs), Collision Analysis Locations (CALs), or Intersection Analysis Locations (IALs) along this section of I-5.

The collision rate along this section of I-5 is expected to increase over the next twenty years without improvements due to:

- Increase in traffic volumes which will result in increased congestion;
- Traffic back-ups along off-ramps will extend onto the I-5 mainline, resulting in traffic stopping on the interstate; and
- Drivers will have a greater tendency to shift lanes to avoid stopping which will increase side swipe collisions.

### WHAT ARE THE GEOMETRIC CONDITIONS OF THE EXISTING INTERCHANGES?

A preliminary geometric review of the Martin Way and Marvin Road interchanges was conducted to determine if the interchange ramp lengths are in accordance with current design standards. Table 1-1 shows a comparison between the standard ramp length and the actual ramp length. The actual ramp lengths were estimated from the as-built plans. The main ramp deficiency is the NB on-ramp from Martin Way.

FIGURE: 1-29: Number of I-5 Collisions by Year

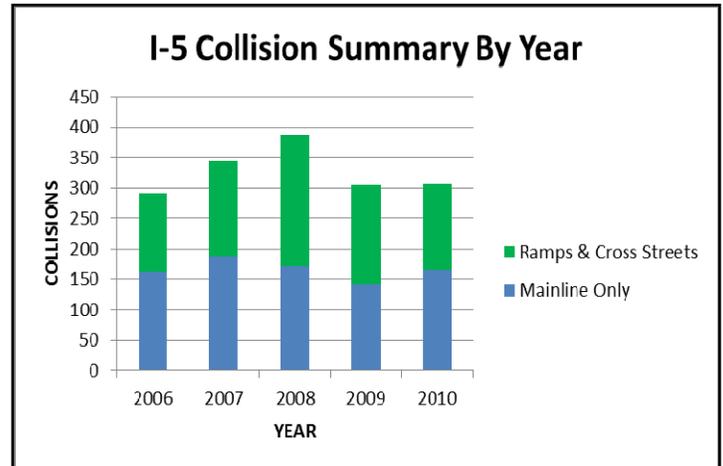
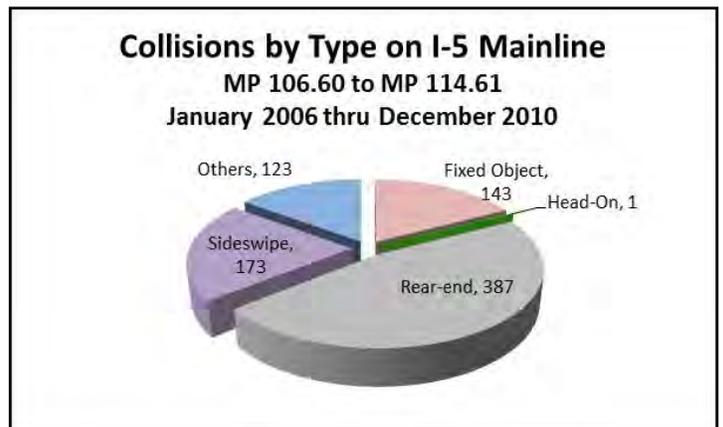


FIGURE: 1-30: I-5 Mainline Collisions by Type



**TABLE 1-1: Summary of Interchange Ramp Lengths**

Ramps	Minimum Standard (feet)	Actual Length (feet)
<b>Marvin Road</b>		
NB On-ramp	1,620	~ 1,925
NB Off-ramp	Two-lane Ramp	NA
SB On-ramp	1,620	~ 1,700
SB Off-ramp	550	~ 1,250
<b>Martin Way</b>		
NB On-ramp	1,620	~ 900
NB Off-ramp	740	~ 1,200
SB On-ramp	Add Lane	NA
SB Off-ramp	615	~ 1,150

**WHAT LOCAL (NON-INTERSTATE) IMPROVEMENTS ARE BEING CONSIDERED BY THE CITY OF LACEY TO RESOLVE THESE TRAFFIC ISSUES?**

As documented in the Assumptions Document and approved by the IJR Stakeholders Group, the local improvement analyses included in the *Lacey Transportation Systems Analysis and Alternatives Evaluation (LTSAAE) Report*, prepared in 2009 for the City of Lacey, has sufficient analyses for this IJR.

As part of those analyses, three local improvement alternative groupings were evaluated in a sequential order, as developed in the LTSAAE Study. These alternatives are listed below and illustrated on Figure 1-31.

**Alternative A**

- 1) Bowker Street Extension – new roadway from 7<sup>th</sup> Avenue to Desmond Drive
- 2) Hoh Street Extension – new roadway from Martin Way to Steilacoom Road
- 3) Non-motorized crossing over I-5 in the vicinity of Stillwater, Whisler, and Horne Streets – from Martin Way to Main Street
- 4) Meridian Road Upgrades (increase capacity and structure to accommodate truck traffic) – from Martin Way to Willamette Drive
- 5) Draham Road NE/15<sup>th</sup> Avenue NE widening to four lanes – from Carpenter Road to Sleater-Kinney Road
- 6) Hogum Bay Road Upgrades (increase structure and geometric capability of roadway to accommodate truck traffic) – from Marvin Road to Hawks Prairie Road
- 7) Added ramp access from I-5 SB off-ramp directly to Hogum Bay Road
- 8) NE Lacey (Hawks Prairie) Interconnecting Roadways – commercial collector grid between Hogum Bay Road and Carpenter Road north of I-5

## Policy Point 1: Need for Access Point Revision

**Alternative B:** Alternative A improvements plus the following:

- 9) 15<sup>th</sup> Avenue Extension – new roadway from Sleater-Kinney Road to Lily Road
- 10) College Street Extension – new roadway from 15th Avenue NE to future 26<sup>th</sup> Avenue Connector
- 11) 26<sup>th</sup> Avenue Connector – new roadway from Marvin Road to Sleater-Kinney Road
- 12) 31<sup>st</sup> Avenue Extension – new roadway from Hogum Bay Road to Marvin Road in vicinity of future 26<sup>th</sup> Avenue Connector

**Alternative C:** This scenario was added for comparative purposes; however, in the initial screening process it was determined that disruption to an existing neighborhood with a high proportion of low income and minority households would prohibit implementation. It includes Alternatives A and B improvements and the following:

- 13) Vehicular crossing over I-5 in the vicinity of Stillwater, Whisler, and Horne Streets – from Martin Way to Main Street

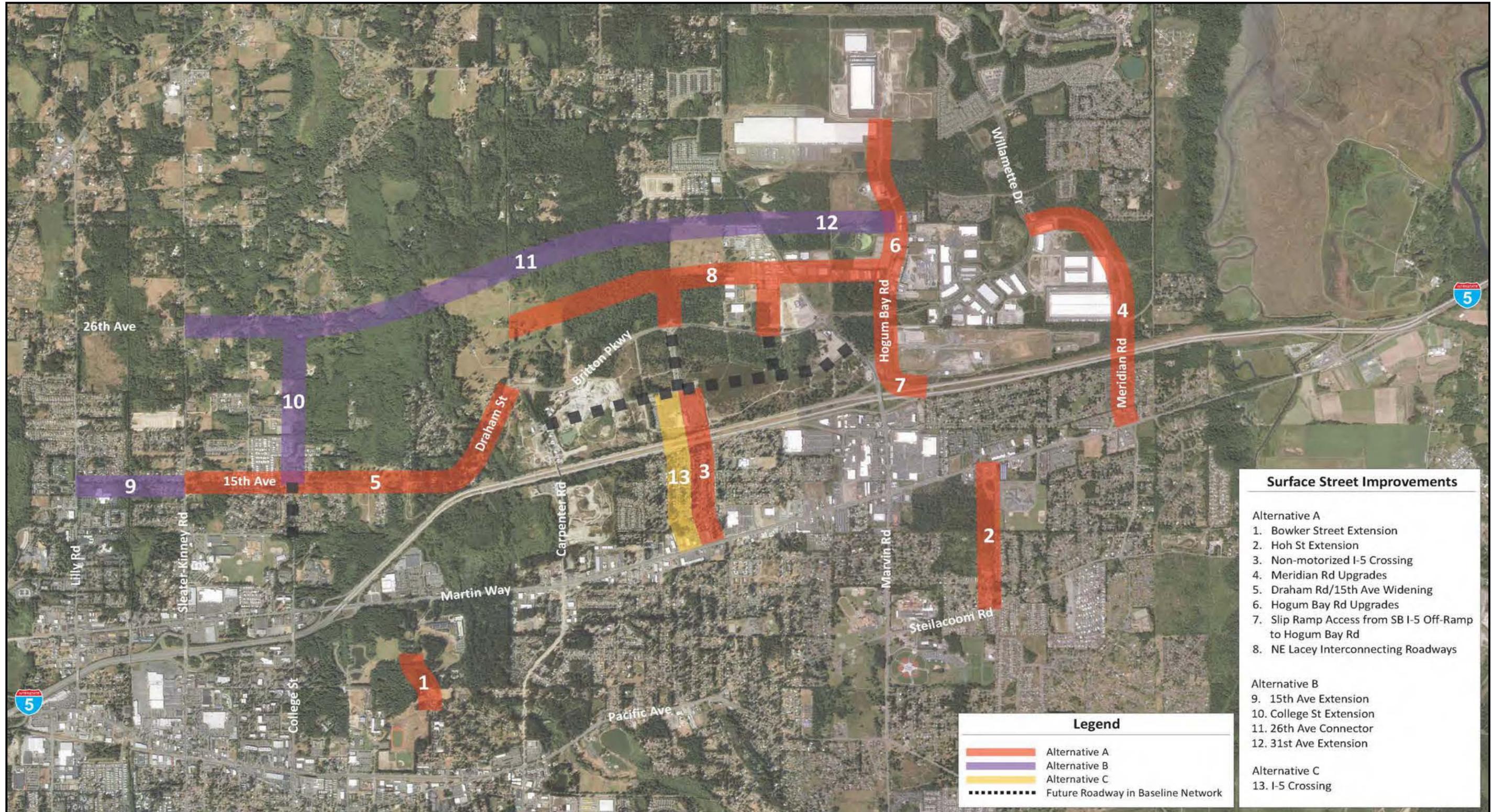
These improvement groupings were incrementally added to the 2030 baseline model scenario and built upon each other. Initially, Alternative A was added to the 2030 baseline scenario and analyzed; then Alternative B was added to the previous scenario and the results analyzed; and finally, Alternative C was added with Alternative B scenario and analyzed. Each alternative provided operational benefits within their own localized area.

The findings from those analyses showed that:

- Alternative A improves regional circulation by providing additional local access connections, and enhances east-west mobility north of I-5. The critical ramp terminal intersections along Martin Way and Marvin Road received only marginal benefit.
- Alternative B improves traffic circulation within the Hawks Prairie area and enhances east-west connections presented in Alternative A. The critical ramp terminal intersections along Martin Way and Marvin Road still only received marginal benefit.
- Alternative C provides a 25 percent traffic reduction on Carpenter Road but only a nine percent traffic reduction on Marvin Road and a six percent reduction on Martin Way with little change (less than two percent) to traffic flows on I-5.

Some of the improvements provided regional benefit and resulted in lower overall congestion levels in some areas; however, they provided little benefit to the critical ramp terminal intersections along Martin Way and Marvin Road or along I-5.

FIGURE 1-31: Proposed Local Improvement Projects



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**WHAT IS THE OVERALL EFFECT OF THE NON-INTERSTATE IMPROVEMENTS?**

Even with the proposed regional and local roadway and transit improvements, traffic flow and access to I-5 are expected to reach unacceptable service levels. The IJR Stakeholder Group, which includes FHWA, WSDOT, City of Lacey, Thurston County, TRPC, and Intercity Transit representatives, agreed that these local improvement alternatives by themselves would not accommodate the projected traffic demand at many of the study intersections, meet level of service goals, nor improve traffic operations along I-5 to acceptable levels. Therefore, evaluation of improvements to the existing I-5/Martin Way Interchange and the I-5/Marvin Road Interchange is warranted.

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## **Policy Point 2: Reasonable Alternatives**

### **HAVE REASONABLE ALTERNATIVES BEEN EVALUATED?**

The focus of this IJR is to identify and analyze reasonable alternatives to improve the operational and safety issues at the I-5/Martin Way Interchange and the I-5/Marvin Road Interchange, as presented in Policy Point 1.

During the previous *Lacey Transportation Systems Analysis and Alternatives Evaluation Study* (LTSAE – typically pronounced “lassie”) and this *I-5/Martin Way and I-5/Marvin Road Interchange Justification Report*, two brainstorming sessions were held with representatives from FHWA, WSDOT, City of Lacey, Thurston County, Intercity Transit, Thurston Regional Planning Council, and consultant teams. The two sessions were designed to identify, discuss, and evaluate improvements at the Martin Way and Marvin Road interchanges. Overall, 25 alternatives were identified and considered during these study group meetings. In addition, during the LTSAE Study, three sets of local street improvement alternatives were identified and evaluated to improve operations at the I-5/Martin Way and the I-5/Marvin Road interchanges.

The stakeholders for this IJR agreed that the analysis of these local improvements documented in the LTSAE Study is sufficient for this IJR. During the brainstorming study session for this IJR, stakeholders reviewed all alternatives from both studies and selected three interchange alternatives for further evaluation.

### **WHAT LOCAL (NON-INTERSTATE) IMPROVEMENTS WERE IDENTIFIED AND ANALYZED?**

During the development of the IJR assumptions and guidelines for this study, the stakeholders group agreed that the local improvements, identified during the LTSAE Study, represented a reasonable list of local street improvements to improve traffic operations at the Martin Way and Marvin Road interchanges. These improvements were grouped into three alternative packages. These alternatives were then analyzed in sequential order; first Alternative A was analyzed; then Alternative B was added and both alternatives were analyzed together; and finally, Alternative C was added and the three alternatives were analyzed together. The following Local Street Alternatives, as illustrated in Figure 2-1, were identified and analyzed, as part of the LTSAE Study:

**Local Street Improvement Alternative A:** This set of improvements to various local streets includes:

- Bowker Street Extension – from 7th Avenue to Desmond Drive
- Hoh Street Extension – from Martin Way to Steilacoom Road
- Non-motorized Interstate 5 over-crossing in vicinity of Stillwell, Whisler and Horne Streets – from Martin Way to Main Street
- Meridian Road Upgrades – from Martin Way to Willamette Drive
- Hogum Bay Road Upgrades – Marvin Road to Hawks Prairie Road

## Policy Point 2: Reasonable Alternatives

- Draham Road NE/15th Avenue NE widen to four lanes – Carpenter Road to Sleater-Kinney Road
- Construct slip ramp access from I-5 SB off-ramp directly to Hogum Bay Road
- NE Lacey (Hawks Prairie) Interconnecting Roadways – commercial collector grid between Hogum Bay Road and Carpenter Road north of I-5

**Conclusion:** Stakeholders recognized that Alternative A did improve regional circulation by providing additional local access connections, and enhancing east-west mobility north of I-5; however, the critical I-5/ Martin Way and I-5/Marvin Road interchanges receive only marginal benefit. By comparing the forecasted volumes with and without this set of local improvements in the LTSAAE Study, engineers determined that the changes in forecasted volumes along I-5, measured at four locations between Sleater-Kinney Road and to Nisqually Cut-Off Road, were less than one percent.

**Local Street Improvement Alternative B:** This set of improvements includes the Alternative A improvements plus the following:

- 15th Avenue Extension – from Sleater-Kinney Road to Lilly Road
- College Street Extension – from 15th Avenue NE to future 26<sup>th</sup> Avenue Connector
- 26th Avenue Connector – from Marvin Road to Sleater-Kinney Road
- 31st Avenue Extension – from Hogum Bay Road to Marvin Road in vicinity of future 26th Avenue Connector

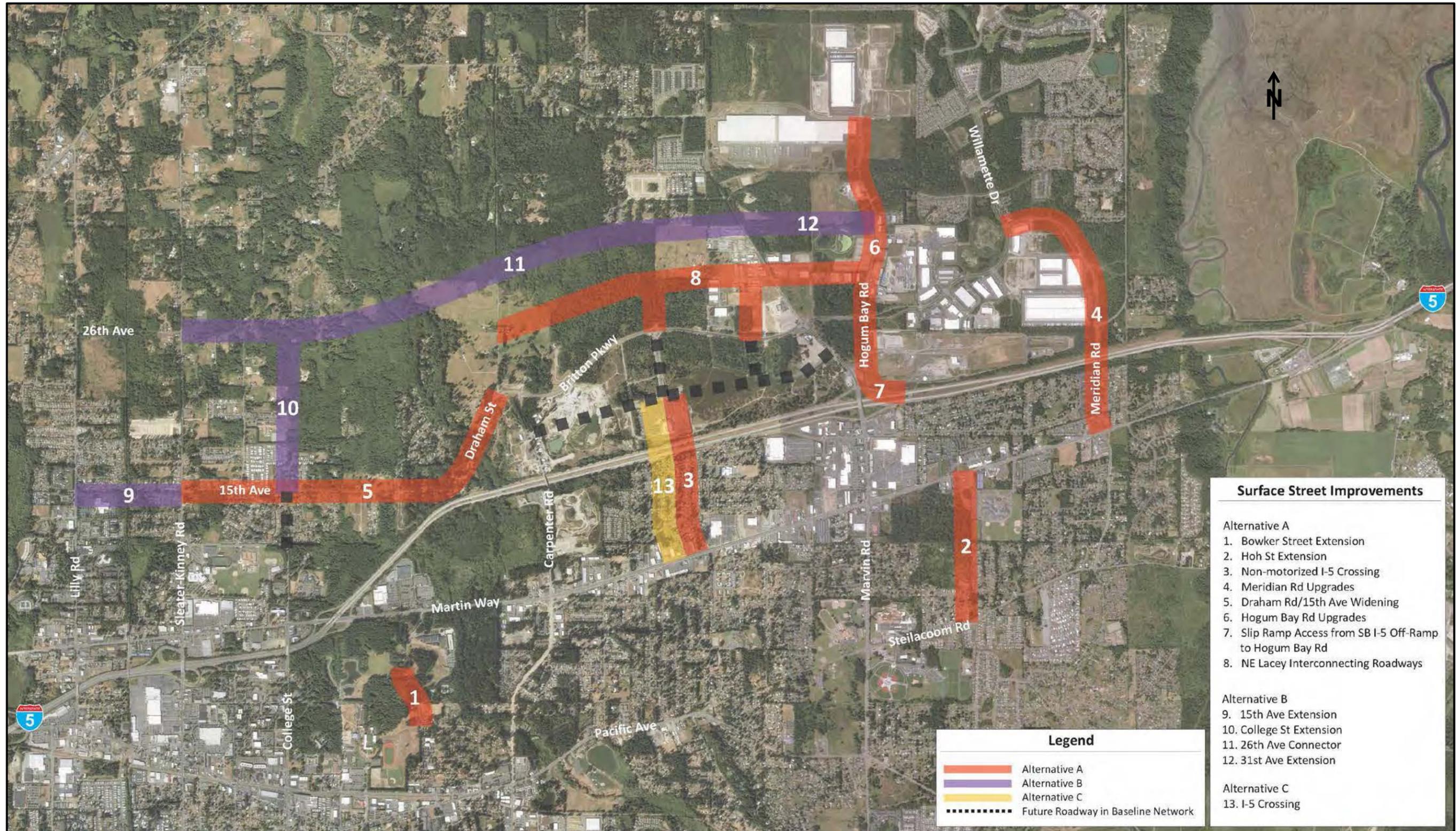
**Conclusion:** The stakeholders agreed that Alternative B significantly improves traffic circulation within the Hawks Prairie area and enhances the east-west connections; however, as with Alternative A, the critical I-5/Martin Way and I-5/Marvin Road interchanges receive only marginal benefit. The engineers estimated that the forecasted volumes at the four measuring locations along I-5 were reduced by approximately one percent.

**Local Street Improvement Alternative C:** This set of improvements includes those from Alternatives A and B plus the following:

- Vehicular crossing over I-5 in the vicinity of Stillwell, Whisler and Horne Streets – Martin Way to Main Street

**Conclusion:** The stakeholders agreed that Alternative C also provides reduction in traffic flows on Marvin Road by approximately nine percent and Martin Way by approximately six percent. This reduction in traffic on Marvin Road could provide some improvement to the function of the I-5/Marvin Road interchange but little improvement at the I-5/Martin Way interchange. The engineers determined that the forecasted volumes at the four locations along I-5 showed an approximate one percent change from the baseline volumes. As a result, the LTSAAE stakeholder group agreed that the slight changes in travel patterns, associated with the new I-5 under-crossing, did not warrant the significant disruption to an existing neighborhood.

FIGURE 2-1: Local Street Improvement Alternatives



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## WHAT CONCLUSIONS DID THE STAKEHOLDERS COME TO REGARDING THE LOCAL STREET IMPROVEMENT ALTERNATIVES?

Based on traffic comparisons, the stakeholders agreed that the local street improvements alone will not improve congestion at the Marvin Road and Martin Way interchanges. At best, the forecasted volumes along I-5 with these local street improvements reduced traffic by approximately one percent. However, the stakeholders recommended that several of the improvements should be incorporated into the *City of Lacey's Transportation Improvement Plan*. These projects, as shown in Figure 2-2, include:

- Widening Carpenter Road from 2 to 4 lanes – Britton Parkway to Pacific Avenue;
- Constructing College Street Extension (1 lane each direction) from 6th Ave NE to 15th Ave NE;
- Widening Britton Parkway from 2 to 4 lanes, Marvin Road to Carpenter Road;
- Constructing roadway grid in Hawks Prairie Business District; and
- Widening 15th Avenue to complete a 4/5 lane corridor generally parallel to and north of Interstate 5 between Orion Drive and Sleater-Kinney Road.

**FIGURE 2-2: Recommended Local Street Improvements**



### WHAT INTERSTATE IMPROVEMENTS WERE IDENTIFIED AS PART OF THE LTSAAE STUDY?

During the LTSAAE Study, the stakeholder group held a design workshop in April 2008 to brainstorm potential interchange improvements to address the existing and projected congestion issues at the Martin Way and Marvin Road Interchanges. Various alternative improvements to the Sleater-Kinney Road, Martin Way and Marvin Road interchanges were screened for:

- adherence to WSDOT design guidelines,
- impacts to existing properties,
- impacts to natural environment,
- construction impacts to I-5 and arterials, and
- cost.

These criteria were used to determine which alternatives would be carried forward for further analysis and refinement as part of this IJR.

The following is a list of those improvements recommended for consideration by the stakeholder group by interchange area.

**Sleater-Kinney Road Interchange:** To relieve congestion at the I-5/Martin Way Interchange, seven alternatives to the Sleater-Kinney Road Interchange were identified and analyzed during the LTSAAE Study. (These were Options 1, 2, 2a, 2b, 2c, 3 and 4, as illustrated on Figure 2-3). These alternatives were not carried forward to this IJR, as none of them drew enough traffic away from the I-5/Martin Way Interchange to eliminate the need for modifications at the Martin Way Interchange. About 250 vehicles in the PM peak hour were shifted from the Martin Way interchange.

Although the Sleater-Kinney Road Interchange modifications by themselves do not address congestion at the I-5/Martin Way Interchange, which is the focus of this IJR, they do provide benefit. The proposed modifications at the Martin Way Interchange do not preclude some of these modifications at Sleater-Kinney Road Interchange in the future.

**Carpenter Road Interchange:** There were three alternatives considered for a new interchange at Carpenter Road, namely Options 7, 8, and 9 during the LTSAAE Study. The stakeholders for this IJR concurred that any discussion of a new interchange at Carpenter Road is premature until modifications are further reviewed at the Martin Way and Marvin Road interchanges. Therefore, these alternatives are not being considered as part of this IJR.

**Martin Way Interchange:** The following seven alternatives were considered in the LTSAAE Study for modifications to the Martin Way Interchange, namely Options 5, 5a, 5b, 5c, 5d, 6 and 6a, as illustrated on Figure 2-4. The LTSAAE stakeholder group recommended Option 5, and the IJR stakeholders concurred with the recommendation.

FIGURE 2-3: Improvement Options At the Sleater-Kinney Road Interchange

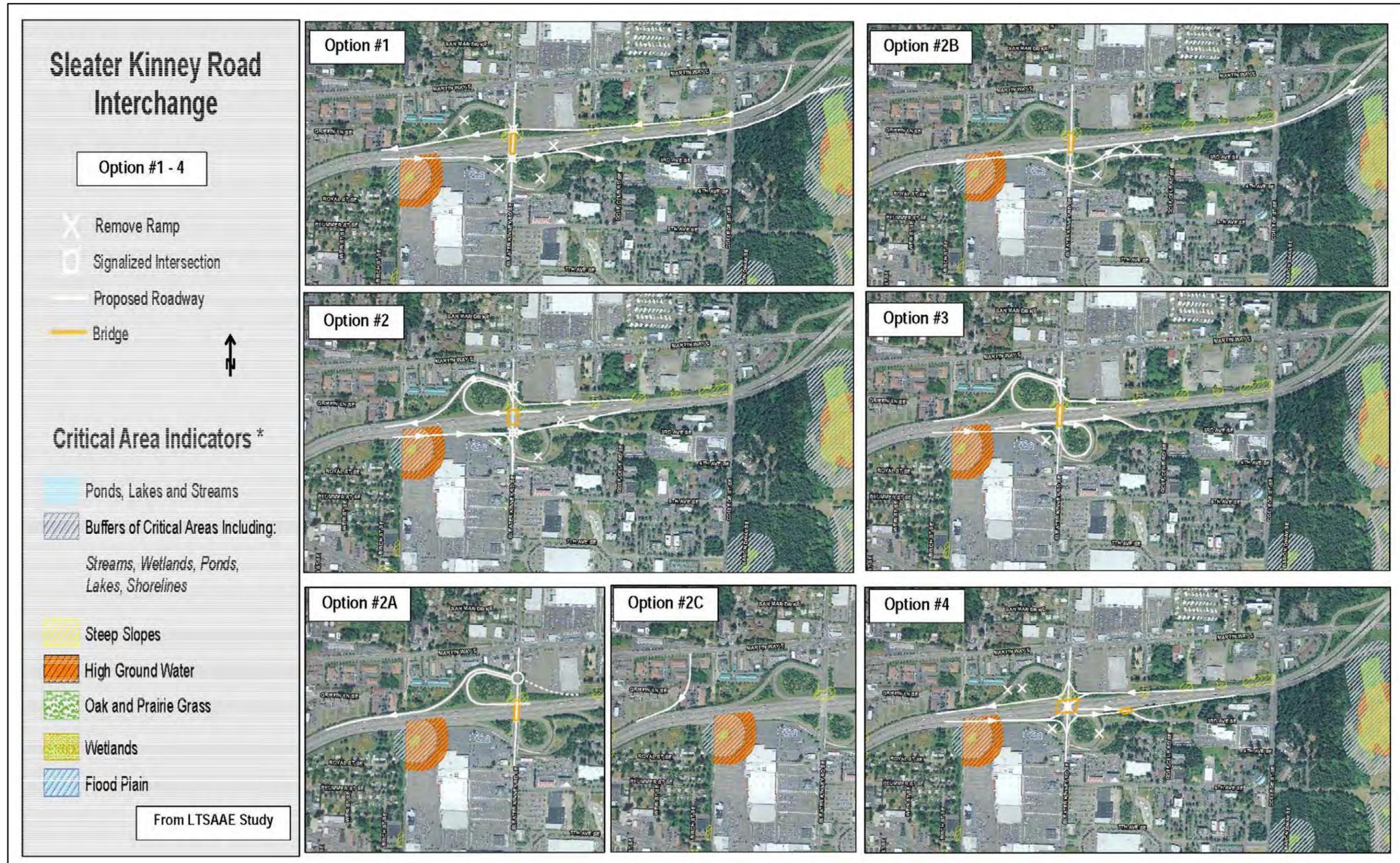
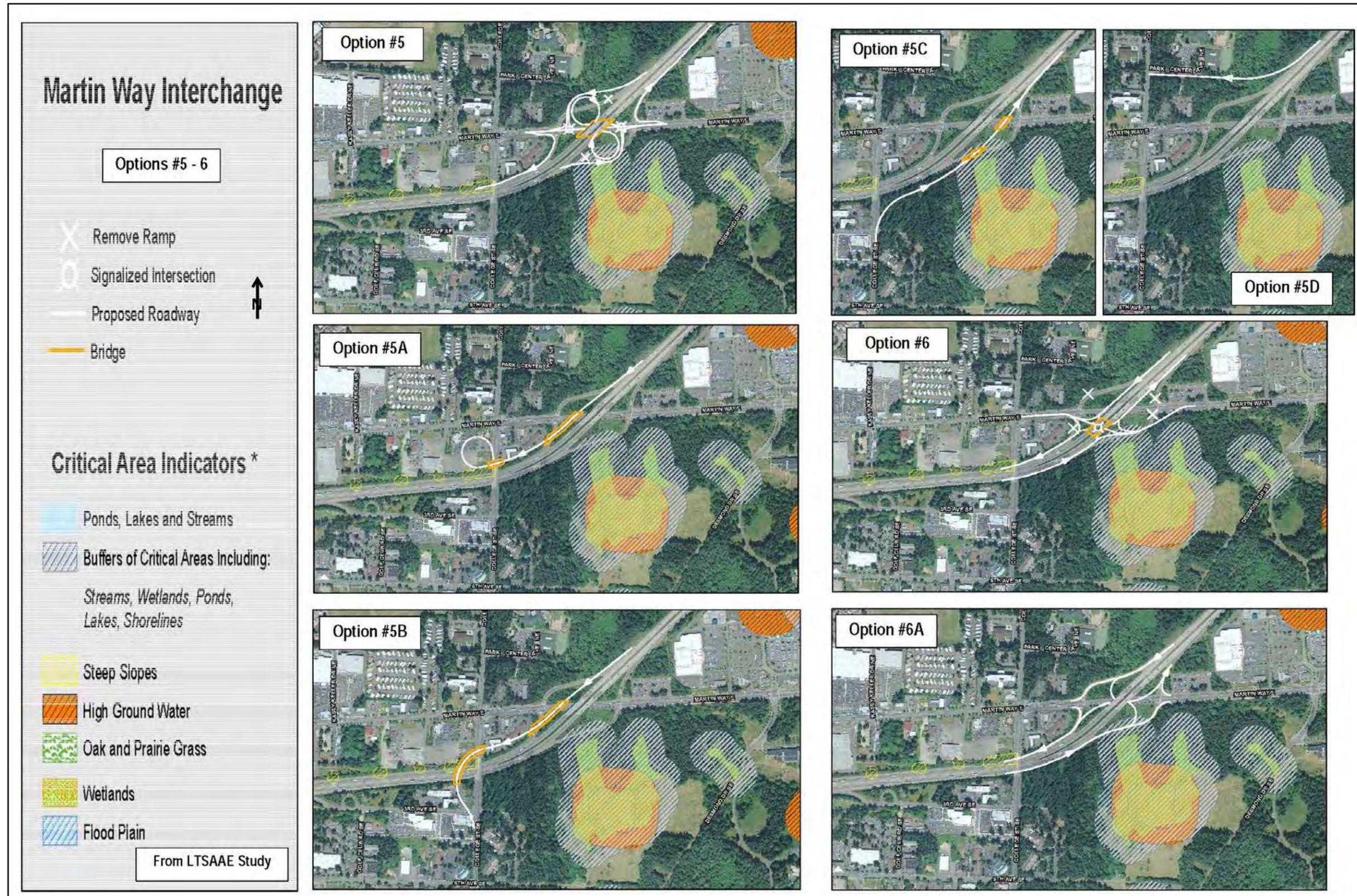


FIGURE 2-4: Improvement Options at the Martin Way Interchange



- **Option 5 - Partial cloverleaf on-ramps:** This alternative is located in the northwest quadrant for EB Martin Way to NB I-5 and in the southeast quadrant for WB Martin Way to SB I-5 and re-aligned adjacent off-ramps. Stakeholders approved the alternative for further study because it improved traffic operations at the Martin Way Interchange by converting heavy left-turning traffic to right turns for movements from Martin Way to the I-5 on-ramps. Traffic operations at these ramp intersections improved from LOS F to LOS C or better.
- **Option 5A - SB bypass loop ramp to SB College Street:** This alternative would divert traffic heading for College Street by means of a direct off-ramp connection from SB I-5 to SB College Street. The SB off-ramp would connect to a collector/ distributor (C/D) road and then to a loop off-ramp in the northwest quadrant of College Street and I-5.

Stakeholders rejected this alternative because of its high cost associated with building new bridges, the new C-D road, and the loop ramp; substantial impacts during construction; and acquisition of a large tract of commercial property. The LTSAAE stakeholder group viewed these impacts as greater than the benefit of drawing about 400 PM peak hour vehicle trips away from the Martin Way SB off-ramp.
- **Option 5B - SB bypass flyover ramp:** This alternative provides a similar function to Option 5A but uses a flyover ramp instead of a loop ramp.

Stakeholders also rejected this option because of its high cost associated with structures and retaining walls, and geometric difficulties in returning to grade near 3rd Avenue SE. This option has a smaller footprint than Option 5A which translate to less impacts on adjacent commercial property. Again, the LTSAAE stakeholder group viewed these impacts as greater than the benefit of drawing about 400 PM peak hour vehicle trips away from the Martin Way SB off-ramp.
- **Option 5C - NB College Street bypass flyover ramp to NB I-5:** This alternative provides a direct connection from College Street to NB I-5 by building an on-ramp to merge with the Martin Way on-ramp. This alternative did improve the operation at the College Street and Martin Way intersection.

Stakeholders rejected the alternative because of the high cost and limited benefit to the Martin Way interchange. This project may be viable for a future project because of the limited impact to the built environment.
- **Option 5D - SB I-5 slip ramp to College Street:** This alternative provide similar function as Options 5A and 5B in that College Street traffic bypasses the Martin Way Interchange, but terminates the slip ramp north of the College Street/Martin Way intersection. Traffic would still impact the College Street/Martin Way intersection.

The Stakeholders acknowledged that this alternative did improve the operation at the Martin Way Interchange ramp terminals, but would require significant property impacts. The LTSAE stakeholder group rejected this alternative because they viewed these property impacts and construction costs as greater than the benefit to the SB Martin Way off-ramp intersection.

- **Option 6 – SPUI:** With realignment of Martin Way and a New Overcrossing. - This alternative improved the operation at the ramp terminals. This alternative would require realigning Martin Way to cross more perpendicular to I-5, and would require a new I-5 over crossing.

The LTSAE stakeholder group recommended Option 5 over this option because the benefits are similar, but the costs were viewed as higher for this alternative.

- **Option 6A – SPUI:** With existing alignment of Martin Way (to minimize modifications to existing bridges) - This alternative would reduce costs associated to realigning Martin Way.

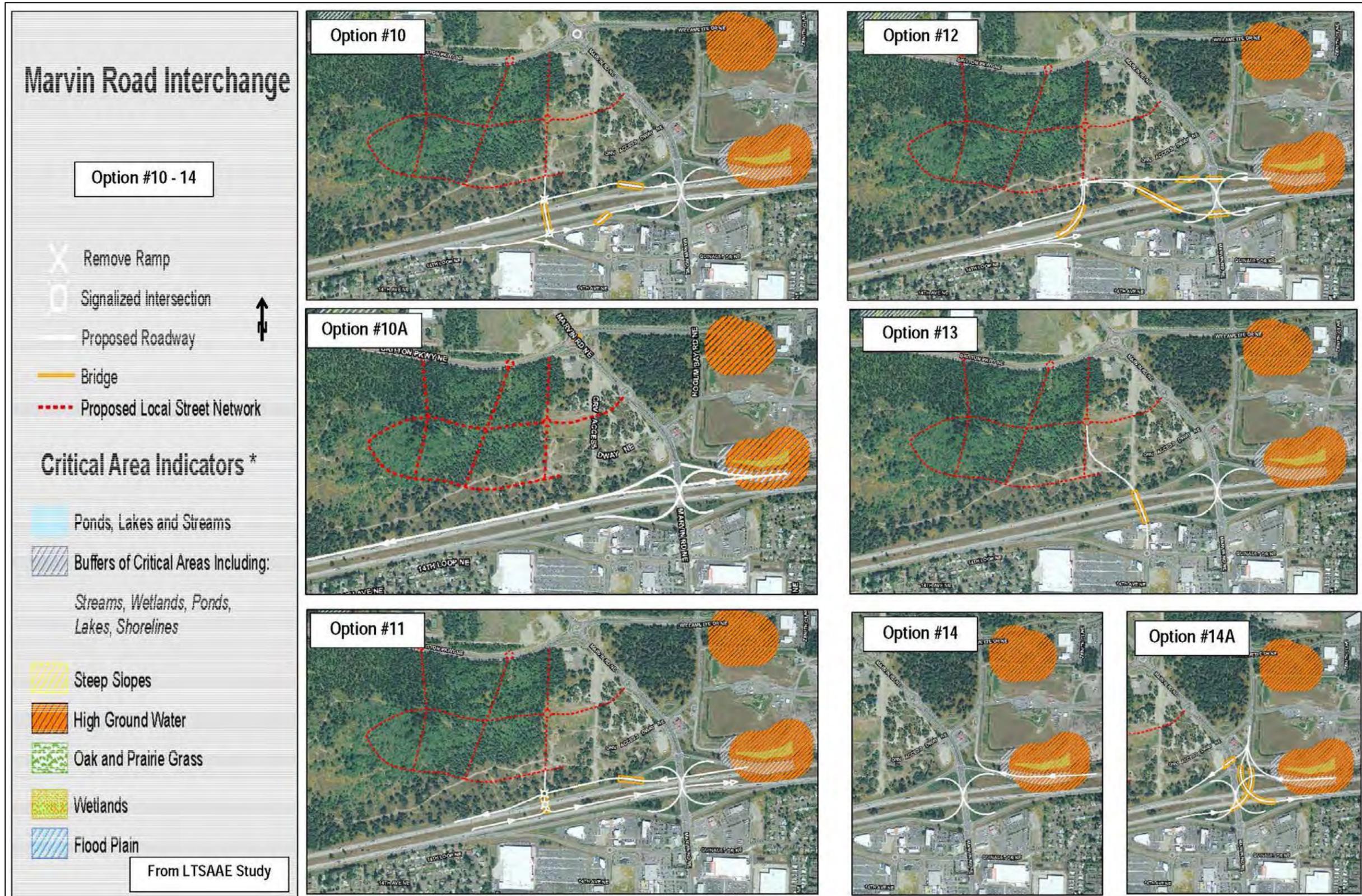
Stakeholders rejected this alternative because it would require a very long clearance time for EB and WB left-turns which would result in a marginally acceptable LOS.

**Marvin Road Interchange** - The following eight alternatives were considered in the LTSAE Study for modifications to the Marvin Road Interchange, namely the original Phase II SPUI concept and Options 10, 10a, 11, 12, 13, 14, and 14a, as illustrated in Figure 2-5. The LTSAE stakeholder group recommended the Phase II SPUI (from the previous Marvin Road IJR), Option 10a (braided ramp and SB frontage road to Carpenter Road) and Option 14 (Hogum Bay Road SB off-ramp). The IJR Stakeholders concurred with these recommendations.

**Phase II SPUI currently planned.** The LTSAE stakeholder group recommended this option be carried forward to this IJR study. The planned Phase II SPUI will not accommodate the projected traffic volumes by itself. In addition the volume of traffic demand projected for Marvin Road north of Interstate 5 is beyond the capacity of the proscribed roadway width. A range of options described below was evaluated to enhance the capacity of the interchange and allow the Marvin Road corridor and SPUI intersection to function better.

- **Option 10 - New overcrossing and braided ramps:** This alternative proposes a new undercrossing west of Marvin Road with a fully directional diamond interchange. The ramps north of the new crossing and the ramps south of the Marvin Road crossing are braided.

FIGURE 2-5: Improvement Options at the Marvin Road Interchange



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The LTSAAE stakeholder group rejected this alternative because of high cost, poor driver expectancy (closely spaced braided ramps), and negative built environment impacts.

- **Option 10A - SB collector-distributor (C/D) from Marvin Road to Carpenter Road:** The LTSAAE stakeholder group recommended this alternative because it did not add a new access point directly to I-5, helps disperse traffic to the Lacey Gateway area, and can complement the recommended Phase II SPUI.

- **Option 11 - New undercrossing and NB left off- / on-ramps:** This alternative is similar in function to Option 10 but uses left sided on and off-ramps for NB I-5.

The LTSAAE stakeholder group rejected this option because of the left sided ramps, and the reasons listed for Option 10.

- **Option 12 - NB off/on flyover ramps:** This alternative is similar in function to Option 10, using flyover ramps instead of an undercrossing structure. It is fully directional, but provides no north-south local road route across I-5. The LTSAAE Stakeholder Group rejected this alternative because of high structure costs.

- **Option 13 - New Undercrossing – Galaxy Drive Extension:** This alternative extends Galaxy Drive from the roundabout, through developed commercial property, over I-5, and north to Britton Parkway through the Lacey Gateway area.

The LTSAAE stakeholder group rejected this alternative because of its high cost and high commercial property impacts with limited benefit, as it is forecasted to draw about 560 PM peak hour vehicle trips away from SB Marvin Road, and 460 PM peak hour vehicle trips away from NB Marvin Road.

- **Option 14 - Direct SB off-ramp to Hogum Bay Road:** This alternative was accepted because it provided a direct truck route to the northeast area, reduces traffic on Marvin Road, and improves safety.

The Hogum Bay Road ramp will allow trucks to access Lacey's light industrial, commercial, and warehouse center, and the Thurston County Waste and Recovery Center (WARC) from I-5 without having to use Marvin Road. The Lacey commercial, warehousing, and light industrial areas contain approximately 1,334 acres which generate a large amount of truck traffic. In addition, the WARC is a regional facility which hosts an Intercity Transit Park and Ride Lot. The Hogum Bay Road ramp would provide a better route for transit buses to access the facility. Access to both of these regionally significant public facilities will be improved with the Hogum Bay Road ramp, and Marvin Road will be less congested.

- **Option 14A - Flyover ramps to Hogum Bay Road – Stakeholders rejected this alternative because of its much higher cost relative to Option 14.**

### WHAT ADDITIONAL INTERSTATE IMPROVEMENTS WERE IDENTIFIED AS PART OF THIS IJR PROCESS?

In August 2011, a brainstorming session with the stakeholders for this IJR was held. The stakeholders reviewed the recommendations from the LTSAAE Study and presented additional interchange improvement ideas for consideration. The following is a summary of the discussion and the resolution of the ideas.

**Martin Way Interchange** - The IJR stakeholder group identified and discussed the following eight improvement ideas for the Martin Way Interchange.

1. Partial cloverleaf in NW and SE quadrants, as recommended in the LTSAAE Study.

**Resolution:** Stakeholders agreed that this alternative should be analyzed as part of the IJR process.

2. Add NB slip on-ramp from Park & Ride Lot for buses only.

**Resolution:** Stakeholders agreed that the project will be designed to allow future construction of a transit only off connection from the NB on-ramp.

3. Re-configure ramp terminals into a Diverging Diamond configuration.

**Resolution:** Stakeholders rejected this alternative because of inadequate storage length on Martin Way to College Street.

4. Incorporate extension of the regional rail system along I-5 towards Marvin Road.

**Resolution:** Stakeholders agreed that this improvement should be considered as a design feature because it does not affect traffic circulation.

5. Re-configure ramp terminal signalized intersections into roundabouts.

**Resolution:** Stakeholders rejected this suggestion because the volumes at the intersection are too large and its close spacing to the existing signal at College Street will create backups into and breakdown traffic flow in the roundabout. (Subsequent analysis of the 2040 PM peak hour estimated the volume to be approximately 6,485 vehicles entering this intersection.)

6. Add ramp metering to the NB on-ramp.

**Resolution:** Stakeholders agreed that ramp meters should be considered as a design feature.

**FIGURE: 2-6: Martin Way Interchange**



7. Make the NB on-ramp longer.

**Resolution:** Stakeholders agreed that ramps should be re-designed to proper length to accommodate queues on ramps with appropriate stopping distances and longer merge area.

8. Lengthen the SB off-ramp to provide more queue space, or add 2-lane off-ramp with auxiliary lane.

**Resolution:** Stakeholders agreed that queue length on ramps would be analyzed to determine appropriate ramp length, lane arrangement, and exit configuration.

**Marvin Road Interchange** - The IJR stakeholder group identified and discussed the following seven improvement ideas for the Marvin Road Interchange:

1. Re-configure into a SPUI interchange with ramp connections from the SB off-ramp to Marvin Road, Hogum Bay Road and a frontage (C/D road between the SB off-ramp to Carpenter Road as recommended in the LTSAAE Study.

**Resolution:** Stakeholders agreed that a 'SPUI' configuration should be analyzed as part of the IJR process.

2. Re-configure ramp terminals into a 'Diverging Diamond' configuration.

**Resolution:** Stakeholders agreed that a 'Diverging Diamond' configuration should be analyzed as part of the IJR process.

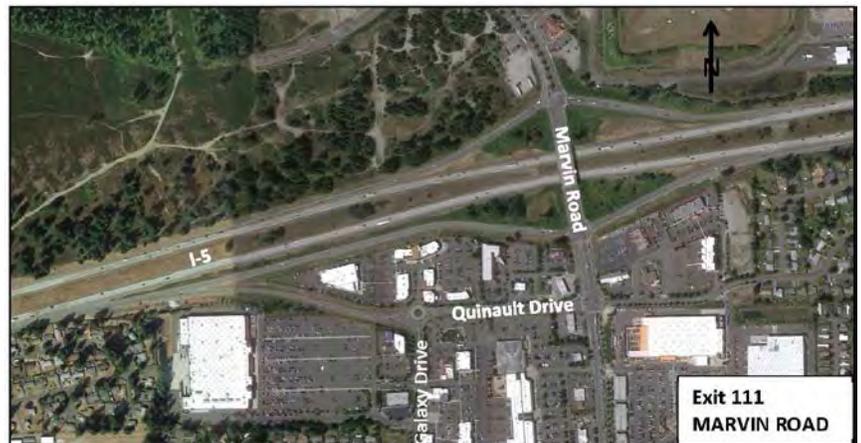
3. Add a HOV by-pass lane to the NB on-ramp with ramp metering (considering the large Park & Ride lot on Hogum Bay Road).

**Resolution:** Stakeholders agreed that ramp meters and HOV by-pass lanes should be considered as a design feature.

4. Add a SB slip off-ramp from the vicinity of Hogum Bay Road to keep Gateway traffic off Marvin Road, as recommended in the LTSAAE Study.

**Resolution:** Stakeholders agreed that this solution to reduce truck traffic on Marvin Road should be carried further for additional consideration, but the Hogum Bay Road slip lane may require a deviation.

FIGURE 2-7: Marvin Road Interchange



## Policy Point 2: Reasonable Alternatives

5. Add a SB truck climbing lane up Nisqually grade.

**Resolution:** Stakeholders agreed that the added lane is in the Highway System Plan as a Tier II Solution and will be included as part of the design.

6. Eliminate left turns on Marvin Road from I-5 to Martin Way.

**Resolution:** Stakeholders rejected this suggestion because it would have little effect on Interstate operations.

7. Add a NB flyover from NB I-5 to Gateway.

**Resolution:** Stakeholders rejected this suggestion because the off-ramp volume is projected to be about 1,300 vehicles per hour (VPH), which would be split between the Quinault Drive Ramp, the Marvin Road Ramp, and new flyover ramp. The high cost of the structure exceeds the possible operational benefits because the volume is low. This solution was previously considered as part of Alternative 13 in the LTSAAE Study and rejected for the same reasons.

### WHAT WERE THE ORIGINAL BUILD ALTERNATIVES APPROVED BY THE IJR STAKEHOLDERS?

From the work completed as part of the LTSAAE Study and the IJR brainstorming meeting, the stakeholders recommended the following three build improvements to be analyzed as part of this IJR:

- **At the Martin Way Interchange:**

Partial cloverleaf in NW and SE quadrants (Figure 2-8).

- **At the Marvin Road Interchange:**

fully directional SPUI interchange

with added SB off-ramp connections to Hogum Bay Road, and to a SB frontage road terminating at Carpenter Road. (Figure 2-9)

**FIGURE: 2-8: Partial Cloverleaf Concept - I-5/Martin Way Interchange**



FIGURE 2.9: SPUI Concept with Frontage Road – I-5/Marvin Road Interchange



- **At the Marvin Road Interchange:** Re-configure ramp terminals into a 'Diverging Diamond' configuration (Figure 2-10).

FIGURE 2-10: Diverging Diamond Concept with Frontage Road I-5/Marvin Road Interchange



### WHAT WERE THE ADDITIONAL IMPROVEMENTS CONSIDERED AT THE MARVIN ROAD INTERCHANGE DURING THE ANALYSIS?

During the analyses of the Build Alternative for the Marvin Road Interchange, various suggestions were made by the stakeholders to modify the build alternative. These suggestions included the following:

- **Split Diamond Interchange:** Reconfigure the existing Diamond Interchange at Marvin Road into a Split Diamond Interchange using an extended Galaxy Drive over I-5 and parallel to Marvin Road. This alternative would move the northbound off-ramp and the southbound on-ramp to connect with the extended Galaxy Drive. One-way connector roads would tie the two parallel roads together.

**Resolution:** Stakeholders agreed that this solution would have severe economic impacts to the commercial area around Galaxy Drive and require several commercial buildings recently constructed in the last ten years to be demolished. As a result, it was decided that this alternative would not be further analyzed.

- **Add an extended right-turn lane along Marvin Road to replace the Hogum Bay Ramp:** The proposed Hogum Bay Ramp was investigated. Based on *WAC 468-58-080 Guides for control of access on crossroads and interchange ramps*, the following excerpt was quoted:

“(1) Fully controlled highways, including interstate.

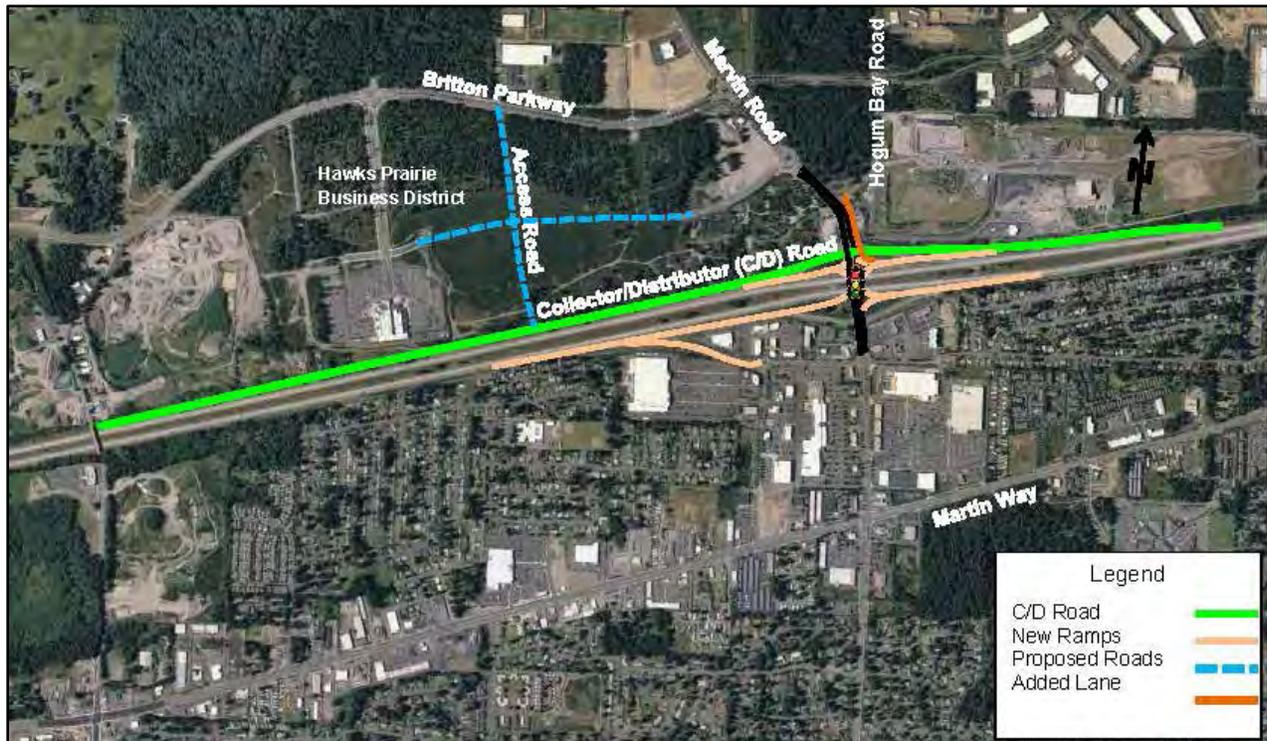
(a) There shall be no connections to abutting property or local service or frontage roads within the full length of any "off" or "on" interchange ramp from a fully controlled limited access highway. Such ramp shall be considered to terminate at its intersection with the local road which undercrosses or overcrosses the limited access facility, provided that in urban areas "off" and "on" ramps may be terminated at local streets other than crossroads where necessary to service existing local traffic.”

**Resolution:** It is the opinion of the stakeholders that an extended right-turn lane along Marvin Road from the I-5 off-ramp to Hogum Bay Road be analyzed.

- **Collector/distributor road:** Reconfigure the proposed frontage/collector/distributor road concept into a collector/distributor road and relocate it behind the existing interchange structure.

**Resolution:** Stakeholders agreed that this solution would better meet WSDOT and FHWA concerns and provide better access to the Hawks Prairie Development area and should be further analyzed. A conceptual layout of the revised Marvin Road Interchange Alternative (Build 2) is illustrated in Figure 2-11

FIGURE 2-11: SPUI Concept with Collector/Distributor Road – I-5/Marvin Road Interchange



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### **Policy Point 3: Operational and Collision Analyses**

Policy Point 3 discusses the impacts associated with the three interchange configurations at I-5/Marvin Road and one interchange configuration at I-5/Martin Way. It also considers various operating assumptions, conditions, and other improvements in accordance with WSDOT’s Design Manual Chapter 550. A summary of the operating assumptions, travel forecasting approach, analysis methodologies and findings for these configurations as compared with the No-Build conditions are presented below.

Overall, the analyses show that the proposed interchange modifications at the I-5/Martin Way Interchange and the I-5/Marvin Road Interchange improve the safety and operation of the interstate by reducing queue lengths on the off-ramps. The new interchanges, with associated highway widening, will maintain or improve design year operating conditions.

#### **WHAT ACCESS MODIFICATIONS ARE BEING CONSIDERED?**

Based on the results of the LTSAAE Study, the brainstorming study sessions with the IJR stakeholder’s group, and subsequent considerations by stakeholders, as discussed under Policy Point 2, the following interchange modifications are considered in this IJR:

**I-5/Martin Way Interchange:** A partial cloverleaf concept, as illustrated in Figure 3-1, is being considered at the Martin Way Interchange. This alternative will add loop ramps in the northwest and southeast quadrants, and revise the NB and SB off-ramps.

**FIGURE: 3-1: Partial Cloverleaf Concept - I-5/Martin Way Interchange**



**I-5/Marvin Road Interchange:** Three concepts were considered at the Marvin Road Interchange, including (1) Build 1 SPUI is a Single Point Urban Interchange (SPUI) concept with a frontage road, (2) a Diverging Diamond concept with a frontage road, and (3) a SPUI concept with a collector/distributor (C/D) road.

## Policy Point 3: Operational and Collision Analyses

The SPUI concept with a frontage road, as illustrated in Figure 3-2, retains the NB off-ramp to Quinault Drive/Galaxy Drive, adds a SB off-ramp to the frontage road to Carpenter Road, a SB off-ramp to Hogum Bay Road, and widens the NB on-ramp to two lanes.

**FIGURE 3-2: Build 1 SPUI Concept with Frontage Road – I-5/Marvin Road Interchange**



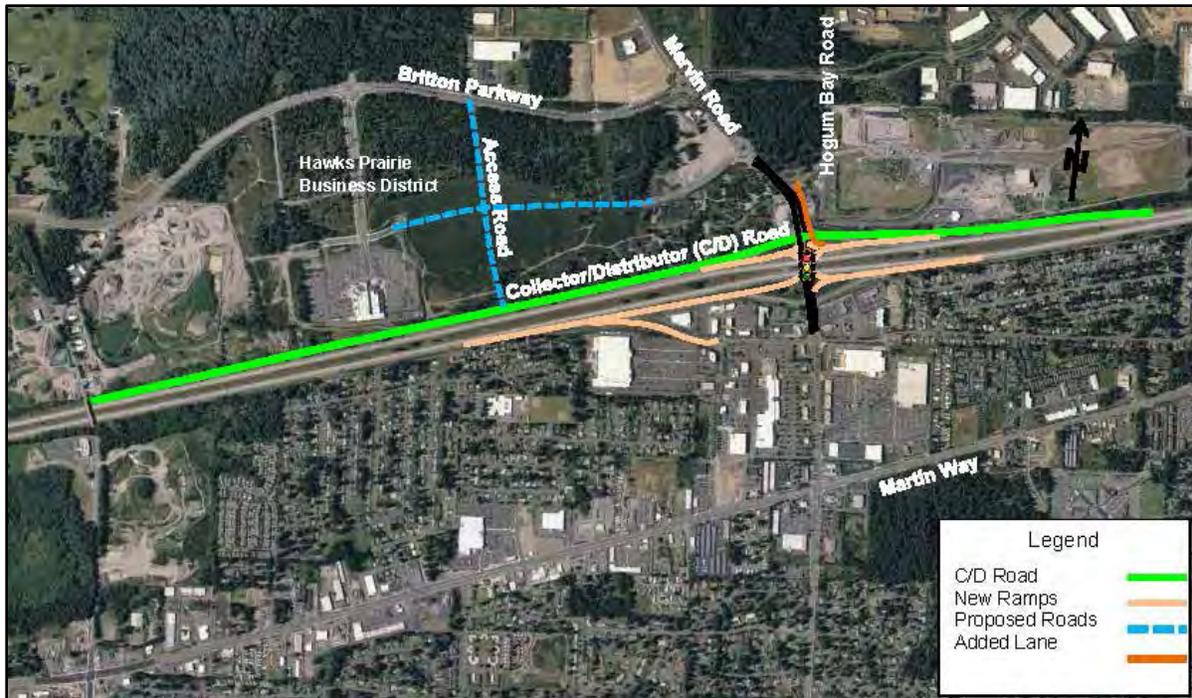
The Diverging Diamond concept with a frontage road, as illustrated in Figure 3-3, also retains the NB off-ramp to Quinault Drive/Galaxy Drive, adds a SB off-ramp to the frontage road to Carpenter Road, a SB off-ramp to Hogum Bay Road, and widens the NB on-ramp to two lanes.

**FIGURE 3-3: Build 1 Diverging Diamond Concept – I-5/Marvin Road Interchange**



The SPUI concept with a C/D road, as illustrated in Figure 3-4, retains the NB off-ramp to Quinault Drive/Galaxy Drive, connects the SB on- and off-ramps to the C/D road, and a new two-lane off- and on-ramps from the C/D road. A two-lane right-turn lane is added to the SB off-ramp to NB Marvin Road with one right-turn lane extended to Hogum Bay Road. The NB on-ramp is widened to two lanes.

**FIGURE 3-4: Build 2 SPUI Concept with Collector/Distributor Road - I-5/Marvin Road Interchange**



**WHAT ARE THE OPERATING ASSUMPTIONS FOR THE ACCESS MODIFICATIONS?**

These concepts were combined into three alternatives, as follows:

- **Build 1 SPUI** - the Marvin Road SPUI concept with the frontage road and the Partial Cloverleaf at Martin Way.
- **Build 1 Diverging Diamond** - the Marvin Road Diverging Diamond concept with the frontage road and the Partial Cloverleaf at Martin Way.
- **Build 2 SPUI** - the Marvin Road SPUI concept with the C/D road and the Partial Cloverleaf at Martin Way.

The operating assumptions, conditions, and improvements for the future year operating environments for the alternative access revisions are as follows:

**Opening Year 2020**

**2020 Build 1 SPUI** assumes the following revisions:

- I-5 maintains the existing 8-lane/6-lane configuration between the I-5/ Pacific Avenue Interchange and the Nisqually River Bridge.

- The existing interchange at I-5/Marvin Road is converted to a new SPUI interchange with the NB off-ramp to Marvin Road remains as a two lane off-ramp with exits to NB Marvin Road and to the Quinault Drive/Galaxy Drive roundabout.
- The SB off-ramp to Marvin Road is redesigned as a two-lane off-ramp with ramp connections to:
  - a) Marvin Road.
  - b) A new frontage road between the SB off-ramp and Carpenter Road.
  - c) Hogum Bay Road.
- The SB and NB off-ramps at the I-5/Martin Way Interchange are re-aligned and new SB and NB loop on-ramps are added. A second right-turn lane is added to the SB off-ramp at Martin Way.
- Traffic demand at the I-5 external station at the Pierce County line is limited to the highway capacity (approximately 6,600 vehicles per hour per direction) of the existing 6-lane interstate.
- 2035 land use data with traffic forecasts extrapolated back to 2020.

**2020W Build 1 SPUI** assumes the same revisions as the 2020 Build 1 SPUI alternative with the following revisions:

- I-5 is widened to include an 8-lane cross-section between the I-5 / Pacific Avenue Interchange and the Nisqually River Bridge.
- Traffic demand at the I-5 external station at the Pierce County line is limited to the highway capacity (approximately 8,800 vehicles per hour per direction) of a widened 8-lane I-5.

**2020 Build 1 Diverging Diamond** the same as the 2020 Build 1 SPUI alternative except that the existing I-5/Marvin Road interchange is converted to a new Diverging Diamond Interchange.

**2020W Build 1 Diverging Diamond** is the same as the 2020W Build SPUI alternative except that the existing interchange at I-5/Marvin Road is converted to a new Diverging Diamond Interchange instead of a SPUI.

**2020 Build 2 SPUI** assumes the same revisions as the 2020 Build 1 SPUI alternative with the following revisions:

- A one-way C/D road southbound along the north side of I-5 from north of Marvin Road to the vicinity of Carpenter Road is added with a two-lane off-ramp and a two-lane on-ramp instead of the frontage road.
- The SB Marvin Road on- and off-ramps are connected to the C/D road.
- The SB off-ramp at Marvin Road has a two-lane right-turn lane with one lanes extended along Marvin Road to Hogum Bay Road.

**2020W Build 2 SPUI** assumes the same revisions as the 2020 Build 2 SPUI Road alternative with the following revisions:

- I-5 is widened to include an 8-lane cross-section between the I-5 / Pacific Avenue Interchange and the Nisqually River Bridge.
- Traffic demand at the I-5 external station at the Pierce County line is limited to the highway capacity (approximately 8,800 vehicles per hour per direction) of a widened 8-lane I-5.

### Design Year 2040

**2040W Build 1 SPUI** is the same as the 2020W Build 1 SPUI alternative except that the 2035 land use data with traffic forecasts extrapolated forward to 2040.

**2040W Build 1 Diverging Diamond** is the same as the 2020W Build 1 Diverging Diamond alternative except that the 2035 land use data with traffic forecasts extrapolated forward to 2040.

**2040W Build 2 SPUI** is the same as the 2020W Build 2 SPUI alternative except that the 2035 land use data with traffic forecasts extrapolated forward to 2040.

### WHAT MODEL AND PROCESSES WERE USED TO FORECAST TRAVEL DEMAND FOR THE VARIOUS ACCESS MODIFICATIONS?

The 2009 Travel Demand Model developed by the Thurston Regional Planning Council (TRPC) was used to forecast the baseline travel demand within the study area for the I-5/Martin Way and I-5/Marvin Road Interchange Justification Study. This is the same basic model used in the LTSAAE Study and for the I-5/US 101 Transportation Study. The summary of the forecasting process and procedures is contained in Appendix E.

### WHAT IS THE EXISTING INTERCHANGE SPACING ALONG THE I-5 CORRIDOR WITHIN THE STUDY AREA?

The existing and proposed interchange spacing and configurations, for the Build operating alternatives and the Base Condition alternatives along I-5, are displayed in Figure 3-5 for opening year 2020 and in Figure 3-6 for design year 2040.

The existing spacing between the I-5/Pacific Avenue Interchange and the I-5/Sleater-Kinney Road Interchange and between the I-5/Sleater-Kinney Road Interchange and the I-5/Martin Way Interchange are less than the desirable one mile spacing; while the spacing between the I-5/Martin Way Interchange and the I-5/Marvin Road Interchange and between the I-5/Marvin Road Interchange and the I-5/Nisqually Interchange are each greater than two miles.

The proposed access modifications at the I-5/Martin Way Interchange and the I-5/Marvin Road Interchange will maintain the existing interchange spacing.

### WHAT IS THE EXISTING AND FORECASTED DAILY TRAFFIC ALONG THE I-5 CORRIDOR WITHIN THE STUDY AREA?

The existing and forecasted annual average daily traffic (AADT) volumes for the Base Condition alternatives and the Build alternatives along I-5, are also displayed in Figure 3-5 for opening year 2020 and in Figure 3-6 for design year 2040.

Peak hour traffic projections were developed for the 2020 opening year and 2040 design year alternatives by combining the area demographic forecasts and local highway networks in TRPC's validated Travel Demand Model. A 'K 30 Factor' of 8.34 percent, derived from WSDOT's 2011 Peak Hour Report for the permanent count station R060 located on I-5 south of the I-5/Marvin Road Interchange at MP 111.01, was applied to the PM peak hour volumes to normalize and estimate the AADT volumes.

For the Build configurations at the I-5/Marvin Road Interchange Interstate, traffic volumes are assumed to be the same for both the SPUI configuration and the Diverging Diamond configuration. Only the ramp intersection turning movements at Marvin Road will vary according to the specific configuration.

A review of these AADT volumes in Figures 3-5 and 3-6 shows the following:

- A comparison of the 2020 AADT without widening I-5 for the 2020 Base Condition and 2020 Build 1 alternative shows that the change in traffic on I-5 varies from a decrease of 0.5 percent to an increase of 0.6 percent.
- A comparison of the 2020 AADT with widening I-5 to four lanes in each direction for the 2020W Base Condition and 2020W Build 1 alternative shows that the change in traffic on I-5 varies from a decrease of 0.3 percent to an increase of 0.3 percent.
- A comparison of the 2020 AADT with widening I-5 to four lanes in each direction for the 2020W Base Condition and 2020W Build 2 alternative shows that the change in traffic on I-5 varies from a decrease of 0.2 percent to an increase of 2.5 percent. This change is because there is more convenient access to I-5 from the Hawks Prairie Development area with Build 2 alternative than in the Base Conditions which slightly less demand on Marvin Road and Martin Way.
- A comparison of the 2040W AADT with widening I-5 to four lanes in each direction for the 2040W Base Condition and the 2040W Build 1 alternative shows that the change in traffic on I-5 varies from a decrease of 0.7 percent to an increase of 0.7 percent.
- A comparison of the 2040W AADT with widening I-5 to four lanes in each direction for the 2040W Base Condition and the 2040W Build 2 alternative shows that the change in traffic on I-5 varies from a decrease of 1.0 percent to an increase of 6.2 percent. With the revision of the C/D road connection to I-5, drivers now have more convenient access from the Hawks Prairie Development.

FIGURE 3-5: I-5 Interchange Spacing and 2020 Mainline Traffic Volumes Summary

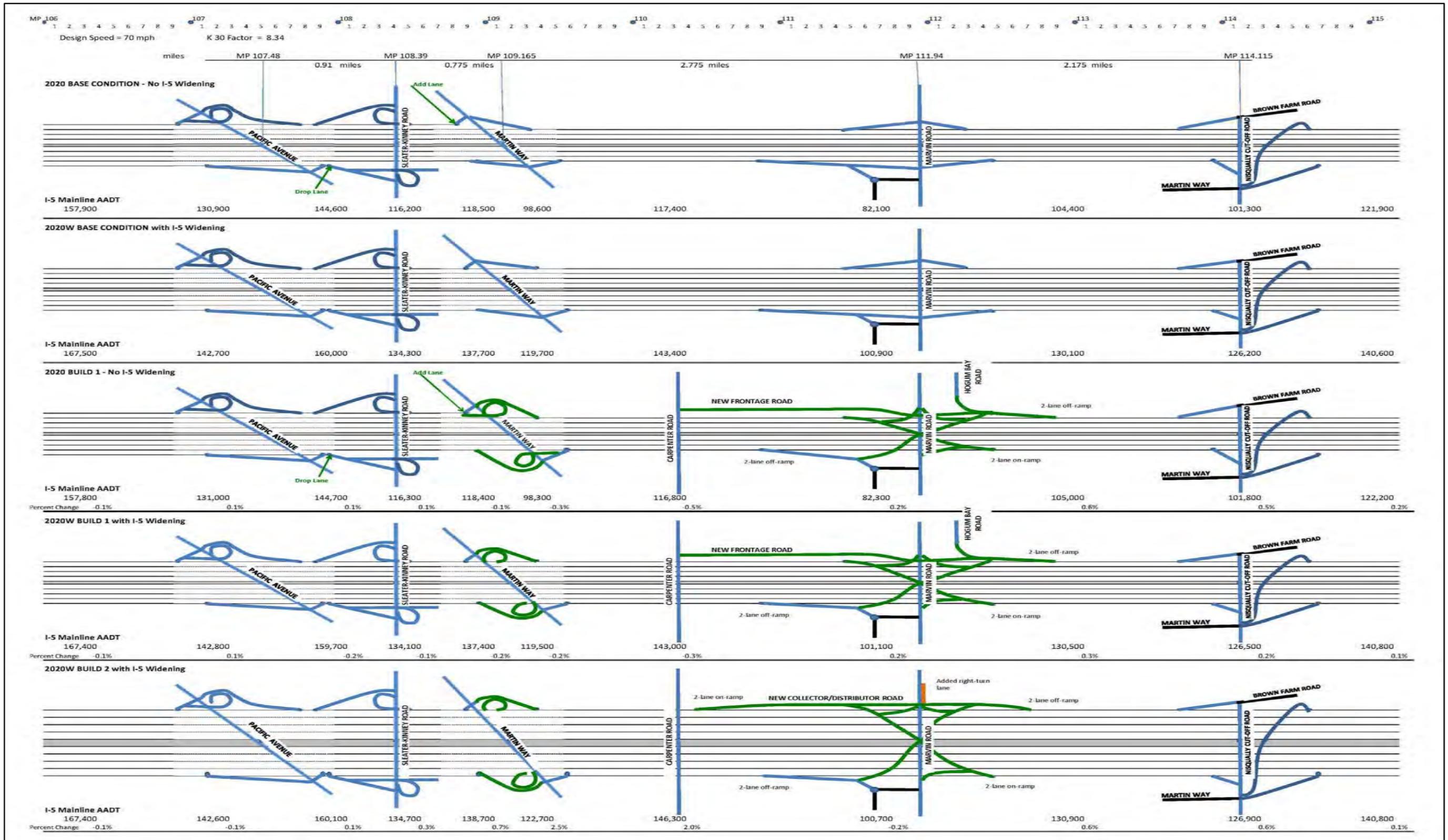
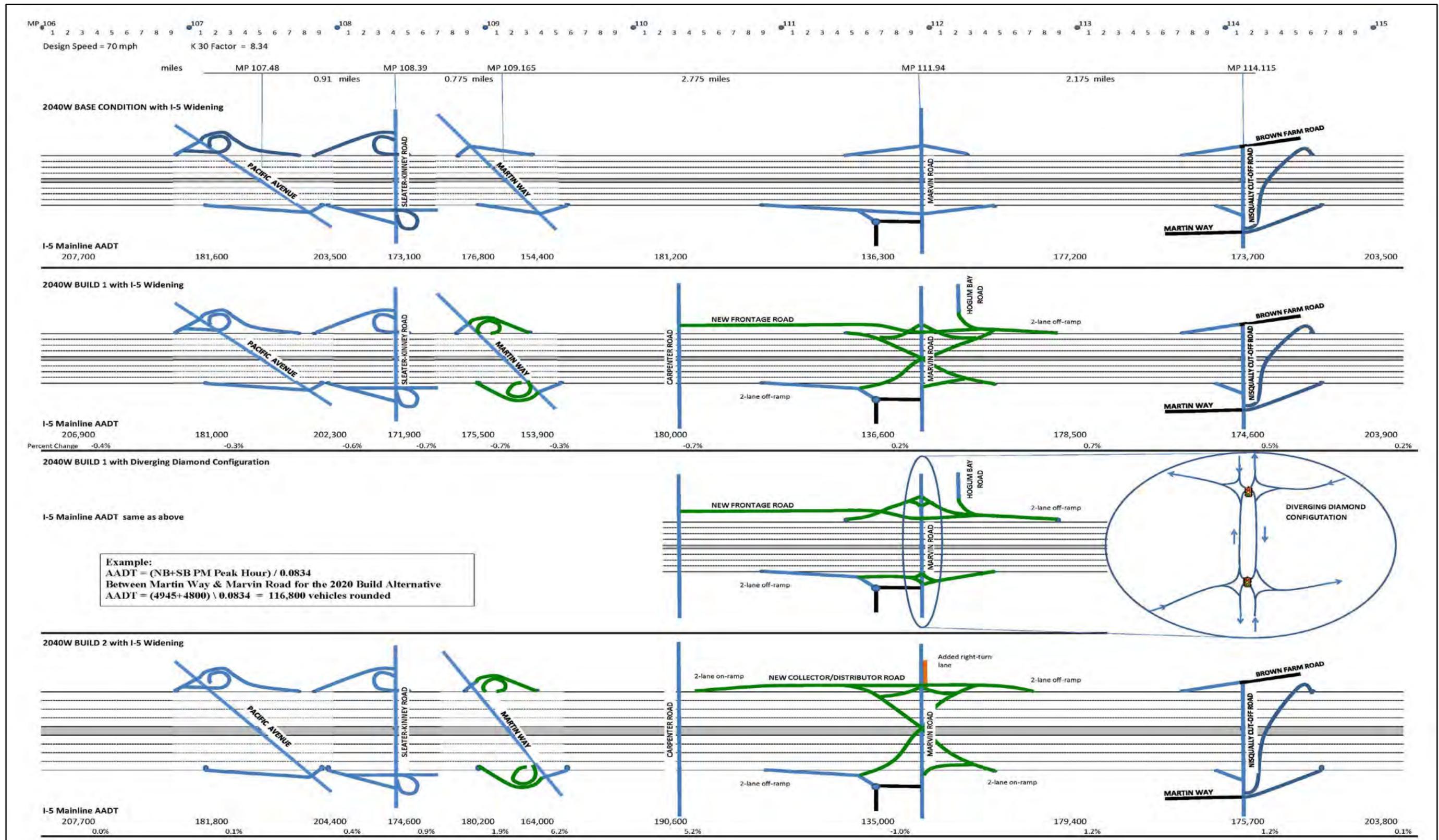


FIGURE 3-6: I-5 Interchange Spacing and 2040 Mainline Traffic Volumes Summary



Build 2 alternative with the C/D road allows access from the Hawks Prairie area, redistributes traffic to I-5, and reduces travel on local streets as well as at the I-5 ramp intersections at Marvin Road, Martin Way, and Sleater-Kinney Road interchanges. By the time traffic reaches the end on the study area at Pacific Avenue and Nisqually, Build 2 traffic volumes are similar to the Base Conditions traffic volumes.

Overall, the Build 2 concept at Marvin Road and the loop ramps at Martin Way will have minimal effect (less than one percent) on the overall I-5 mainline traffic volumes. This is partially because the external trips passing through the Nisqually area is limited to the practical capacity of I-5 (either 6-lane or eight-lane scenarios). Other external trips are not restricted. The small I-5 traffic variations with the interchange modifications do show that there will not be any significant increase in local trip usage on I-5 through the study area.

### **HOW WERE THE INTERSTATE TRAFFIC ANALYSES CONDUCTED?**

Analyses of traffic were conducted using the *2000 Highway Capacity Software* (HCS)<sup>1</sup> for mainline analysis and merge/diverge analysis, which are based on the methodologies and procedures contained in the *2000 Highway Capacity Manual* (HCM). The HCM and HCS use density (number of vehicles per mile per lane) as a measure to estimate level of service. For this IJR, LOS D or better is considered acceptable.

At the I-5/Marvin Road Interchange, both configurations have the same general interstate exits and entrances with the same traffic volumes. As a result, I-5 traffic analyses for the Build conditions with a SPUI or a Diverging Diamond configuration were the same. Traffic analyses were conducted for both the morning (AM) and afternoon (PM) peak hours for the opening year (2020) and design year (2040).

The analyses conducted used HCS for Interstate operations, Synchro for intersections and SimTraffic to verify queue lengths with similar results. As agreed with WSDOT, the VISSIM model for the base conditions and the preferred improvement concepts were developed to confirm interstate operations and ramp lengths for the preliminary design of the proposed improvements.

### **WHAT IS THE IMPACT OF THE ACCESS MODIFICATIONS ON INTERSTATE TRAVEL?**

The interstate LOS, as expressed in density (vehicles per hour per lane) for the 2020 and 2040 Build operating scenarios, is summarized in Figures 3-7 through 3-16. A comparison of the Build alternative analyses with the similar Base Condition analyses (presented in Policy Point 1) shows the following observations. For the I-5 traffic operation analysis, the Build 1 SPUI and Build 1 Diverging Diamond have the same traffic assignment. The difference between the two alternatives is in the intersection operations on Marvin Road.

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<sup>1</sup> As agreed upon in the Methods and Assumptions document, the 2000 HCS was used rather than the 2010 HCS for this study and to be consistent with WSDOT procedures in that WSDOT has retained use of the 2000HCS, pending full training and implementation for the 2010 HCS within the department.

### Opening Year 2020 Summary

**2020 Build 1 Conditions:** By reconfiguring the I-5/Martin Way Interchange and the I-5/Marvin Road Interchange, the interstate LOS remains about the same as it was for the Base Conditions. Only a slight shift in the SB off-ramp to Marvin Road diverge LOS analysis showed a change from LOS E (density of 35.2 pc/hr/ln) to LOS D (density of 34.9 pc/hr/ln) during the PM peak hour. The greatest positive difference is in the reduced queue back-ups at the interchange ramp terminals.

**2020W Build 1 SPUI:** By reconfiguring the I-5 Martin Way Interchange and the I-5/Marvin Road Interchange the interstate LOS remains about the same as it was for the 2040W Base Conditions with only minor density changes.

**2020W Build 2 SPUI:** By reconfiguring the I-5 Martin Way Interchange and the I-5/Marvin Road Interchange, the interstate LOS remains about the same as it was for the 2040W Base Conditions with only minor density changes.

### Design Year 2040 Summary

**2040W Build 1:** By reconfiguring the interchanges at Martin Way Interchange to a partial cloverleaf and Marvin Road Interchange to a SPUI with a frontage road, the AM peak hour LOS remains similar to the 2040W Base Condition with I-5 Widening with minor changes in density noted.

During the 2040 PM Peak Hour, LOS changes occur in the following areas from the 2040W Base Condition:

- SB Off-ramp - Marvin Road Interchange (Diverge) from LOS F (>36) to LOS C (21.9)
- SB On-ramp - Marvin Road Interchange (Merge) from LOS E (35.4) to LOS D (34.3)
- SB mainline - Marvin Road to Martin Way from LOS E (35.1) to LOS D (34.0)
- SB On-ramp - Martin Way Interchange (Merge) from LOS E (35.3) to LOS D (34.7)
- NB On-ramp - Marvin Road (Merge) from LOS D (34.8) to LOS E (35.1)

Queue lengths were reduced along the off-ramps as noted below:

- SB Martin Way off-ramps from 1,711 feet to 426 feet.
- SB Marvin Road off-ramp from 1,022 feet to 267 feet
- NB Marvin Road off-ramp from 1,388 feet to 987 feet

These queue lengths are developed for the SPUI concept using SimTraffic data. A comparison of the queue length differences between the SPUI and the Diverging Diamond interchange concepts are presented within figure 3-18.

FIGURE 3-7: 2020 Build 1 Alternative – AM Peak Hour Volumes, LOS & Densities (No I-5 Widening)

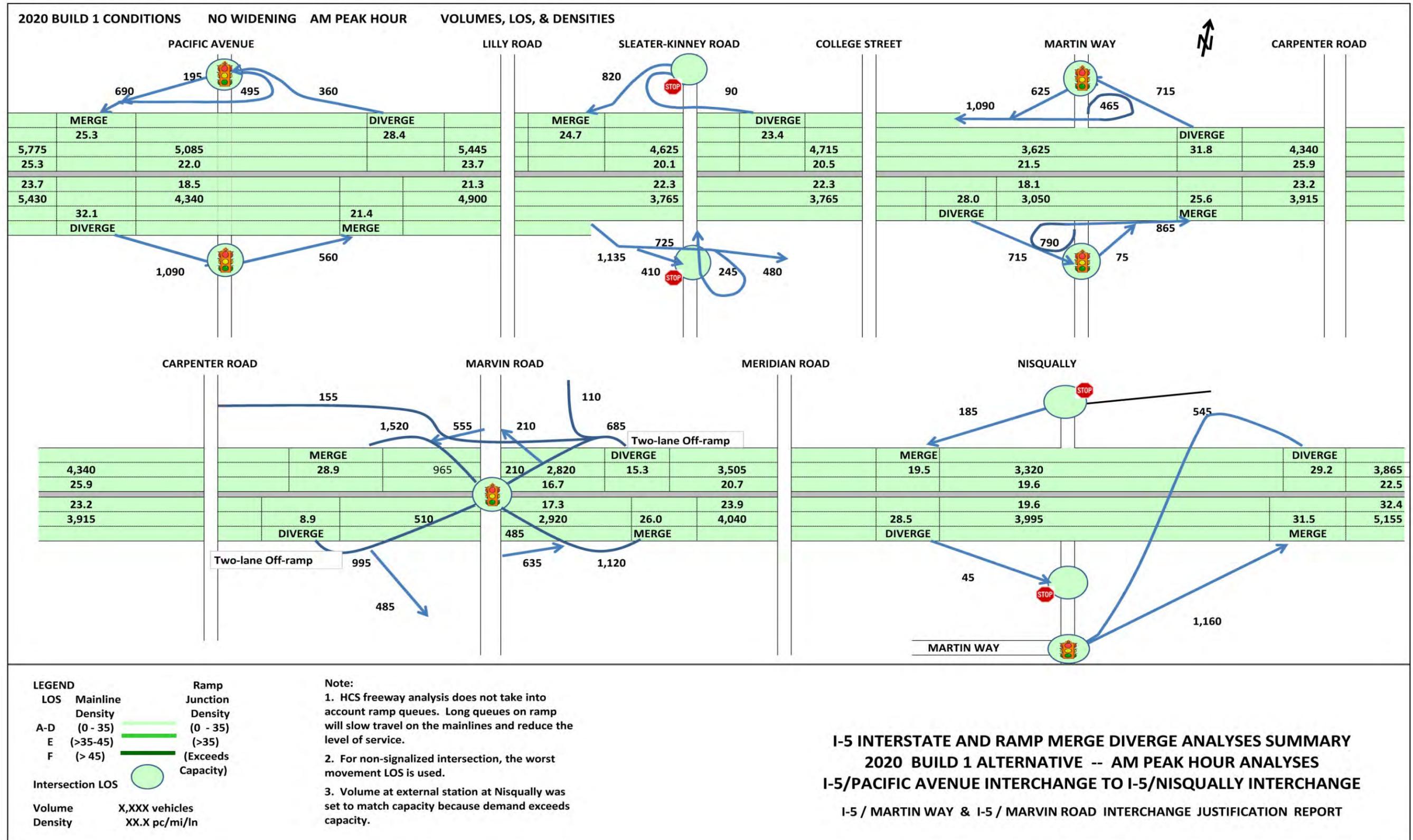


FIGURE 3-8: 2020 Build 1 Alternative – PM Peak Hour Volumes, LOS & Densities (No I-5 Widening)

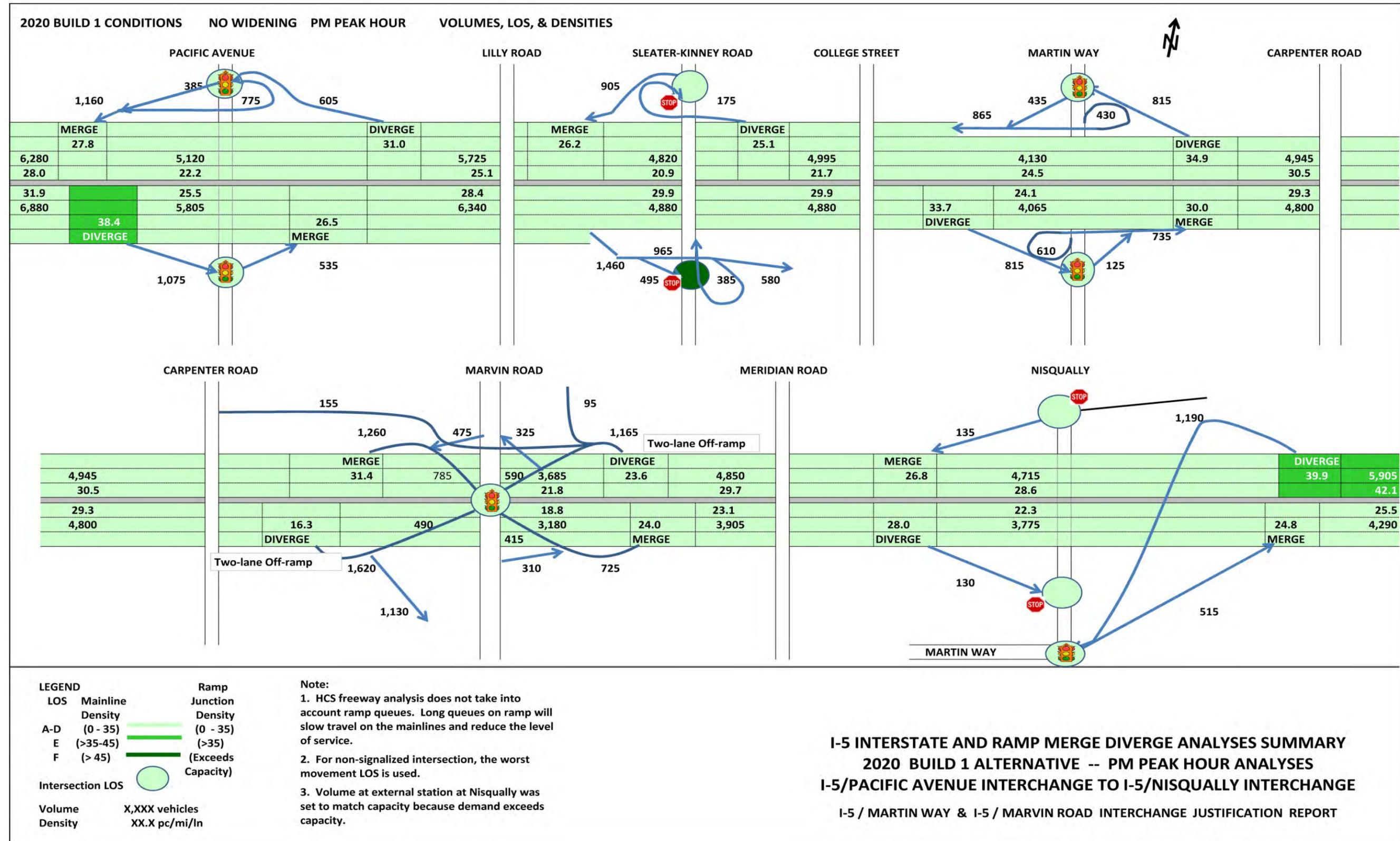


FIGURE 3-9: 2020W Build 1 Alternative – AM Peak Hour Volumes, LOS & Densities (with I-5 Widening)

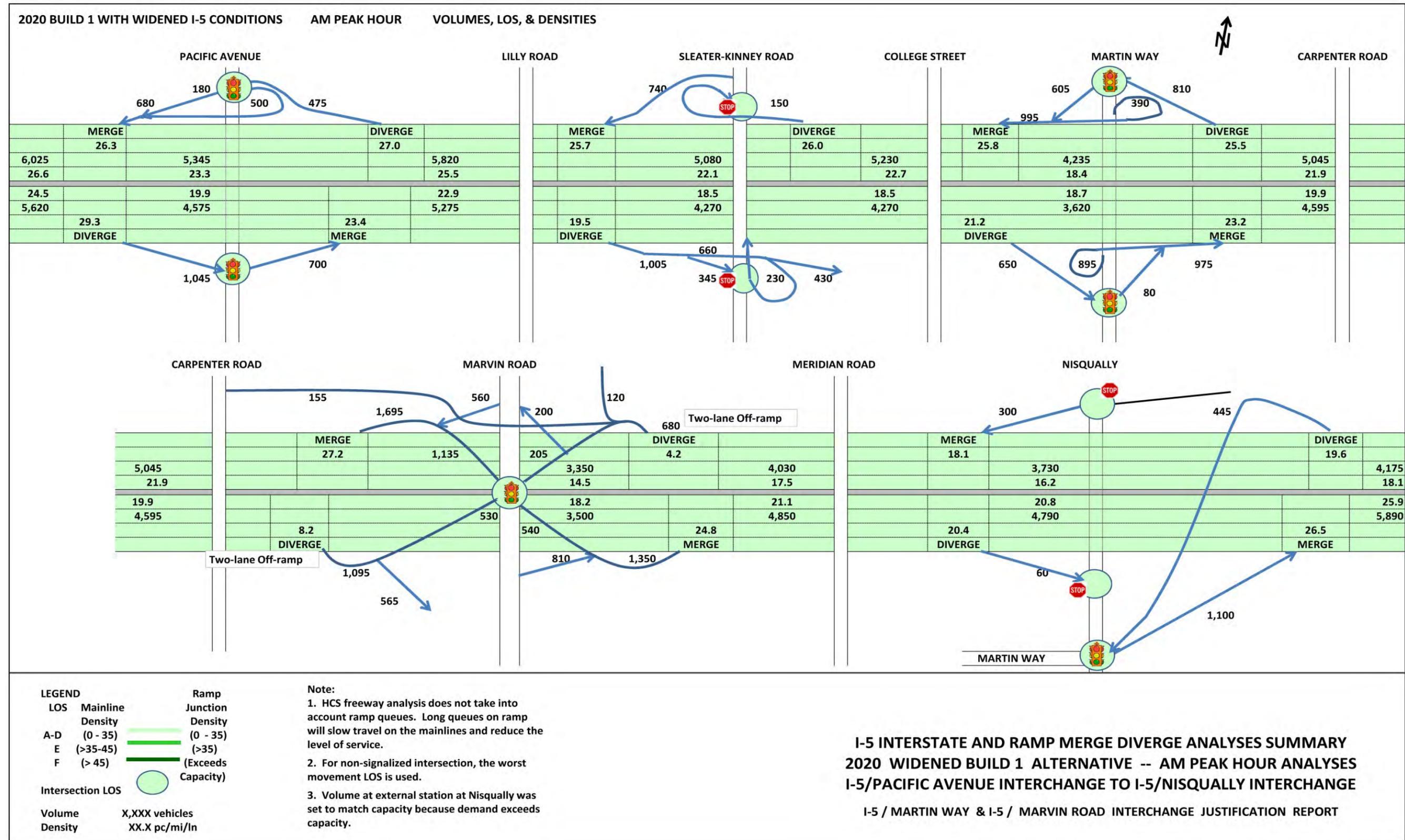


FIGURE 3-10: 2020W Build 1 Alternative – PM Peak Hour Volumes, LOS & Densities (with I-5 Widening)

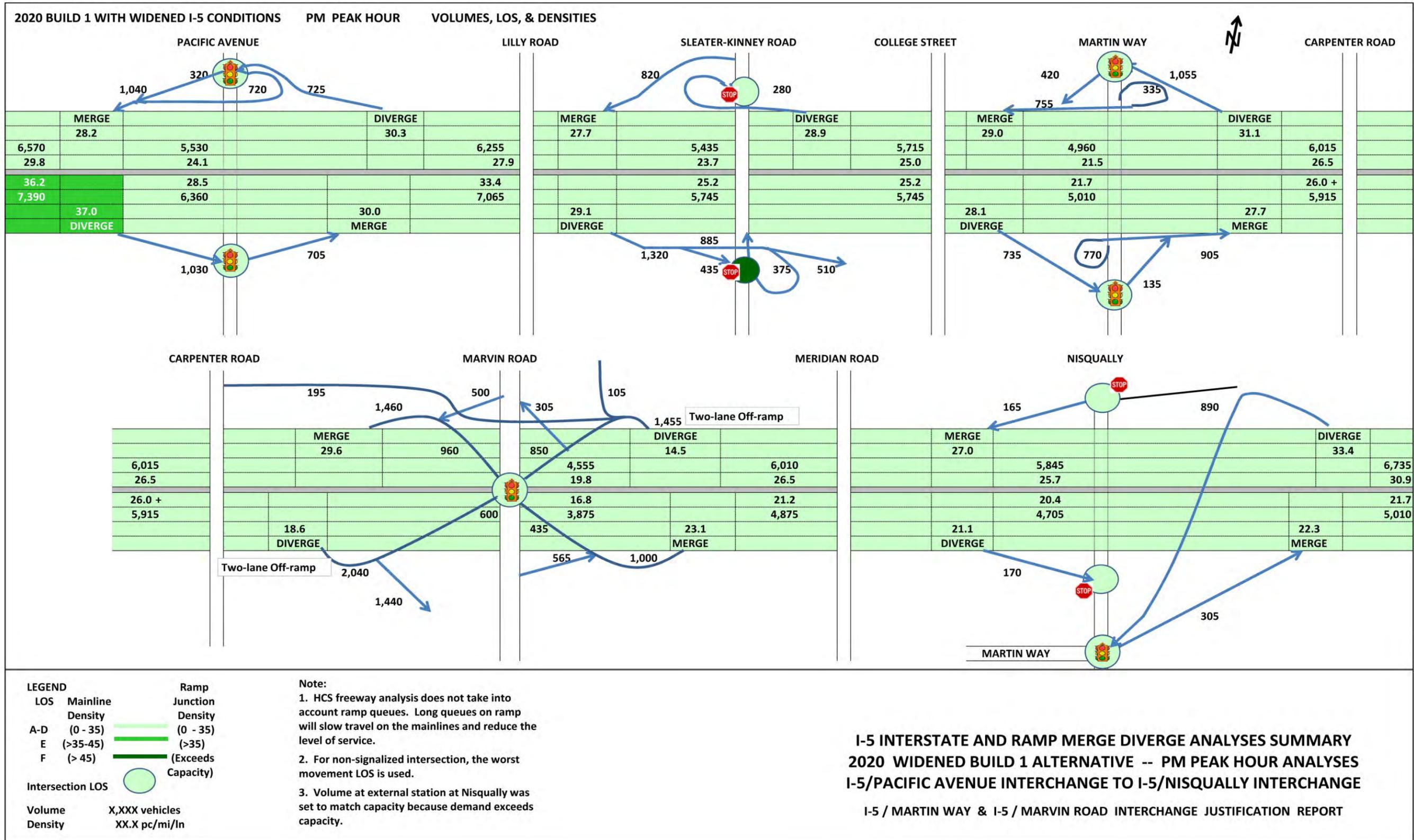


FIGURE 3-11: 2020W Build 2 Alternative – AM Peak Hour Volumes, LOS & Densities (with I-5 Widening)

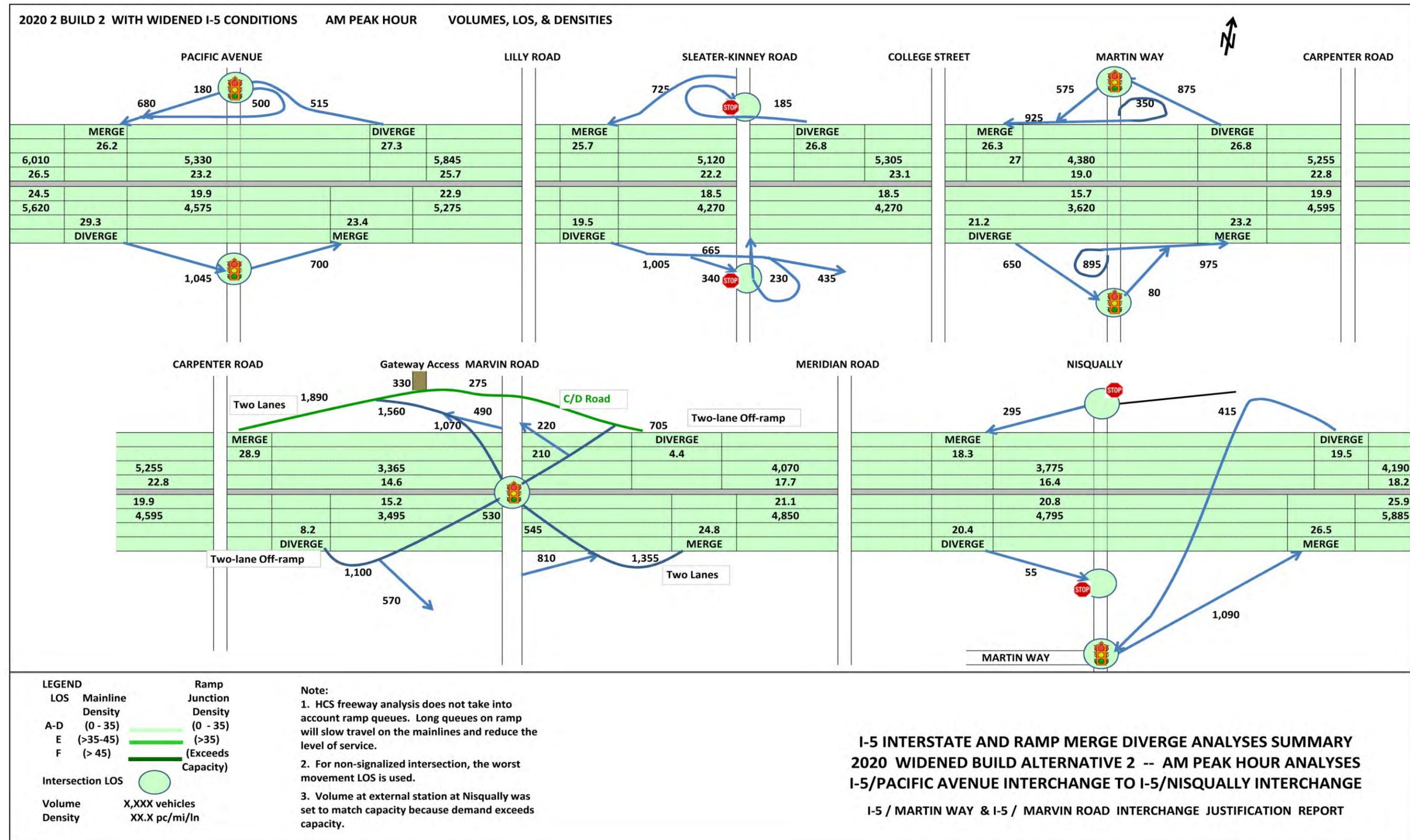


FIGURE 3-12: 2020W Build 2 Alternative – PM Peak Hour Volumes, LOS & Densities (with I-5 Widening)

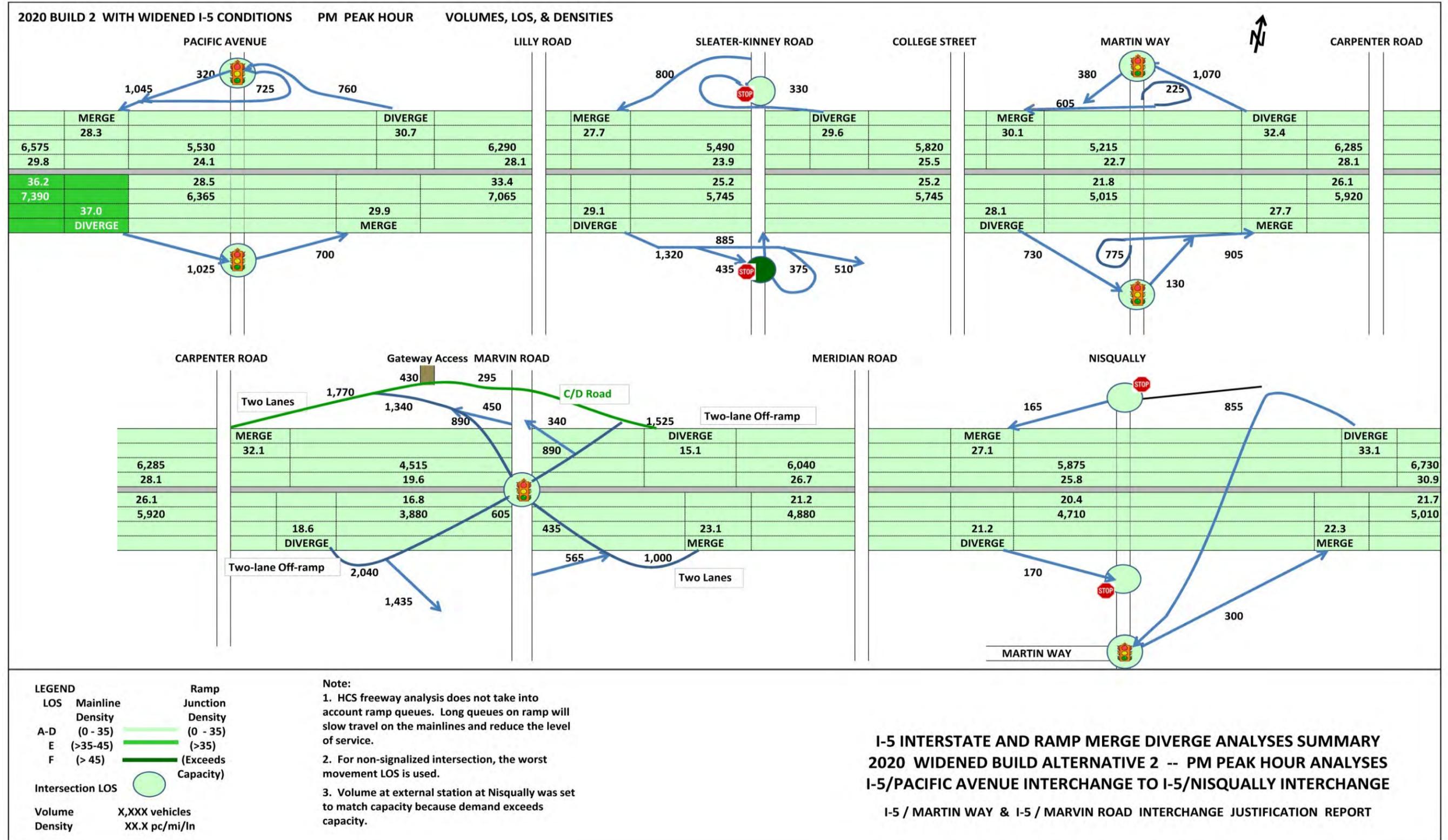


FIGURE 3-13: 2040W Build 1 Alternative – AM Peak Hour Volumes, LOS & Densities (with I-5 Widening)

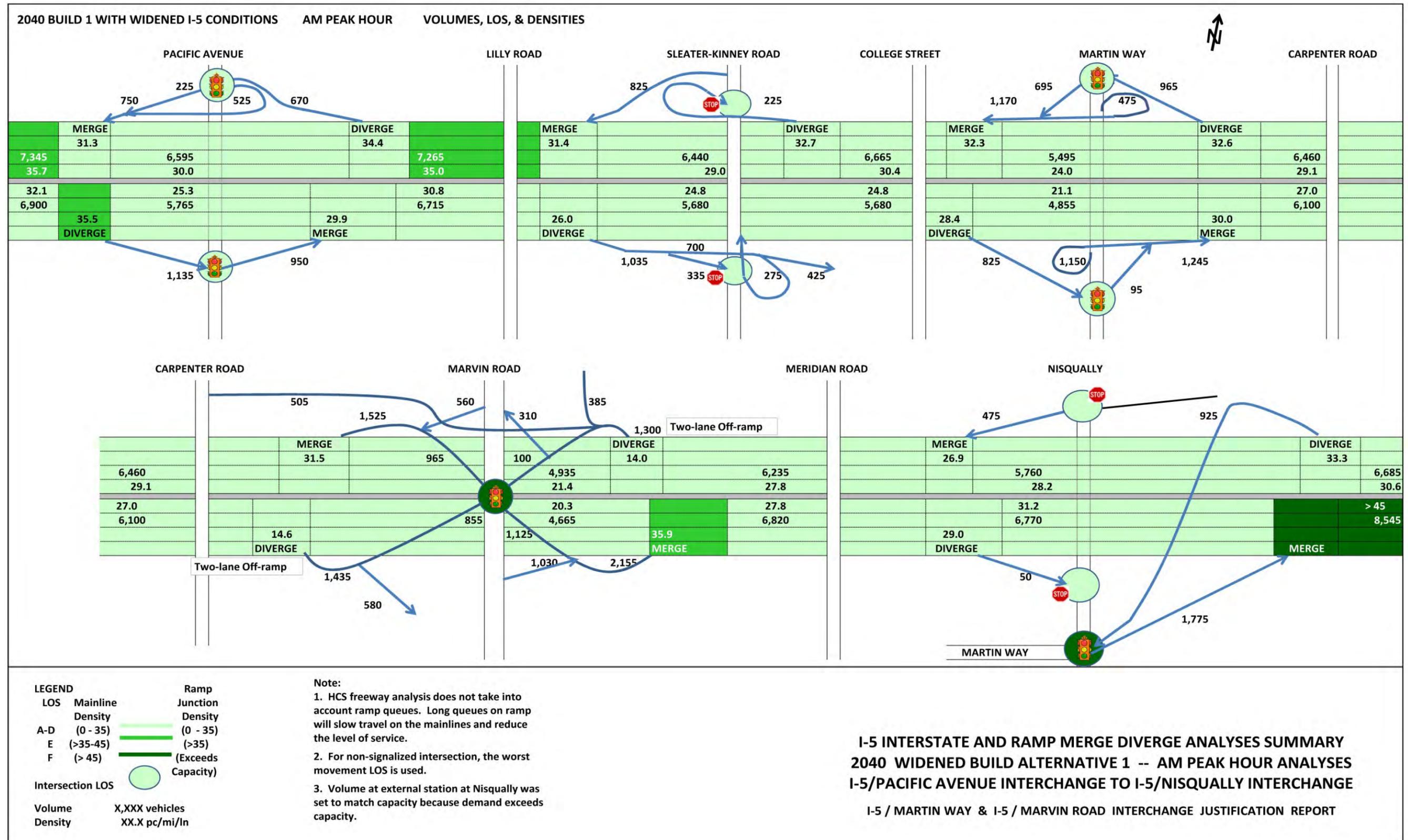


FIGURE 3-14: 2040W Build 1 Alternative – PM Peak Hour Volumes, LOS & Densities (with I-5 Widening)

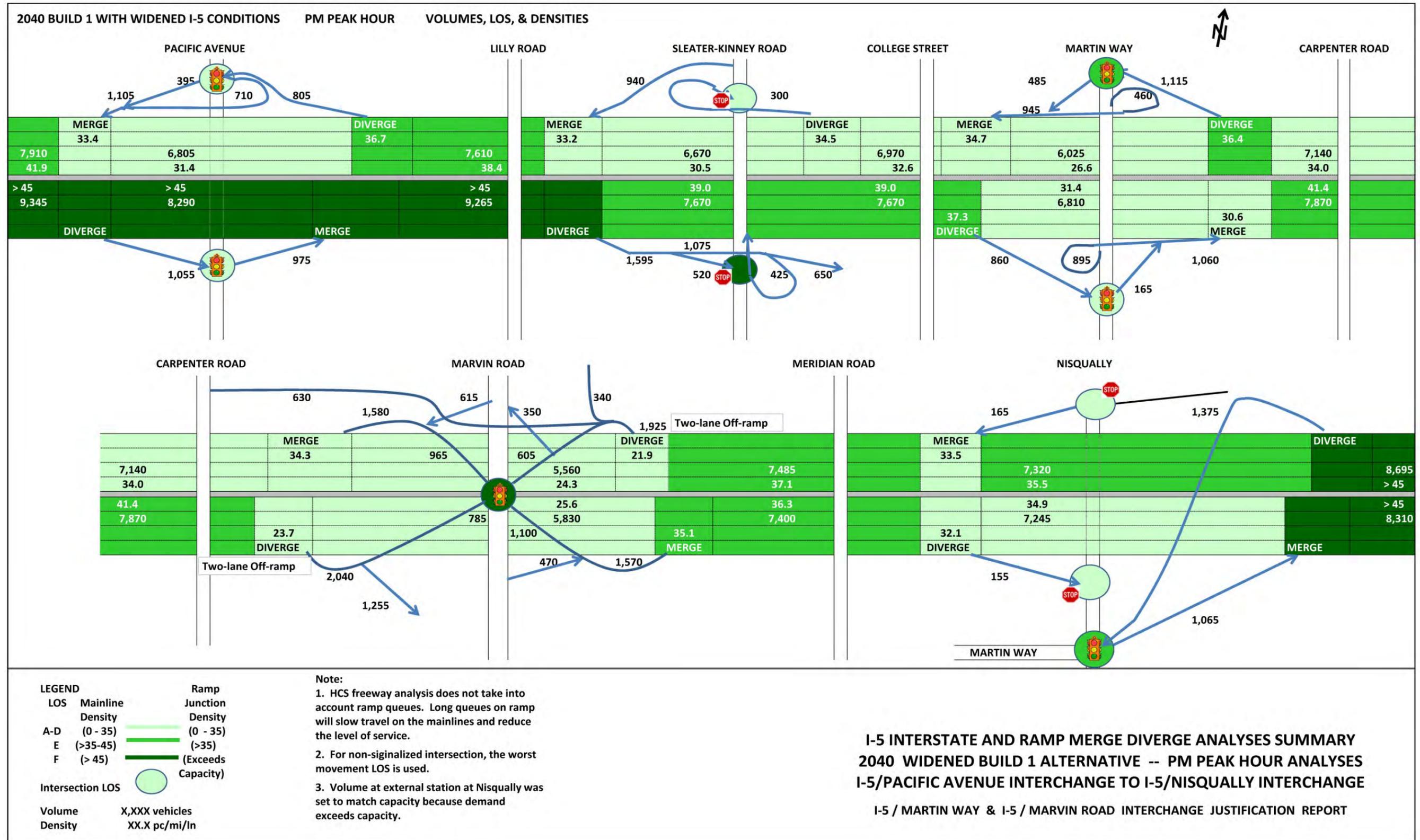


FIGURE 3-15: 2040W Build 2 Alternative – AM Peak Hour Volumes, LOS & Densities (with I-5 Widening)

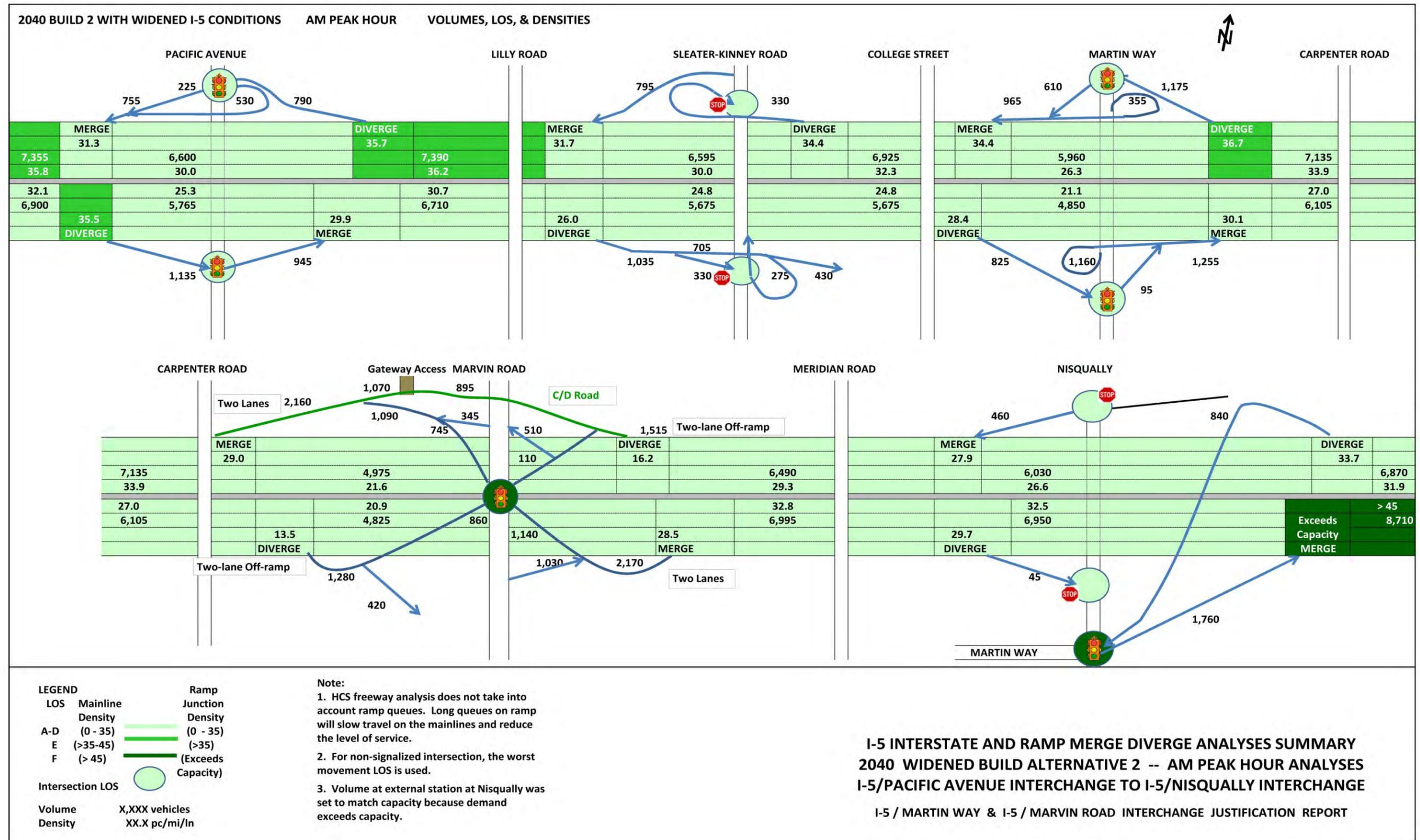
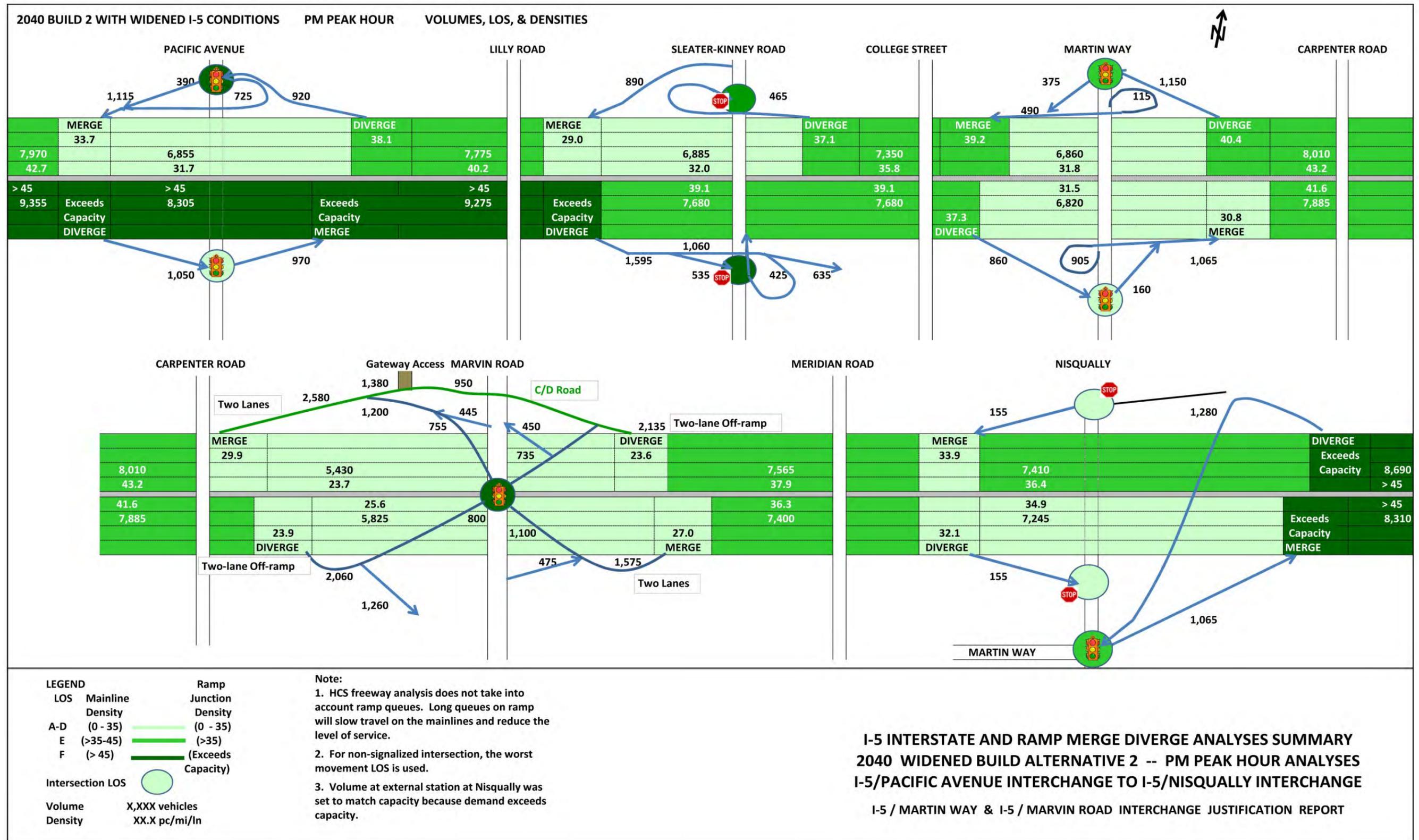


FIGURE 3-16: 2040W Build 2 Alternative – PM Peak Hour Volumes, LOS & Densities (with I-5 Widening)

23



**2040W Build 2:** By reconfiguring the interchanges at Martin Way Interchange to a partial cloverleaf and Marvin Road Interchange to a SPUI with a C/D road, the AM peak hour LOS remains similar to the 2040W Base Condition with I-5 widening with the following changes:

- SB Off-ramp - Martin Way Interchange (Diverge) from LOS D (33.6) to LOS E (36.7)
- SB On-ramp - Pacific Avenue Interchange (Merge) from LOS D (34.7) to LOS E (35.7)
- NB On-ramp - Marvin Road Interchange (Merge) from LOS E (36.2) to LOS D (28.5)

During the 2040 PM Peak Hour, LOS changes occur in the following areas from the 2040W Base Condition:

- SB Off-ramp at the Marvin Road Interchange (Diverge) from LOS F to LOS C
- SB On-ramp at the Marvin Road Interchange (Merge) from LOS E to LOS D
- SB mainline operations Marvin Road to Martin Way from LOS E to LOS D
- SB On-ramp at the Martin Way Interchange (Merge) from LOS E to LOS D
- NB On-ramp at the Marvin Road (Merge) from LOS D to LOS E

Queue lengths are reduced along the off-ramps as noted below:

- SB Martin Way off-ramps from 1,711 feet to 389 feet.
- SB Marvin Road off-ramp from 1,022 feet to 541 feet
- NB Marvin Road off-ramp from 1,388 feet to 974 feet

Overall, changes to the mainline volumes and LOS are minor with the greatest improvement to the queue back-ups on to the I-5 mainline as discussed below. It is important to note that the above HCM merge/diverge analysis does not consider the queue back-up from the cross street intersections. Long back-ups on the off-ramps will cause some of the traffic to queue onto the I-5 mainline travel lane or shoulder. This will cause traffic to slowdown or stop completely in some lanes and along shoulders. The new ramps are designed to meet current standards and allow sufficient ramp length for drivers to stop behind the expected queues without having to slow down on I-5. These ramps lengths were confirmed by analyzing the proposed improvements using VISSIM software.

### WHAT WERE THE RESULTS OF THE VISSIM ANALYSIS?

The future traffic analyses were completed using *VISSIM* (Version 5.40) micro-simulation modeling software. Analysis was conducted along I-5 from south of Pacific Avenue to north of Nisqually Cut Off Road and included ramp terminals along this segment. The recommended alternative was modeled for design year (2040) traffic conditions. Additionally, a no-build alternative with widening of the I-5 corridor to 4 lanes was also modeled for comparison with the recommended alternative. For both the No-

Build and Recommended Alternatives, ramp meters were assumed at all on-ramps throughout the corridor.

Each alternative was simulated eleven times for both the AM and PM peak periods using random seed numbers 1 through 11. The AM and PM models simulate traffic conditions from 5 AM to 9 AM and from 2 PM to 6 PM, respectively. The Measures of Effectiveness (MOEs) for each alternative were then calculated by averaging the results for the eleven model runs. Segment performance for the controlled access mainline was evaluated using volumes, speeds and densities. Intersection operations were evaluated using volumes, queuing and control delays. For comparative purposes, the intersection control delays were assigned LOS values based on the criteria established in the 2010 Highway Capacity Manual.

Key portions of the analysis for each alternative are discussed below. For fully detailed result summaries, please see Appendix N.

### **Overall Network**

On a network wide basis, the 2040 No-Build models have traffic deficiencies which result in a large portion of the traffic not being processed over the course of the 4-hour model runs. Only 73% of vehicles are processed by the model during the AM peak period and approximately 84.8% are processed over the PM peak period. The improvements in recommended alternative solve many of the issues present in the 2040 No-Build network.

With the recommended improvements at the Martin Way and Marvin Road interchanges, the 2040 models are able to process the majority of the demand volumes. The recommended alternative processes 95.5% of the demand during the AM peak period and 96.7% of the demand during the PM peak period.

### **Analysis Results**

As shown in **Table 3-1**, the recommended alternative provides improved level-of-service at both interchanges.

Table 3-1. Peak Hour Traffic Analysis Results

Alternative	Intersection		Approach	AM Peak Hour		PM Peak Hour	
				Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
2040 No-Build	Martin Way / I-5 Interchange	SB Ramps (Signalized)	EB Arterial	208	F	129	F
			WB Arterial	59	E	77	E
			Off-Ramp	38	D	27	C
			<b>Overall Intersection</b>	<b>126</b>	<b>F</b>	<b>91</b>	<b>F</b>
		NB Ramps (Signalized)	EB Arterial	112	F	66	E
			WB Arterial	151	F	147	F
			Off-Ramp	6	A	3	A
			<b>Overall Intersection</b>	<b>98</b>	<b>F</b>	<b>83</b>	<b>F</b>
	Marvin Road / I-5 Interchange	SB Ramps (Signalized)	NB Arterial	48	D	51	D
			SB Arterial	0	A	76	E
			Off-Ramp (WB Appr)	12	B	83	F
			<b>Overall Intersection</b>	<b>48</b>	<b>D</b>	<b>69</b>	<b>E</b>
		NB Ramps (Signalized)	NB Arterial	69	E	84	F
			SB Arterial	0	A	40	D
			Off-Ramp (EB Appr)	60	E	409	F
			<b>Overall Intersection</b>	<b>66</b>	<b>E</b>	<b>103</b>	<b>F</b>
2040 Recommended	Martin Way / I-5 Interchange	SB Ramps (Signalized)	EB Arterial	16	B	16	B
			WB Arterial	11	B	11	B
			Off-Ramp	37	D	41	D
			<b>Overall Intersection</b>	<b>20</b>	<b>C</b>	<b>21</b>	<b>C</b>
		NB Ramps (Signalized)	EB Arterial	6	A	4	A
			WB Arterial	2	A	1	A
			Off-Ramp	4	A	2	A
	<b>Overall Intersection</b>		<b>3</b>	<b>A</b>	<b>2</b>	<b>A</b>	
	Marvin Road / I-5 Interchange	SPUI (Signalized)	NB Ramp (EB Appr)	79	E	62	E
			SB Ramp (WB Appr)	44	D	55	E
			NB Arterial	80	F*	68	E*
			SB Arterial	114	F*	86	F*
			<b>Overall Intersection</b>	<b>88</b>	<b>F</b>	<b>72</b>	<b>E</b>

\*Note the level of service for the intersection of F is driven by the North/South movement of traffic on Marvin Rd.

**WHAT IS THE IMPACT OF THE BUILD ALTERNATIVES ON THE QUEUE BACKUPS ON THE OFF-RAMPS AT THE MARTIN WAY AND MARVIN ROAD INTERCHANGES?**

Figures 3-17 and 3-18 illustrate the impacts associated with the length of queue backups from the off-ramp intersections to the ramp gore at Martin Way and Marvin Road, respectively.

**FIGURE 3-17: I-5 Off-ramp Queues at Martin Way Interchange**

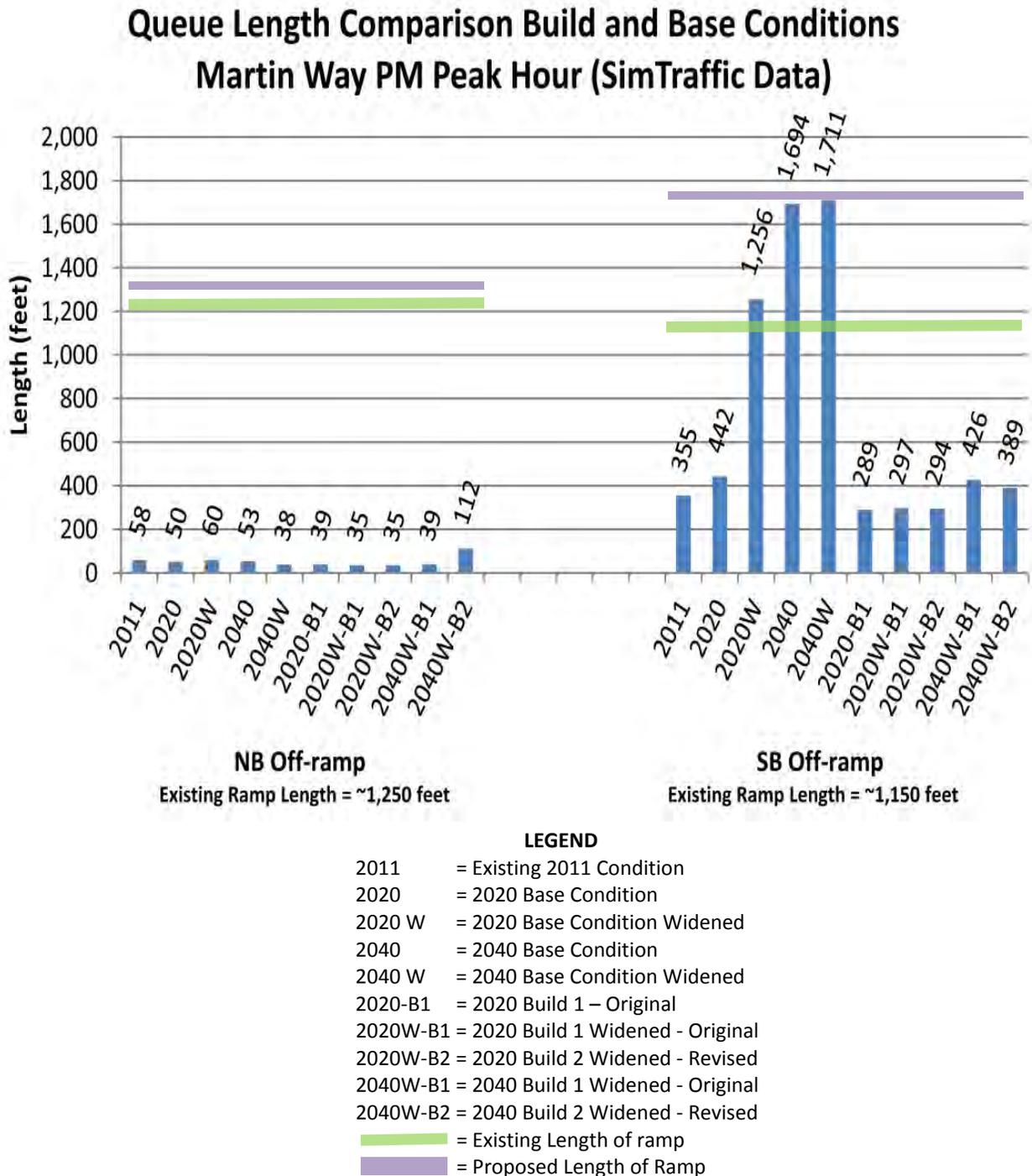
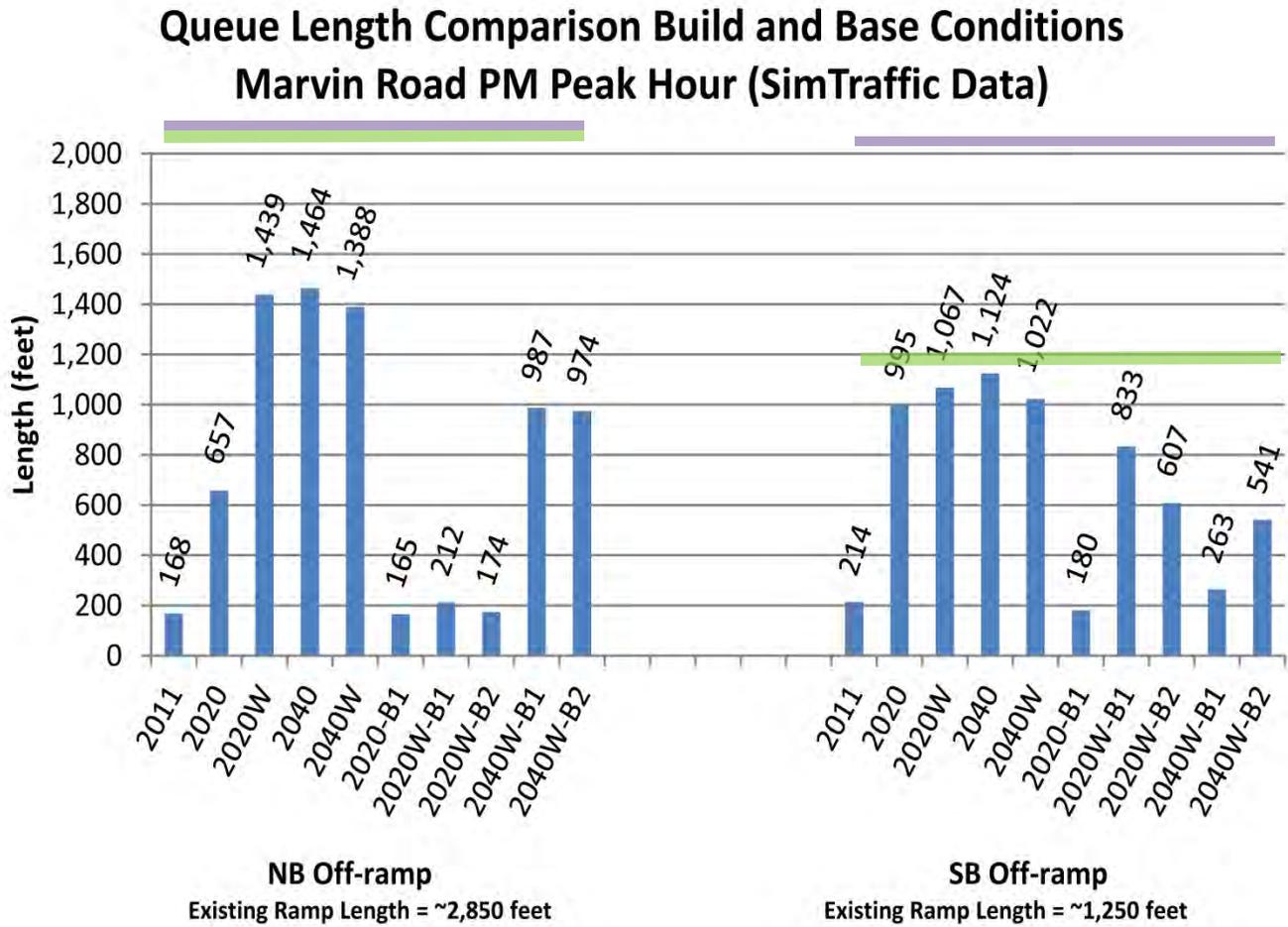


FIGURE 3-18: I-5 Off-ramp Queues at Marvin Road Interchange



**LEGEND**

- 2011 = Existing 2011 Condition
- 2020 = 2020 Base Condition
- 2020 W = 2020 Base Condition Widened
- 2040 = 2040 Base Condition
- 2040 W = 2040 Base Condition Widened
- 2020-B1 = 2020 Build 1 – Original
- 2020W-B1 = 2020 Build 1 Widened - Original
- 2020W-B2 = 2020 Build 2 Widened - Revised
- 2040W-B1 = 2040 Build 1 Widened - Original
- 2040W-B2 = 2040 Build 2 Widened - Revised
- █ = Existing Length of ramp
- █ = Proposed Length of Ramp

For Martin Way, queues on the SB, single lane, off-ramp are greatly reduced with the addition of a double right-turn lane and do not extend onto the I-5 mainline, a very positive outcome. This ramp will be slightly extended to provide stopping distance at the back of the queue without having to slow down on I-5. This improvement minimizes slowdowns on the I-5 mainline lanes and will decrease collisions, especially rear-end collisions. This reduction of the queue length at the SB Martin Way off-ramp results from removal of the left-turning traffic onto I-5 from the intersection operation and the addition of a second right-turn lane on the SB off-ramp.

The expected queue lengths with the Build alternatives using the existing NB, two-lane, off-ramp at Marvin Road will be improved. At the SB off-ramp, the queue lengths will be reduced and backups will not extend onto the C/D road or the I-5 mainline.

The queue length reduction at the SB Marvin Road off-ramp is because a two-lane C/D road off-ramp is provided, and the reconfiguration of the interchange into a SPUI for more efficient operations. These queue length reductions are expected to improve safety by minimizing the number of rear-end collisions.

In summary, the reconfiguration of the Martin Way and Marvin Road interchanges is expected to improve I-5 mainline operations by reducing the queue lengths on the off-ramps, thus reducing slowdowns on the I-5 mainline lanes. The final ramp lengths are designed to include sufficient length for drivers to slow down on the ramps to stop at back of queues confirmed by the VISSIM simulations completed.

### **WHAT EFFECT WILL THE BUILD ALTERNATIVES HAVE ON THE TRIP DISTRIBUTION ALONG I-5 BETWEEN THE OLYMPIA EXIT 105 AND THE THURSTON COUNTY/PIERCE COUNTY LINE?**

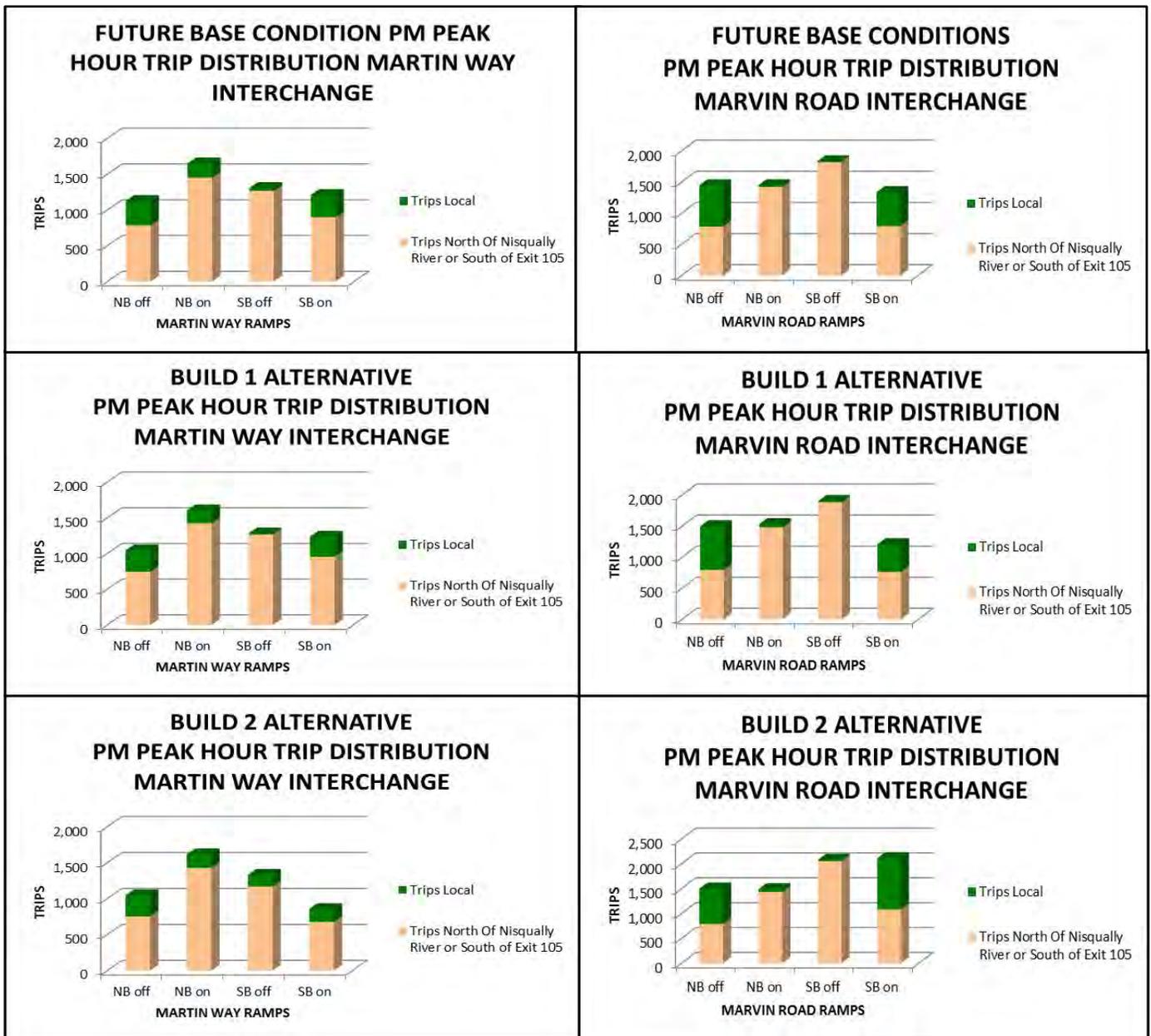
Selected link analyses were used to estimate the number of trips using the Martin Way and Marvin Road on- and off-ramps with the revised Martin Way and Marvin Road interchange concepts during the 2040 PM peak hour. The number of I-5 trips from outside the local Olympia/Lacey area was estimated by comparing the volumes on the Martin Way and Marvin Road ramps with the selected link volumes on I-5 south of Exit 105, State Capital/Port of Olympia, and north of Exit 114, Nisqually. For local area trips, the number of trips was estimated by comparing the selected link volumes on the Martin Way and Marvin Road ramps with the volumes that also used the other area ramps.

Table 3-2 and Figure 3-19 show that for the Future Base Conditions 81 percent of the trips using the Martin Way Interchange ramps and the Marvin Road Interchange ramps either started or ended south of Exit 105 or north of Nisqually River with only 19 percent of these trips using other area ramps for local trips. For the Build 1 alternatives, the percent of trips from outside the area slightly increased whereas, for the Build 2 alternative, the percentage of trips slightly decreased.

**TABLE 3-2: Percentage of Trips to or from Outside the Lacey/Olympia Area (South of Exit 105 or North of the Nisqually River)**

ALTERNATIVES	MARTIN WAY		MARVIN ROAD		TOTAL
	NB RAMPS	SB RAMPS	NB RAMPS	SB RAMPS	
<b>FUTURE BASE CONDITION</b>	80%	86%	76%	82%	<b>81%</b>
<b>BUILD 1</b>	82%	88%	75%	85%	<b>82%</b>
<b>BUILD 2</b>	82%	84%	75%	75%	<b>78%</b>

**FIGURE 3-19: Distribution of Trips using the I-5 Ramps at Martin Way and Marvin Road**



This information indicates that a high percent of the trips are from outside the Lacey/Olympia area that use the I-5 Martin Way and I-5 Marvin Road interchanges (that is south of Exit 105 or north of Exit 114). Conversely, the number of short trips using these interchanges is relatively low (19% to 22%), especially when compared to the Mount Vernon/ Burlington area where the number of short trips using I-5 is over 40 percent.

### **HOW WAS THE ANALYSES CONDUCTED FOR THE RAMP TERMINAL INTERSECTIONS?**

Ramp intersections at various cross street locations were analyzed using Synchro software (version 7) for signalized and non-signalized intersections, and Sidra software (version 5.1) for roundabouts. SimTraffic was used to verify queue lengths at the intersections. These software packages correspond to the 2000 HCM procedures and were used to analyze the intersection LOS and vehicle queuing conditions. The ramp lengths were verified using VISSIM software.

### **WHAT WERE THE INTERSECTION ANALYSES FINDINGS?**

Summaries of the No-Build and Build conditions at the I-5 ramp junction intersection analyses for various optional interchange configurations at Martin Way and Marvin Road interchanges are presented in Figure 3-20 for AM delays and in Figure 3-21 for PM delays.

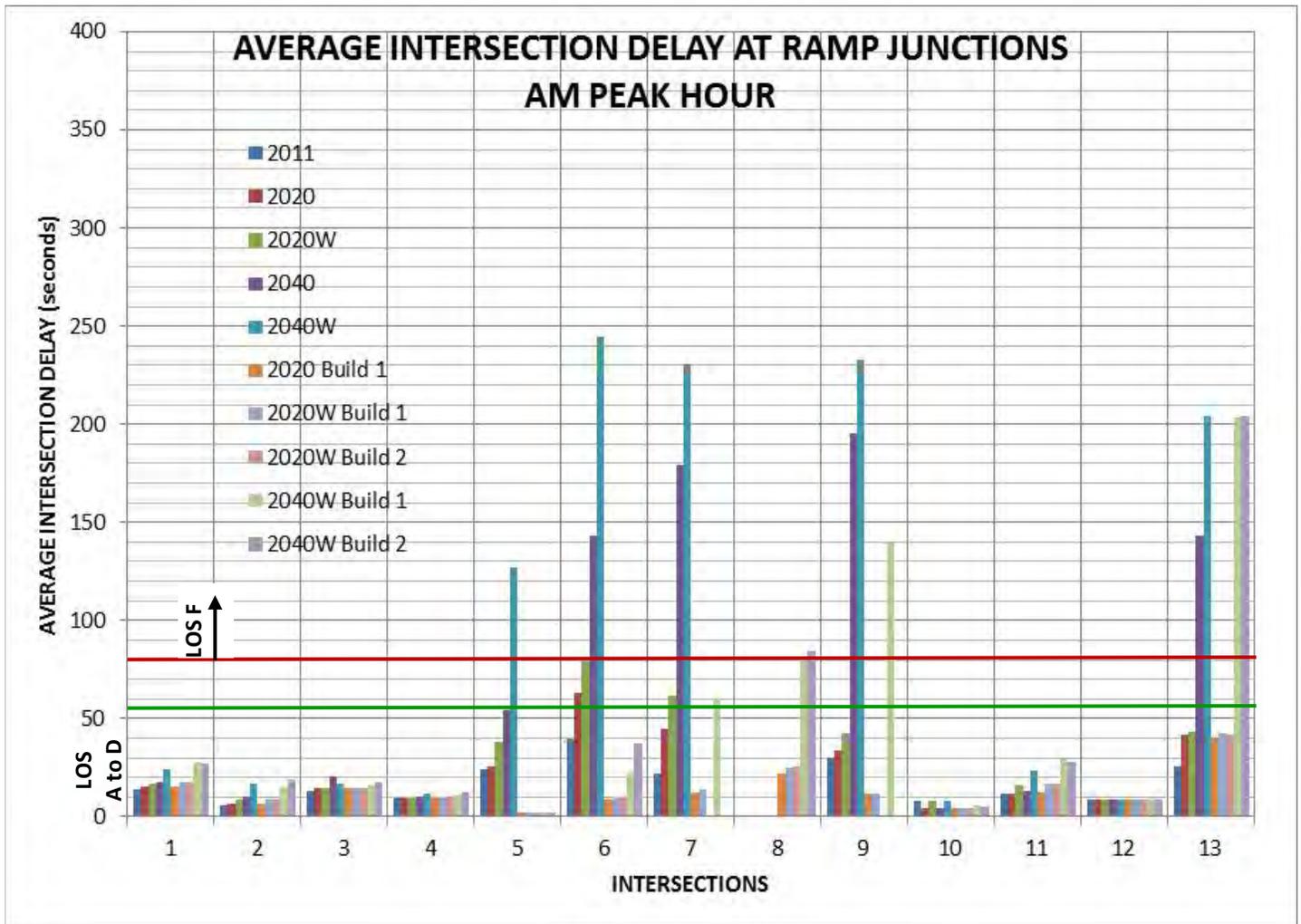
Ramp junction intersections at the adjacent Pacific Avenue, Sleater-Kinney Road, and Nisqually interchanges will not be adversely affected by the reconfiguration of the Martin Way and Marvin Road interchanges. At these adjacent interchanges, the average delay is expected to be roughly the same with the following differences in the 2040 design year:

- At the Pacific Avenue ramp junctions, the average intersection delay change ranges from a 12 second reduction to an increase of 9 seconds.
- At the Sleater-Kinney Road ramp junctions, the worst approach delay change ranges from a decrease of 73 seconds to an increase of 28 seconds.
- At the Nisqually Interchange ramp junctions, the intersection delay change ranges from a decrease of 12 seconds to an increase of 4 seconds.

At the Martin Way and Marvin Road interchanges the average intersection delay is significantly improved. A detailed summary of the LOS, average delay, and queue lengths for the Martin Way and Marvin Road interchanges are shown on Tables 3-3 and 3-4, respectively. The symbols on these tables refer to the following:

- # = 95<sup>th</sup> percentile volume exceeds capacity, queue may be longer
- m = Volume for 95<sup>th</sup> percentile queue is metered by upstream signal
- \* = Queue length exceed distance to upstream intersection
- Red = level of service worse than LOS D.

FIGURE 3-20: Summary of the AM Peak Hour Intersection Analyses



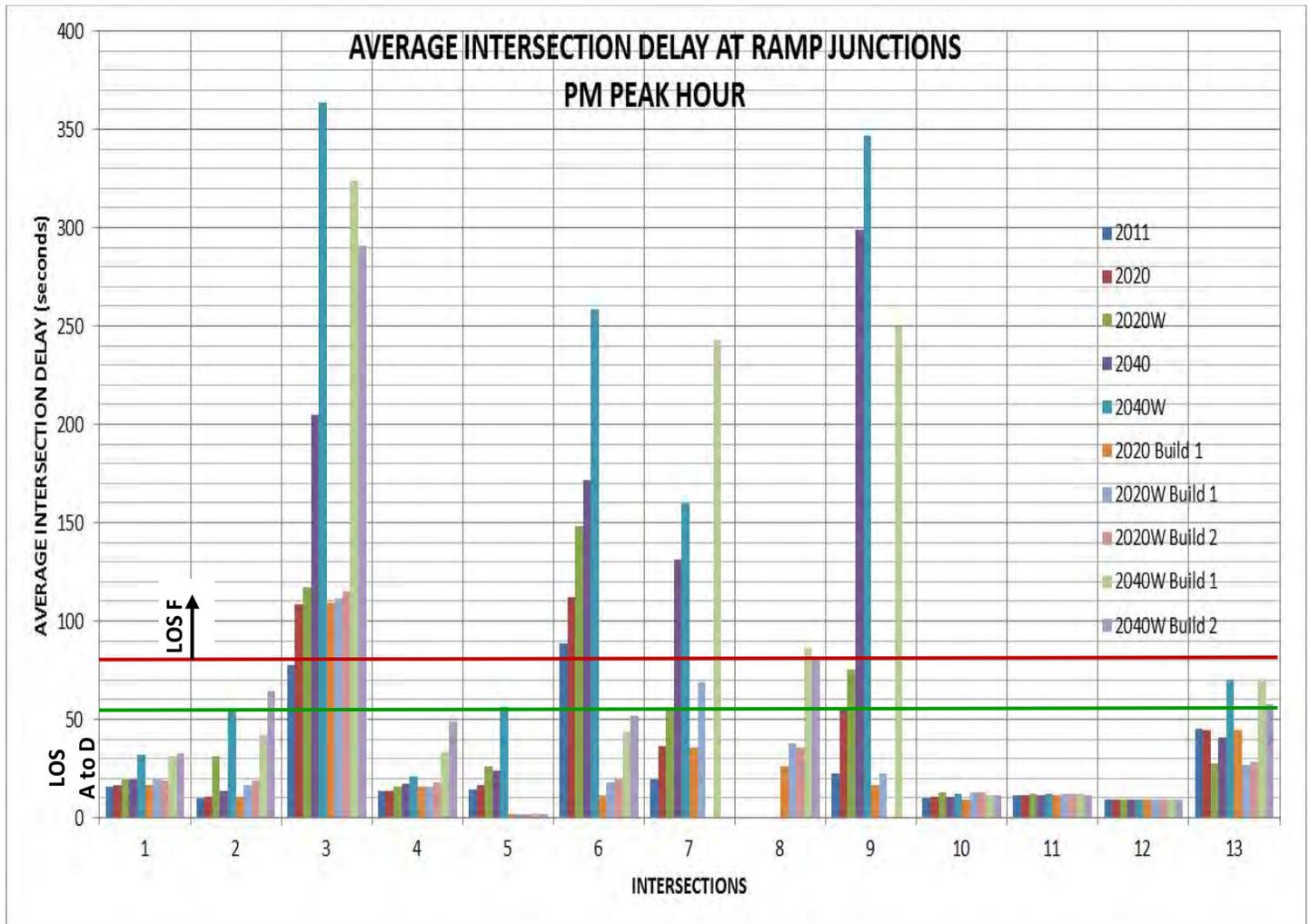
Intersections	
1. I-5 NB Ramps Pacific Ave.	7. I-5 NB Ramps/Marvin Rd. (Build – Diverging Diamond)
2. I-5 SB Ramps/Pacific Ave.	8. I-5 Ramps (Build - SPUI)
3. I-5 NB Ramps/Sleater-Kinney Rd.	9. I-5 SB Ramps/Marvin Rd. (Build – Diverging Diamond)
4. I-5 SB Ramps/Sleater Kinney Rd.	10. I-5 NB Off-ramp/ Quinault Dr./Galaxy Dr.
5. I-5 NB Ramps/Martin Way	11. I-5 SB On-ramp/ Nisqually Cut-Off Rd./Brown Farm Rd.
6. I-5 SB Ramps/Martin Way	12. I-5 NB Off-ramp/ Nisqually Cut-Off Rd.
	13. I-5 NB On-ramp/SB Off-ramp/Nisqually Cut-Off Rd./ Martin Way

Note: From HCM for signalized intersections

LOS A – D = average delay < 55 seconds

LOS F = average delay > 80 seconds

**FIGURE 3-21: Summary of the PM Peak Hour Intersection Analyses**



Intersections	
1. I-5 NB Ramps Pacific Ave.	7. I-5 NB Ramps/Marvin Rd. (Build – Diverging Diamond)
2. I-5 SB Ramps/Pacific Ave.	8. I-5 Ramps (Build - SPUI)
3. I-5 NB Ramps/Sleater-Kinney Rd.	9. I-5 SB Ramps/Marvin Rd. (Build – Diverging Diamond)
4. I-5 SB Ramps/Sleater Kinney Rd.	10. I-5 NB Off-ramp/ Quinault Dr./Galaxy Dr.
5. I-5 NB Ramps/Martin Way	11. I-5 SB On-ramp/ Nisqually Cut-Off Rd./Brown Farm Rd.
6. I-5 SB Ramps/Martin Way	12. I-5 NB Off-ramp/ Nisqually Cut-Off Rd.
	13. I-5 NB On-ramp/SB Off-ramp/Nisqually Cut-Off Rd./ Martin Way

Note: From HCM for signalized intersections

LOS A – D = average delay < 55 seconds  
 LOS F = average delay > 80 seconds

**TABLE 3-3: Comparison of the Martin Way Intersections  
2040 Widened Concept during the AM & PM Peak Hours**

**INTERSECTION TRAFFIC ANALYSIS -- 2040 WIDENED -- BASE CONDITIONS -- MARTIN WAY**

Intersection	Control	Movement	PM Peak Hour					
			Volumes (vph)	LOS	Delay (sec)	95th Queue (ft) Synchro	95th Queue (ft) SimTraffic	
I-5 SB Ramps / Martin Way	Signal	Overall		4,895	F	258.2		
		EB-T	Martin Way	2,000	F	327.3	# 1,732	858
		EB-R	Martin Way	345	D	35.8	284	486
		WB-L	Martin Way	575	F	402.5	# 1,104	927
		WB-T	Martin Way	840	B	18.0	307	487
		SB-L	I-5 Ramp	160	C	33.7	187	328
		SB-T	I-5 Ramp	5	C	33.7	187	328
		SB-R	I-5 Ramp	970	F	355.5	# 1,649	1,711
I-5 NB Ramps / Martin Way	Signal	Overall		4,730	E	56.0		
		EB-L	Martin Way	945	F	117.4	# 1,376	746
		EB-T	Martin Way	1,210	A	1.1	109	350
		WB-T	Martin Way	1,490	F	98.5	# 1,049	2,177
		WB-R	Martin Way	145	C	26.3	99	1,792
		NB-L	I-5 Ramp	20	E	69.5	58	112
		NB-T	I-5 Ramp	5	E	69.5	58	112
		NB-R	I-5 Ramp	915	A	1.9	0	38

**INTERSECTION TRAFFIC ANALYSIS -- 2040 WIDENED -- BUILD 1 CONDITIONS -- MARTIN WAY**

Intersection	Control	Movement	PM Peak Hour					
			Volumes (vph)	LOS	Delay (sec)	95th Queue (ft) Synchro	95th Queue (ft) SimTraffic	
I-5 SB Ramps / Martin Way	Signal	Overall		4,695	E	55.0		
		EB-T	Martin Way	2,080	E	55	# 1,213	1,781
		EB-R	Martin Way	480	B	13	131	1,274
		WB-L	Martin Way	NA				
		WB-T	Martin Way	1,020	B	14	313	253
		SB-L	I-5 Ramp	160	F	109	# 786	187
		SB-T	I-5 Ramp	5	F	109	# 786	426
		SB-R	I-5 Ramp	950	F	113	# 775	400
I-5 NB Ramps / Martin Way	Signal	Overall		3,920	A	2		
		EB-L	Martin Way	NA				
		EB-T	Martin Way	1,345	A	2	127	81
		WB-T	Martin Way	1,555	A	2	167	100
		WB-R	Martin Way	160	A	1	10	11
		NB-L	I-5 Ramp	20	E	56	31	39
		NB-T	I-5 Ramp	5	E	56	31	39
		NB-R	I-5 Ramp	835	A	2	0	0

**INTERSECTION TRAFFIC ANALYSIS -- 2040 WIDENED -- BUILD 2 CONDITIONS -- MARTIN WAY**

I-5 SB Ramps / Martin Way	Signal	Overall		4,720	D	52		
		EB-T	Martin Way	2,100	E	56	# 1,146	1,158
		EB-R	Martin Way	375	B	11	82	689
		WB-L	Martin Way	NA				
		WB-T	Martin Way	1,090	B	14	317	250
		SB-L	I-5 Ramp	160	C	32	168	159
		SB-T	I-5 Ramp	5	C	32	168	159
		SB-R	I-5 Ramp	990	F	104	# 635	389
I-5 NB Ramps / Martin Way	Signal	Overall		3,655	A	2		
		EB-L	Martin Way	NA				
		EB-T	Martin Way	1,355	A	2	131	74
		WB-T	Martin Way	1,280	A	2	118	66
		WB-R	Martin Way	160	A	1	10	6
		NB-L	I-5 Ramp	20	D	38	27	38
		NB-T	I-5 Ramp	5	D	38	27	38
		NB-R	I-5 Ramp	835	A	2	0	0

**TABLE 3-4: Comparison of the Marvin Road Intersections  
2040 Widened Concept during the AM & PM Peak Hours**

**INTERSECTION TRAFFIC ANALYSIS -- 2040 WIDENED -- BASE CONDITIONS -- MARVIN ROAD**

Intersection	Control	Movement	PM Peak Hour				
			Volumes (vph)	LOS	Delay (sec)	95th Queue (ft) Synchro	95th Queue (ft) SimTraffic
I-5 SB Ramps / Marvin Road	Signal	Overall	7,680	F	346.7		
		WB-L I-5 Ramp	570	C	32.3	306	1,022
		WB-T I-5 Ramp	0				
		WB-R I-5 Ramp	1,300	F	579.9	# 2,346	650
		NB-L Marvin Road	880	F	595.0	# 850	327
		NB-T Marvin Road	1,670	E	76.6	# 1,219	*
		SB-T Marvin Road	2,425	F	481.4	# 2,076	*
I-5 NB Ramps / Marvin Road	Signal	Overall	6,105	F	159.7		
		EB-L I-5 Ramp	675	F	250.6	# 1,212	1,388
		EB-T I-5 Ramp	5	D	37.8	29	NA
		EB-R I-5 Ramp	15	D	37.8	29	NA
		NB-T Marvin Road	1,915	F	220.5	m # 1,141	*
		NB-R Marvin Road	500	B	17.9	m 69	*
		SB-L Marvin Road	1,030	F	304.4	# 925	280
SB-T Marvin Road	1,965	C	30.4	1, 045	*		

**INTERSECTION TRAFFIC ANALYSIS -- 2040 WIDENED -- BUILD 1 CONDITIONS -- MARVIN ROAD**

**SINGLE POINT URBAN INTERCHANGE (SPUI)**

Intersection	Control	Movement	PM Peak Hour				
			Volumes (vph)	LOS	Delay (sec)	95th Queue (ft) Synchro	95th Queue (ft) SimTraffic
I-5 / Marvin Road SPUI	Signal	Overall	6,025	F	86.3		
		EB-L I-5 Ramp	785	F	128	# 525	987
		WB-L I-5 Ramp	605	E	58	# 355	267
		NB-L Marvin Road	965	F	108	# 610	357
		NB-T Marvin Road	1,130	E	62	# 653	1,018
		SB-L Marvin Road	1,100	E	79	# 652	402
		SB-T Marvin Road	1,440	F	85	# 853	1,314

**DIVERGING DIAMOND**

I-5 NB Ramps / Marvin Road	Signal	Overall	6,535	F	243		
		EB-L I-5 Ramp	785				1,646
		NB-T Marvin Road	2,135	E	77	# 1,270	897
		NB-R Marvin Road	470	A	1	0	
		SB-L Marvin Road	1,100				
I-5 SB Ramps / Marvin Road	Signal	Overall	6,990	F	249		
		WB-L I-5 Ramp	605				1,164
		WB-R I-5 Ramp	350				1,164
		NB-L Marvin Road	965				
		NB-T Marvin Road	1,915	F	123	# 1,409	*
		SB-T Marvin Road	2,540	F	405	# 2,194	1,068
SB-R Marvin Road	615	A	1	0			

**INTERSECTION TRAFFIC ANALYSIS -- 2040 WIDENED -- BUILD 2 CONDITIONS -- MARVIN ROAD**

**SINGLE POINT URBAN INTERCHANGE (SPUI)**

I-5 / Marvin Road SPUI	Signal	Overall	5,970	F	80		
		EB-L I-5 Ramp	800	F	104	#516	974
		WB-L I-5 Ramp	735	E	77	#455	541
		NB-L Marvin Road	755	F	97	#486	326
		NB-T Marvin Road	1,160	E	39	#681	1,294
		SB-L Marvin Road	1,100	F	100	#675	329
		SB-T Marvin Road	1,420	D	53	#785	1,230

**Martin Way Interchange Ramps:** Under the Base Conditions, this intersection is expected to operate at LOS F with average delays of about four minutes. For both Build Alternatives, the intersection LOS and average intersection delays will be significantly improved at the NB and SB Martin Way ramp junctions. Only during the 2040 PM peak hour for the widened Build 1 alternative will the intersection operation for the SB ramps be just over the LOS D threshold and into LOS E. For the Build 2 alternative the SB ramp intersection will be at LOS D. In addition, the traffic back-ups at these intersections will also be greatly reduced.

**Marvin Road Interchange Ramps:** From a review of Table 3-4, the following observations are seen:

- With no improvements to this intersection, the 2040 Base LOS at the NB and SB ramp intersections will be at LOS F with average delays from 3.5 minutes to nearly 5 minutes.
- With the Build 1 SPUI configuration, the intersection operations will still be at LOS F but the average delays will be reduced to less than 90 seconds.
- For the Build 1 Diverging Diamond configuration, the intersection operations will be improved to LOS E in the AM peak hour, but remain at LOS F in the PM peak hour. The average delays will be reduced to about 4 minutes.
- With the Build 2 SPUI configuration with C/D road, the intersection will continue to operate at LOS F, but the average intersection delay will range from about 84 seconds during the AM peak Hour to about 80 seconds in the PM peak hour. This is just above the LOS E threshold of less than 80 seconds.
- With either Build alternative, the traffic back-up on the I-5 off-ramps is also greatly reduced from about 1,220 feet to 2,350 feet for the Base Conditions to less than 525 feet with the SPUI configuration. Back-ups were not estimated for the Diverging Diamond alternative because the turning movements are yield conditions outside the intersection.

### **HOW DOES THE SPUI AND DIVERGING DIAMOND OPERATE FOR THE MARVIN ROAD INTERCHANGE?**

With the information from the intersection analyses, we can conclude that the Diverging Diamond configuration at Marvin Road Interchange will operate less efficiently than the SPUI configuration. For the Diverging Diamond configuration, average delays in 2040 will range from one minute to over four minutes at the two intersections in the AM and PM peak hours. Whereas, for the SPUI configurations, the average intersection delay is less than 90 seconds for both the AM and PM peak hours. Based on this comparison, the Diverging Diamond was not considered with the Build 2 configuration. SPUI operations were also analyzed with Vissim to verify interchange performance.

### WHAT BUILD ALTERNATIVES ARE RECOMMENDED?

From a review of the interstate and intersection traffic operations, Build 2 Alternative with a partial cloverleaf interchange at Martin Way and a SPUI interchange configuration with a C/D road at Marvin Road are recommended because:

- It improves safety by reducing traffic back-ups on the off-ramps at both Martin Way and Marvin Road.
- It improves intersection operations by reduced average vehicle delay at ramp junction intersections.
- It slightly increases traffic along I-5 in the 2040 design year.
- It meets current WSDOT standards and maintains existing right-of-way for future mainline widening options.

The Diverging Diamond configuration was not recommended because it has considerable longer average intersection delays at the Marvin Road interchange.

The Frontage Road to Carpenter Road with a separate off-ramp to Hogum Bay Road was not recommended because the frontage as designed is within WSDOT right-of-way, reduces right-of-way available for future mainline widening opportunities, and the off-ramp with connections to Carpenter Road and Hogum Bay Road is not consistent with WSDOT policy .

### WHAT IS THE COLLISION HISTORY BETWEEN 2006 AND 2010 ALONG THE I-5 CORRIDOR?

A five year collision analysis was conducted along the I-5 from MP 106.60 south of the I-5/Pacific Avenue interchange to MP 114.61 at the Nisqually Bridge, including ramps and cross streets within the limited access area.

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

From January 1, 2006 through December 31, 2010, there were a total of 827 collisions reported along the I-5 mainline, with an additional 807 collisions reported along the ramps and cross streets, as shown in Figure 3-22. The collision total throughout the study area varies on a yearly basis, with the average of 165 mainline collisions per year with an additional 162 collisions per year on ramps and cross streets. This is a total of 327 collisions per year.

FIGURE 3-22: I-5 Collision Summary

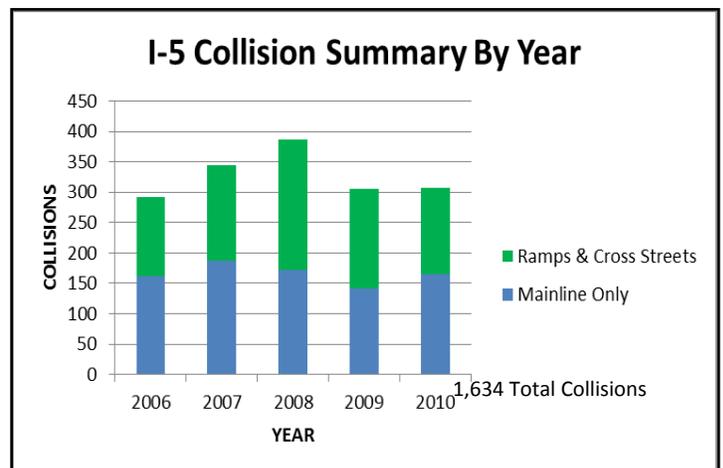


Table 3-5 shows a comparison of the severity of collisions through the project area with the statewide and Olympic Region averages for interstate travel. The estimated collision rates on I-5 through the project area are well below the statewide and Olympic Region interstate averages for urban areas.

Based on WSDOT’s safety assessment, there are no Collision Analysis Corridors (CACs), Collision Analysis Locations (CALs), or Intersection Analysis Locations (IALs) <sup>2</sup> along this section of I-5.

As can be observed from Table 3-4, property damage only collisions comprise nearly 70 percent of all collisions. There was only one collision involving a fatality over the five year period along I-5 within the study area. Overall, less than eight percent of the collisions involved serious injury, evident injury, or a fatality. These high percentages of property damage or possible injury collisions are characteristic in areas of high congestion and slower moving traffic throughout the interstate system.

**TABLE 3-5: Comparison of Corridor Collision Rates**

	I-5 Collisions	I-5 Collision Rate per MVM <sup>1</sup>	2010 Average Collision Rates <sup>2</sup> Interstate - Statewide			2010 Average Collision Rates <sup>2</sup> Interstate – Olympic Region		
			Rural	Urban	All	Rural	Urban	All
<b>I-5 Mainline</b>								
Fatalities	1	0.0006	0.0035	0.0027	0.0029		0.0046	0.0037
Injury	242	0.15	0.16	0.39	0.32	0.18	0.48	0.43
Property Damage Only	584	0.36	0.35	0.86	0.71	0.40	1.11	0.98
Total	827	0.50	0.51	1.25	1.03	0.59	1.59	1.41
<b>Mainline, Ramps, Cross Street</b>								
Fatalities	1	0.0006	0.0035	0.0027	0.0029		0.0046	0.0037
Injury	506	0.31	0.16	0.39	0.32	0.18	0.48	0.43
Property Damage Only	1,127	0.69	0.35	0.86	0.71	0.40	1.11	0.98
Total	1,634	1.00	0.51	1.25	1.03	0.59	1.59	1.41

Notes: <sup>1</sup> Based on I-5 collision data between MP 106.60 and 114.61 for years 2006 through 2010 as prepared by H. W. Lochner

<sup>2</sup> Statewide and Olympic Region Collision Rates include mainline, ramp and cross street collisions.

Source 2010 Washington State Collision Data Summary

### WHAT ARE THE TYPES OF I-5 MAINLINE COLLISION?

Between January 2006 and December 2010, there were 827 collisions reported along this section of I-5. These collisions are generally grouped according to type. For this analysis the following types are used:

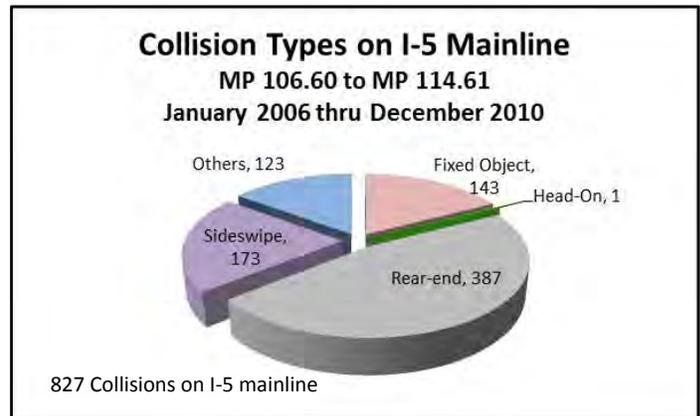
- rear-end collisions
- head-on collisions
- fixed object collisions
- sideswipe collisions
- other collisions

The Other Collision category includes vehicle overturns, animal related collisions, and those collision types not identified.

<sup>2</sup> An explanation of the CACs, CALs, and IALs and how WSDOT identifies them is contained in Appendix G.

Figure 3-23 shows a breakdown of the collision types and number along I-5 mainline. This collision chart clearly indicates that rear-end and sideswipe collisions accounted for nearly 68 percent of the mainline collisions. Hitting fixed object collisions, which include hitting the median barrier, guardrail, bridge abutments, embankments and ditches, accounted for over 17 percent of the mainline collisions.

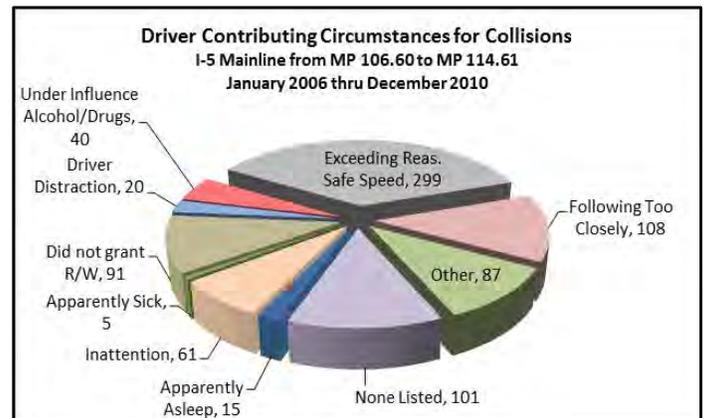
**FIGURE 3-23: I-5 Collision Types**



**WHAT WERE THE DRIVER CONTRIBUTING CIRCUMSTANCES FOR THESE COLLISIONS?**

Driver contributing circumstances for collisions (as reported by the responding police officer) along this section of I-5 are summarized on Figure 3-24.

**FIGURE 3-24: Contributing Circumstances for Collisions**



Drivers who are exceeding reasonable speed, following too closely, inattention, and driver distractions combine for nearly 60 percent of the mainline collisions, while drivers who did not grant others the right of way accounted for another 11 percent of mainline collisions. About five percent of the I-5 mainline collisions involve alcohol or drugs.

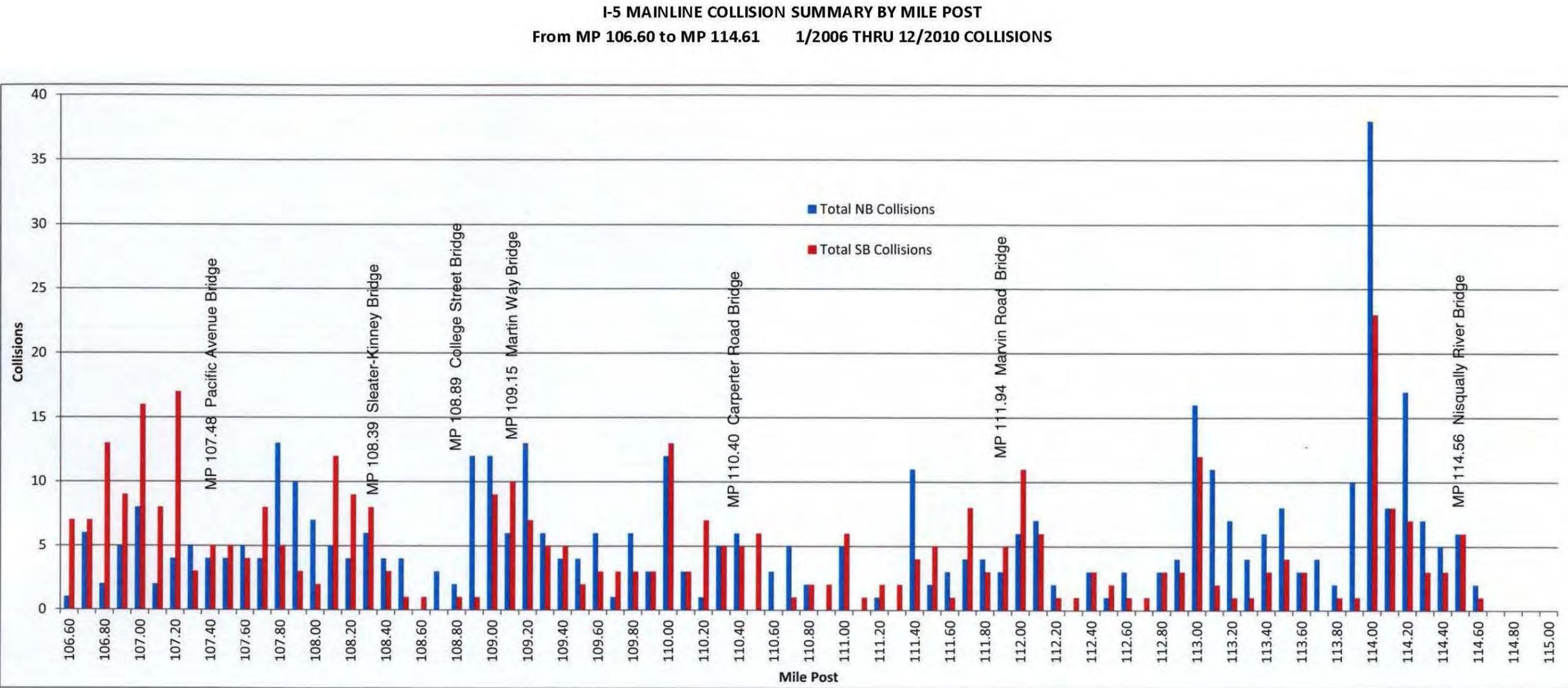
**WHAT IS THE FREQUENCY OF COLLISION ALONG I-5 IN THE STUDY AREA?**

Figure 3-25 illustrates the frequency of collisions by milepost along I-5 where the mainline collisions have occurred over the five year period. As expected, the majority of the collisions are in the vicinity of the interchanges where traffic tends to slow down for entering and exiting vehicles. Over the five period, the most collisions along I-5 in the study area occurred near the Nisqually exit, where heavy traffic is entering and exiting the interstate and trucks begin to slow down along the uphill grade.

**HOW SEVERE WERE THE COLLISIONS AT I-5 INTERCHANGES WITHIN THE STUDY AREA?**

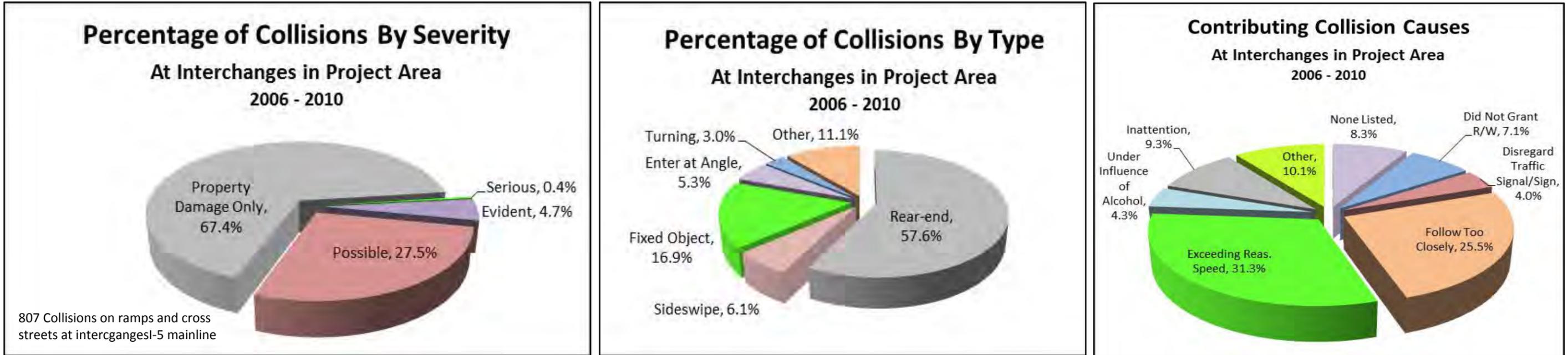
For this analysis, interchange collisions include collisions on the various interchange ramps and associated cross streets. A summary of the collisions at the five interchanges in the study by severity, type, and contributing circumstances is presented in Figure 3-26.

FIGURE 3-25: Frequency of Collisions along I-5 from MP 106.60 to MP 114.61 (2006 to 2010)



There are no CACs, CALs, or IALs along this section of I-5 through Lacey on WSDOT's current safety list, as reported by Kumiko Izawa, Traffic Safety & Analysis Engineer, WSDOT on 12/8/2011

FIGURE 3-26: Summary of Collisions at Area Interchanges (2006 to 2010)



Overall there were 807 collisions at the five interchanges with 67 percent of them classified as property-damage only (PDO) collisions. There were no fatalities and only three serious injury collisions over the five-year period. Summaries of the collisions at each interchange including ramps and cross streets collisions within the limited access area are contained in Appendix G.

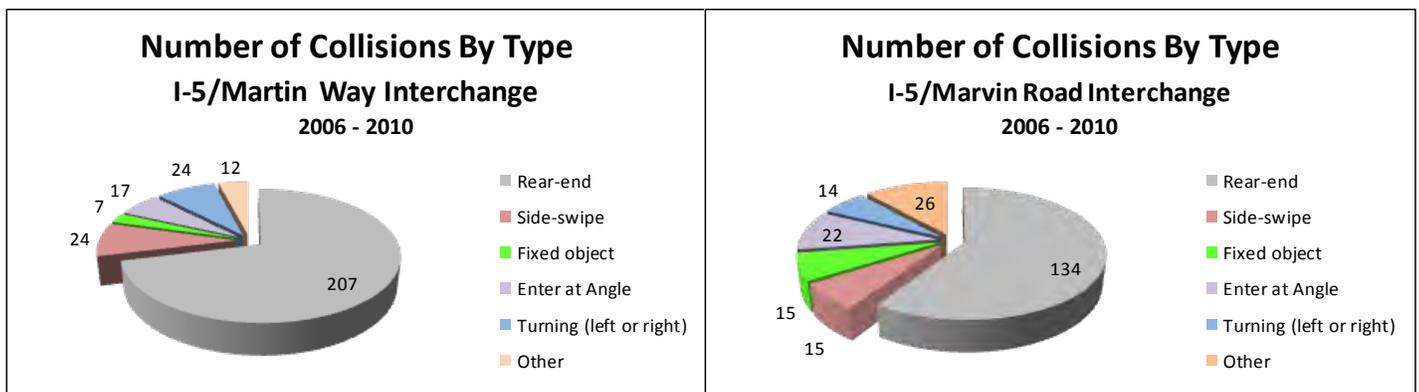
These collisions are grouped according to type for the five interchanges along I-5. The categories used are rear-end collisions, sideswipe collisions, fixed object collisions, entering at angle, turning collisions, and an encompassing 'other' category, which includes vehicle overturns, animal related collisions, and those collision types not identified.

The figure shows a breakdown of the collision types for all five interchange. The highest percentage of these collisions is rear-end collisions with over 57 percent. This type of collision correlates with congestion at these interchange and long queues.

The main causes for these collisions were exceeding reasonable speed, following too closely, and inattention. Combined over the five year period, they total over 66 percent.

Figure 3-27 summarizes the collisions by type at the I-5/Martin Way Interchange and the I-5/Marvin Road Interchange. Of these two interchanges, most collisions occurred at the I-5/Martin Way Interchange over the five-year period with a total 291 collisions. There were 244 collisions occurring along Martin Way and 51 collisions on the ramps. Nearly 72 percent of these collisions were rear-enders. Likewise, at the Marvin Road Interchange, 226 collisions occurred with 164 collisions along Marvin Road. Nearly 60 percent of the collisions were rear-end collisions.

**FIGURE 3-27: Collisions by Type at the Martin Way & Marvin Road Interchanges**



### **HOW ARE THE COLLISION RATES ALONG I-5 EXPECTED TO CHANGE OVER THE NEXT 20 YEARS WITH NO CHANGES TO I-5?**

The collision rate along this section of I-5 is expected to increase over the next twenty years without improvements due to:

- Increase in traffic volumes which will result in increased congestion;
- Queue back-ups along off-ramps will extend onto the I-5 mainline, resulting in traffic stopping on the interstate; and
- Drivers will have a greater tendency to shift lanes to avoid stopping which will increase sideswipe and rear-end collisions.

As a result, the collision rate along this section of I-5 through Lacey is expected to begin approaching the statewide collision rate for interstate travel in urban areas.

### **HOW WILL THE INTERCHANGE MODIFICATIONS AFFECT THE COLLISION RATE IN THE FUTURE?**

The Build alternatives will be designed to current design standards with longer ramps to allow vehicles to decelerate and smoothly stop at the back of the queue without having to slow down on the mainline lanes. The expected 2040 queue lengths with stopping distance from a 70 mph design speed will be used to determine the appropriate ramp length. This will allow vehicles travelling on the I-5 to proceed at normal traffic speeds.

On-ramps will also be sized to allow smooth acceleration up to I-5 operating speeds before merging into interstate traffic. Merging areas will also be analyzed to determine proper ramp type with extended lanes.

By providing adequate ramp lengths, queues will not back up onto I-5 at the Martin Way and Marvin Road interchanges. Because ramp congestion is decreased and ramps are longer, the rear-end collisions are expected to decrease.

Specifically, rear-end collisions are also expected to decrease at the Martin Way ramp junction intersections, because left turns from Martin Way on to the I-5 on-ramps will be converted to right turns which avoid conflicting movements and reduce intersection delays.

At the Marvin Road Interchange, ramp junction intersections will be combined into a single intersection, thus eliminating one signalized intersection and reducing the opportunity for collisions. In addition, the overall intersection delay and congestion at the Marvin Road ramp intersections will be reduced, as compared to the 2040 base condition.

As a result of these interchange modifications, the overall interchange collision rate, as compared to no interchange modifications, is expected to decrease at the I-5/Martin Way and I-5/Marvin Road interchanges and overall safety on the interstate will improve through the study area.

## **Policy Point 4: Access Connections and Design**

### **WILL THE PROPOSAL PROVIDE FULLY DIRECTIONAL INTERCHANGES CONNECTED TO PUBLIC STREETS OR ROADS, SPACED APPROPRIATELY, AND DESIGNED TO FULL DESIGN LEVEL GEOMETRIC CONTROL CRITERIA?**

Both the Martin Way and Marvin Road I-5 Interchanges are currently and will continue to be fully directional, connected to public roads, and designed to full WSDOT design standards. With the planning level design completed to date, no design deviations are identified. The proposed interchange modifications will not affect the existing interchange spacing.

### **WHAT ARE THE MARTIN WAY INTERCHANGE MODIFICATIONS?**

The I-5 / Martin Way Interchange will be a fully directional interchange in a Partial Cloverleaf, as illustrated in Figure 4-1. All ramps will continue to be connected to Martin Way. However, instead of left turns from Martin Way to the SB and NB on-ramps, loop ramps will be constructed in the northwest and southeast quadrants to provide for right-turns. The SB off-ramp will have a double right-turn lane as well as a combined through and left-turn lane. All ramp lengths and turn lanes will be designed based on the latest traffic analysis.

These revisions will reduce the average delay a driver experiences at the ramp terminal intersections by reducing the number of phases for the traffic signals and provide more green time to the through movements along Martin Way and for traffic on the off-ramps.

**FIGURE 4-1: I-5/Martin Way Interchange - Partial Cloverleaf Interchange**



## Policy Point 4: Access Connections and Design

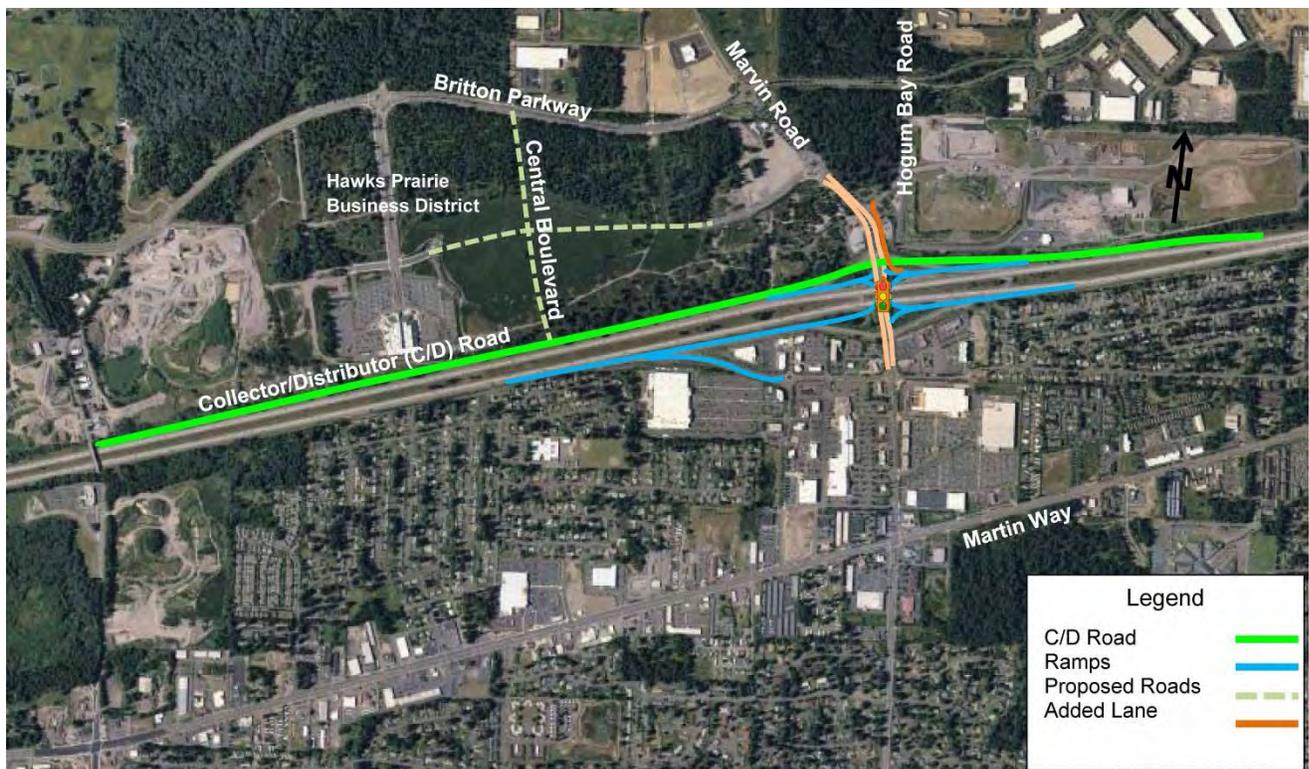
Between College Street and Desmond Drive, Martin Way is a principle arterial with two continuous travel lanes in each direction and bike lanes. The revised Martin Way will have the following features:

- From College Street to SB ramps, westbound Martin Way will continue to have double left-turn lanes, two through lanes, and a right-turn lane; eastbound Martin Way will have two through lanes and a right-turn lane.
- Between the SB and NB ramp intersections, Martin Way will have two through lanes and a right turn lane in each direction; and
- From the NB ramp intersection to Desmond Drive; Martin Way will continue to have two through lanes in each direction, a center left-turn lane, an eastbound auxiliary lane that eventually becomes a right-turn lane at Desmond Drive, and a westbound right-turn lane to the northbound on-ramp.

### WHAT ARE THE MARVIN ROAD INTERCHANGE MODIFICATIONS?

The I-5/Marvin Road Interchange will be a fully directional interchange with connections for NB and SB on- and off-ramps for all vehicular movements, as illustrated on Figure 4-2.

**FIGURE 4-2: I-5 / Marvin Road Interchange - Single Point Urban Interchange (SPUI) Concept with new Collector/Distributor (C/D) Road**



The proposed interchange at the Marvin Road Interchange will include the following improvements

- It will be modified as Single Point Urban Interchange (SPUI), with two through lanes and double left turn lanes in each direction.
- It will keep the existing NB two-lane off-ramp with an additional off-ramp to the Quinault Drive / Galaxy Drive roundabout.
- A C/D road will be added and will have a two-lane exit from I-5 east of the existing Marvin Road exit. The C/D road will continue under Marvin Road and along the south side of the Hawks Prairie Development and reconnect to I-5 with a two-lane on-ramp near Carpenter Road underpass.
- The SB on- and off-ramps with Marvin Road will be redesigned and connected to the proposed C/D road.
- An additional right-turn lane will be extended along Marvin Road between the I-5 off-ramp and Hogum Bay Road.
- Central Boulevard will be constructed in the Hawks Prairie Development area and connected to the proposed C/D road.
- The NB on-ramp will be redesigned to a two-lane on-ramp.

Between the proposed Main Street Roundabout to Martin Way, Marvin Road will continue as a principal arterial with two continuous travel lanes in each direction. South of the interstate, Marvin Road is also State Route 510. Marvin Road will also maintain:

- A SB auxiliary lane that becomes a right-turn lane at the I-5 SB on ramp between the Main Street roundabout and the SB ramps;
- A center left-turn lane and right-turn lanes on both sides from the NB ramp intersection to Quinault Drive; and
- A center left-turn lane south of Quinault Drive.

All ramp lengths and turn lanes will be designed based on the latest traffic analysis.

### **WHAT ARE THE CONCEPTUAL LAYOUT AND SIGNING PLANS FOR THE MARTIN WAY AND MARVIN ROAD INTERCHANGE MODIFICATIONS?**

The conceptual layout and signing plans for the I-5/Martin Way and I-5/Marvin Road Interchanges are illustrated on Figures 4-3 and 4-4, respectively. This conceptual drawings show the proposed lane arrangement and signing plan to direct drivers through the revised interchanges. These plans will be revised during the design phase of the project.

During the environmental documentation phase, the preliminary design of the proposed interchange improvements will be developed. A VISSIM simulation of the entire I-5

## Policy Point 4: Access Connections and Design

corridor from Pacific Avenue Interchange to the Nisqually Interchange was developed to validate the ramps and merge areas along I-5 to meet expected future year demands.

FIGURE 4-3: I-5/Martin Way Interchange - Partial Cloverleaf Interchange – Conceptual Signing Plan



FILE NAME	c:\pw_working\lochner-sic\mtoy\dms303044710_PS_SN_001.dgn			REGION NO.	STATE	FED.AID PROJ.NO.	<b>PRELIMINARY</b> NOT FOR CONSTRUCTION		I-5 MARTIN WAY TO MARVIN ROAD INTERCHANGE IMPROVEMENTS  SIGNING PLAN	PLAN REF NO.
TIME	10:05:45 AM			10	WASH					SN1
DATE	3/23/2015									SHEET
PLOTTED BY	mtoy									OF
DESIGNED BY	G.WILLHELM									SHEETS
ENTERED BY	P.WOLF									
CHECKED BY	R.HOWARD									
PROJ. ENGR.	M. BURRUS									
	DESCRIPTION	DATE	NO.							

FIGURE 4-3: I-5/Martin Way Interchange - Partial Cloverleaf Interchange – Conceptual Signing Plan Continued

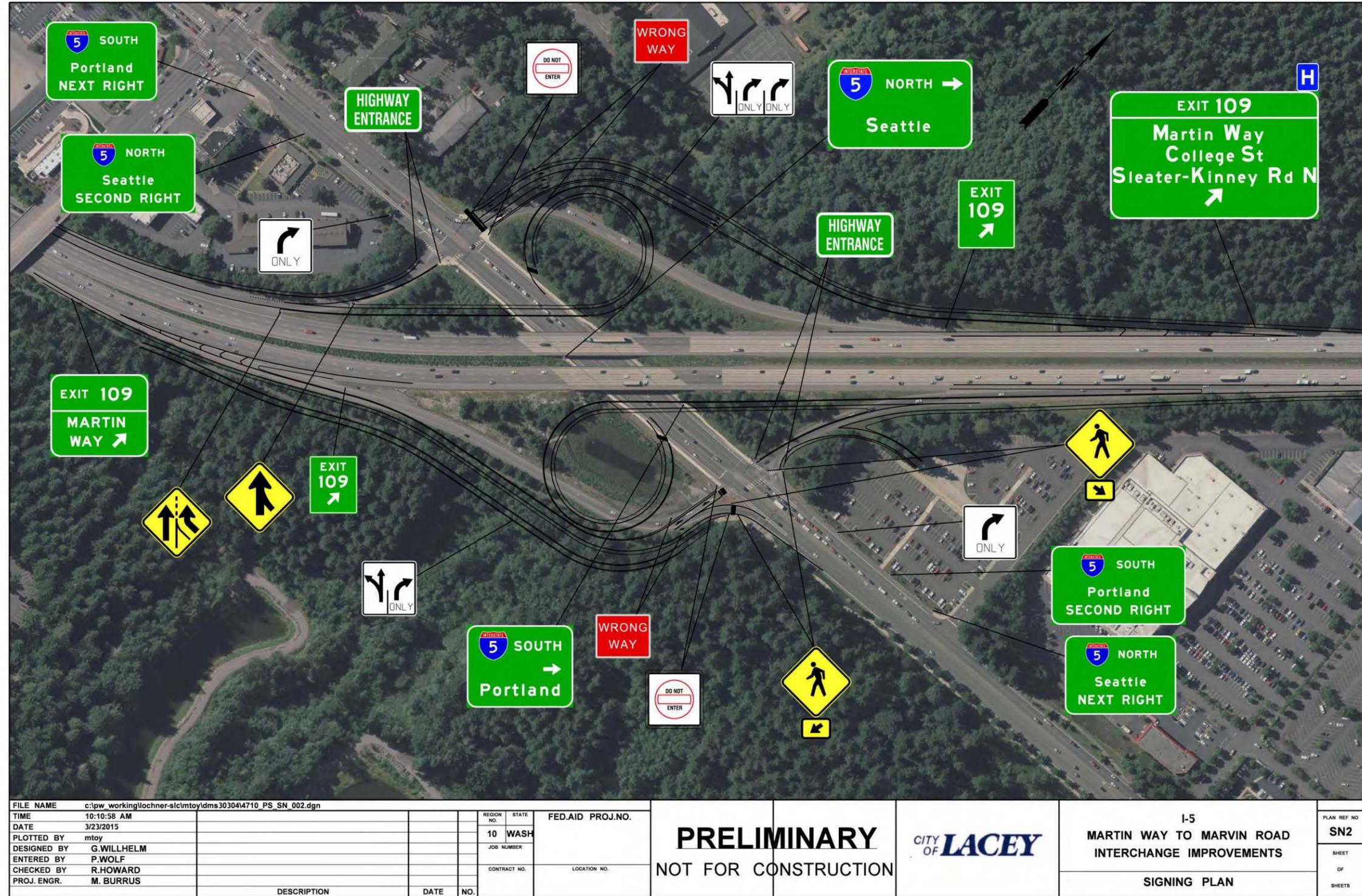


FIGURE 4-3: I-5/Martin Way Interchange - Partial Cloverleaf Interchange – Conceptual Signing Plan Continued



FIGURE 4-4: I-5 / Marvin Road Interchange - Single Point Urban Interchange (SPUI) Concept with new Collector/Distributor (C/D) Road – Conceptual Signing Plan



FILE NAME	c:\pw_working\lochner-slc\mtoy\dms303044710_PS_SN_004.dgn			REGION NO.	STATE	FED.AID PROJ.NO.	<b>PRELIMINARY</b> NOT FOR CONSTRUCTION	CITY OF <b>LACEY</b>	I-5 MARTIN WAY TO MARVIN ROAD INTERCHANGE IMPROVEMENTS	PLAN REF NO
TIME	8:49:29 AM			10	WASH					SN4
DATE	4/20/2015									SHEET
PLOTTED BY	mtoy									OF
DESIGNED BY	G.WILLHELM									SHEETS
ENTERED BY	P.WOLF									
CHECKED BY	R.HOWARD									
PROJ. ENGR.	M. BURRUS									
		DESCRIPTION	DATE	NO.						

FIGURE 4-4: I-5 / Marvin Road Interchange - Single Point Urban Interchange (SPUI) Concept with new Collector/Distributor (C/D) Road – Conceptual Signing Plan Continued



FIGURE 4-4: I-5 / Marvin Road Interchange - Single Point Urban Interchange (SPUI) Concept with new Collector/Distributor (C/D) Road – Conceptual Signing Plan Continued

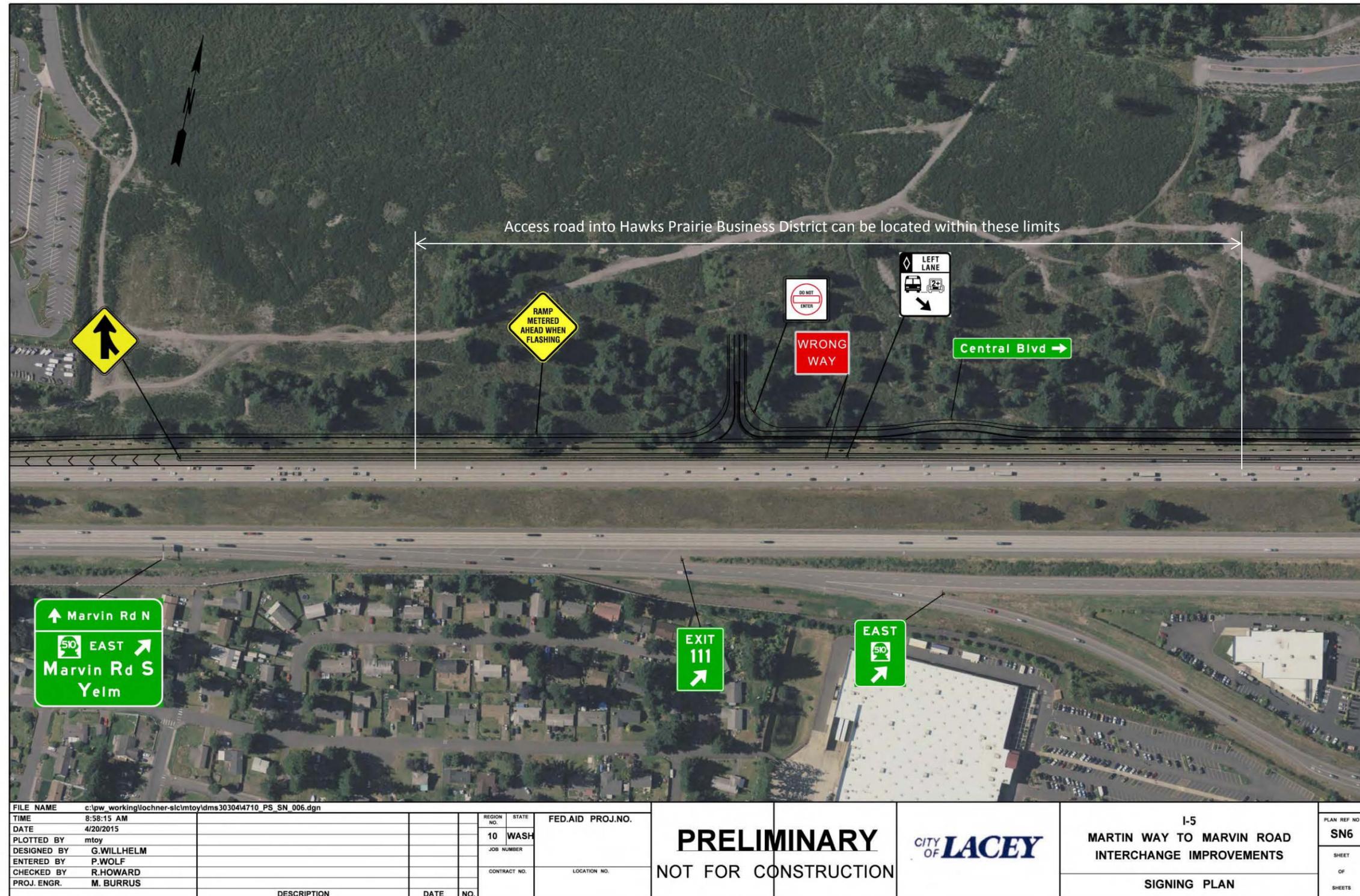


FIGURE 4-4: I-5 / Marvin Road Interchange - Single Point Urban Interchange (SPUI) Concept with new Collector/Distributor (C/D) Road – Conceptual Signing Plan Continued

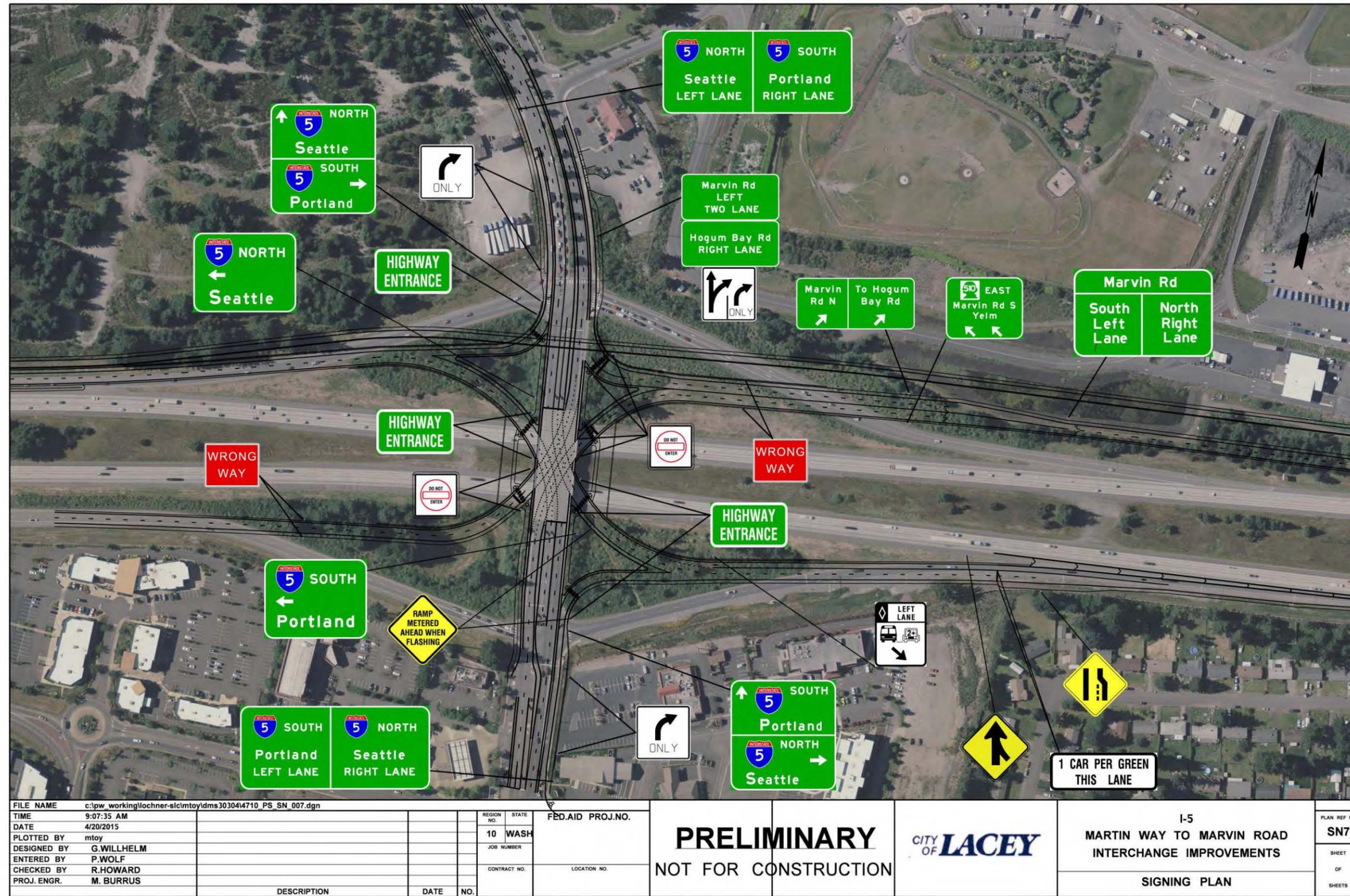


FIGURE 4-4: I-5 / Marvin Road Interchange - Single Point Urban Interchange (SPUI) Concept with new Collector/Distributor (C/D) Road – Conceptual Signing Plan Continued



FIGURE 4-4: I-5 / Marvin Road Interchange - Single Point Urban Interchange (SPUI) Concept with new Collector/Distributor (C/D) Road – Conceptual Signing Plan Continued



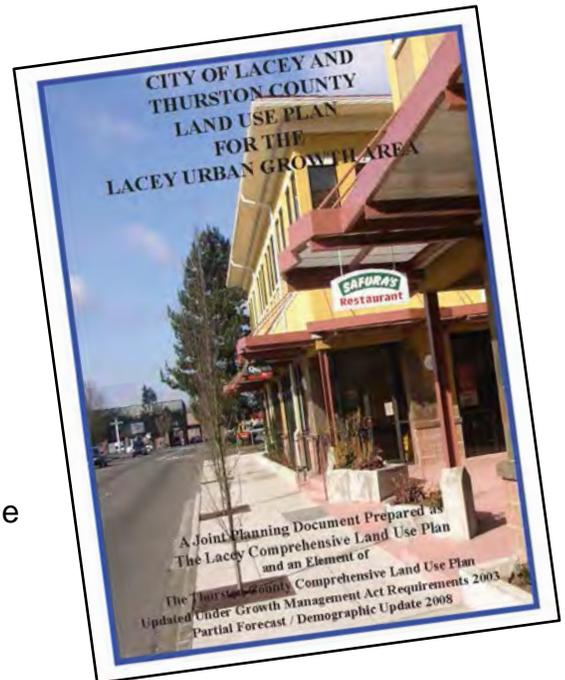
FILE NAME	c:\pw_working\lochner-slc\mto\ids303044710_PS_SN_009.dgn	REGION NO.	STATE	FED.AID PROJ.NO.	<b>PRELIMINARY</b> NOT FOR CONSTRUCTION	<b>CITY OF LACEY</b>	I-5 MARTIN WAY TO MARVIN ROAD INTERCHANGE IMPROVEMENTS  SIGNING PLAN	PLAN REF NO	SN9	
TIME	11:14:16 AM	10	WASH	CONTRACT NO.				LOCATION NO.	SHEET	OF
DATE	3/23/2015									
PLOTTED BY	mtoy									
DESIGNED BY	G.WILLHELM									
ENTERED BY	P.WOLF									
CHECKED BY	R.HOWARD									
PROJ. ENGR.	M. BURRUS									
	DESCRIPTION	DATE	NO.							

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## Policy Point 5: Land Use and Transportation Plans

### **IS THE PROPOSED ACCESS POINT REVISION COMPATIBLE WITH LAND USES FOR THE AREA?**

The proposed I-5/Martin Way Interchange and the I-5/Marvin Road Interchange improvements are consistent with City of Lacey and Thurston County area land use plans. As discussed in Policy Point 1, the traffic forecasts used to analyze these improvements were based on the adopted land use plans. The Thurston Regional Planning Council (TRPC), in conjunction with Thurston County and the local jurisdictions, including Lacey, developed the land use data from these plans that was used to calibrate the regional travel model and to forecast future travel volumes.

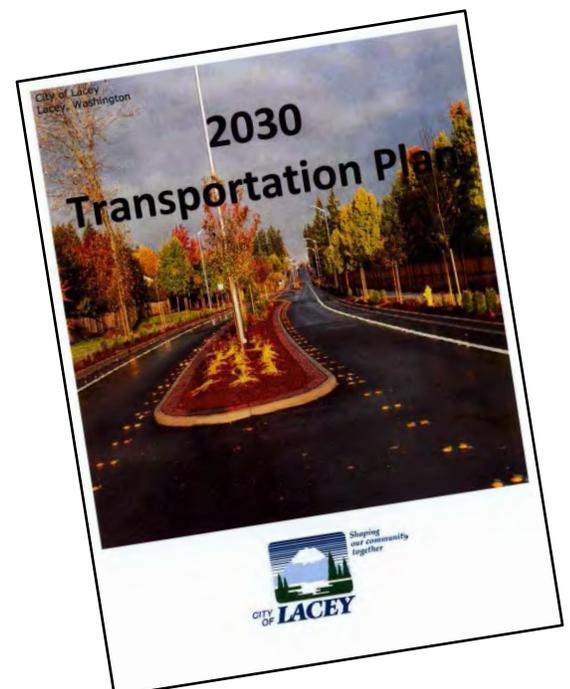


### **IS THE PROPOSED ACCESS POINT REVISION COMPATIBLE WITH TRANSPORTATION PLANS FOR THE AREA?**

The proposed improvements to the I-5/Martin Way and the I-5/Marvin Road interchanges are consistent with state, regional, county and local plans.

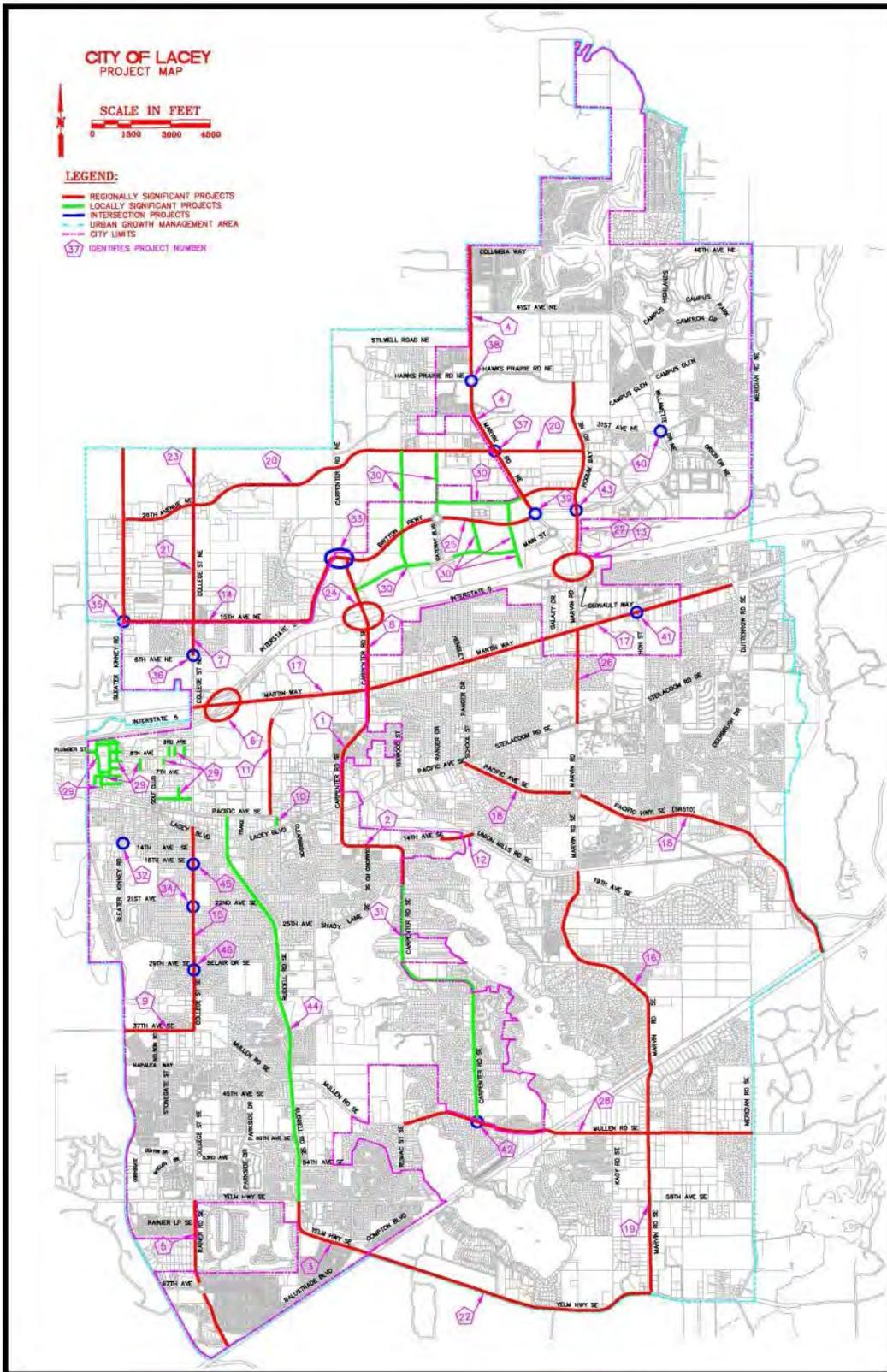
**WSDOT:** WSDOT's Highway System Plan 2007-2026 acknowledges that a SPUI is a potential solution that requires further analysis at the I-5/Marvin Road Interchange. The Highway System Plan also acknowledges that further analysis is needed at the I-5/Martin Way Interchange.

**City of Lacey:** The City's 2030 Transportation Plan includes improvements at the I-5/Martin Way Interchange and the I-5/Marvin Road Interchange. The City's plan also recommends several local improvements that support local circulation off the interstate. Figure 5-1 is an illustration of these improvements from the City's 2030 Transportation Plan. These improvements are listed on Table 5-1.



# Policy Point 5: Land Use and Transportation Plans

FIGURE 5-1 Project Map from Lacey's 2030 Transportation Plan



Source: 2030 Lacey Transportation Plan, page 77

**TABLE 5-1 Local Improvements from Lacey’s 2030 Transportation Plan**

Road	Improvement
15 <sup>th</sup> Avenue NE/ Draham Road	Widening from Carpenter Road to Sleater-Kinney Road
26 <sup>th</sup> Avenue	Extension from Hogum Bay Road to Sleater-Kinney Road
Britton Parkway	Extension from Gateway Blvd to Carpenter Road
Carpenter Road	Widening from Martin Way to Britton Parkway
Carpenter Road	Widening from Pacific Avenue to Martin Way (Completed)
Carpenter Road	Widening from Pacific Avenue to Shady Lane
College Street	Extension from Martin Way to 15 <sup>th</sup> Avenue
College Street	Extension from 15 <sup>th</sup> Avenue to 26 <sup>th</sup> Avenue
Desmond Road	Extension from Martin Way to Pacific Avenue
Hogum Bay Road	Improves roadway to a collector roadway from I-5 to Hawks Prairie Road
Marvin Road	Widening from Britton Parkway to Columbia Way
Marvin Road	Widening from Union Mills Road to Mullen Road
Lacey / Hawks Prairie Business District Commercial	Corridor improvements
Pacific Avenue	Widening from Union Mills Road to Marvin Road
Marvin Road	Extension from Mullen Road to Yelm Highway

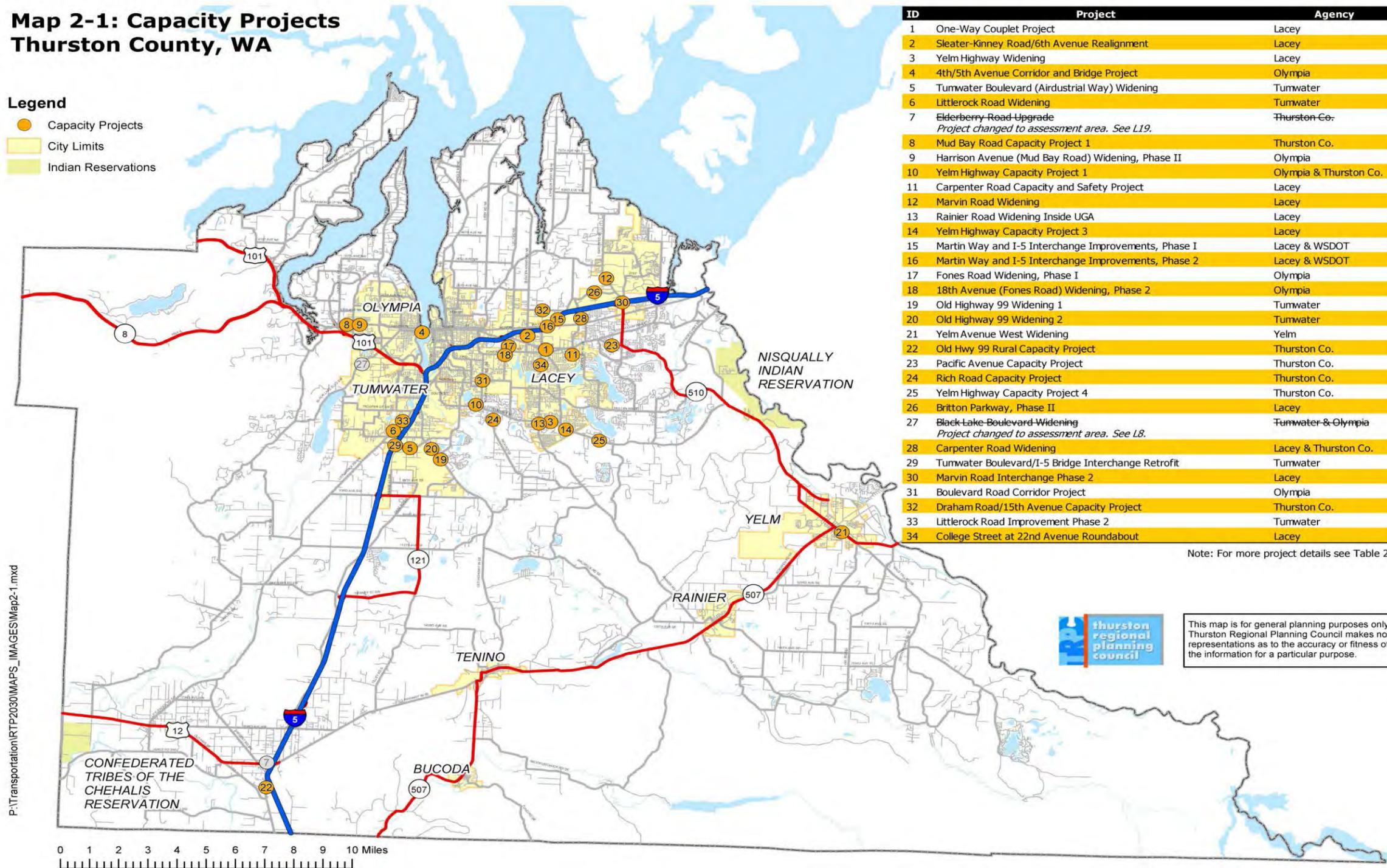
**TRPC:** TRPC is the Metropolitan Planning Organization (MPO) for the project area and has included these interchange projects in their 2025 Thurston Regional Transportation Plan ‘Guiding Our Future’, May 2004 and amended in June 2010.

Maps from Regional Transportation Plan showing planned capacity, planned connections, subarea analysis projects and transit improvements are included on the following pages.

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**Map 2-1: Capacity Projects  
Thurston County, WA**

- Legend**
- Capacity Projects
  - City Limits
  - Indian Reservations



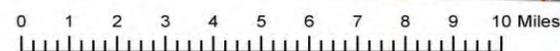
ID	Project	Agency
1	One-Way Couplet Project	Lacey
2	Sleater-Kinney Road/6th Avenue Realignment	Lacey
3	Yelm Highway Widening	Lacey
4	4th/5th Avenue Corridor and Bridge Project	Olympia
5	Tumwater Boulevard (Airdustrial Way) Widening	Tumwater
6	Littlerock Road Widening	Tumwater
7	Elderberry Road Upgrade <i>Project changed to assessment area. See L19.</i>	Thurston Co.
8	Mud Bay Road Capacity Project 1	Thurston Co.
9	Harrison Avenue (Mud Bay Road) Widening, Phase II	Olympia
10	Yelm Highway Capacity Project 1	Olympia & Thurston Co.
11	Carpenter Road Capacity and Safety Project	Lacey
12	Marvin Road Widening	Lacey
13	Rainier Road Widening Inside UGA	Lacey
14	Yelm Highway Capacity Project 3	Lacey
15	Martin Way and I-5 Interchange Improvements, Phase I	Lacey & WSDOT
16	Martin Way and I-5 Interchange Improvements, Phase 2	Lacey & WSDOT
17	Fones Road Widening, Phase I	Olympia
18	18th Avenue (Fones Road) Widening, Phase 2	Olympia
19	Old Highway 99 Widening 1	Tumwater
20	Old Highway 99 Widening 2	Tumwater
21	Yelm Avenue West Widening	Yelm
22	Old Hwy 99 Rural Capacity Project	Thurston Co.
23	Pacific Avenue Capacity Project	Thurston Co.
24	Rich Road Capacity Project	Thurston Co.
25	Yelm Highway Capacity Project 4	Thurston Co.
26	Britton Parkway, Phase II	Lacey
27	Black Lake Boulevard Widening <i>Project changed to assessment area. See L8.</i>	Tumwater & Olympia
28	Carpenter Road Widening	Lacey & Thurston Co.
29	Tumwater Boulevard/I-5 Bridge Interchange Retrofit	Tumwater
30	Marvin Road Interchange Phase 2	Lacey
31	Boulevard Road Corridor Project	Olympia
32	Draham Road/15th Avenue Capacity Project	Thurston Co.
33	Littlerock Road Improvement Phase 2	Tumwater
34	College Street at 22nd Avenue Roundabout	Lacey

Note: For more project details see Table 2-2



This map is for general planning purposes only. Thurston Regional Planning Council makes no representations as to the accuracy or fitness of the information for a particular purpose.

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Source: TRPC Geographical Information System

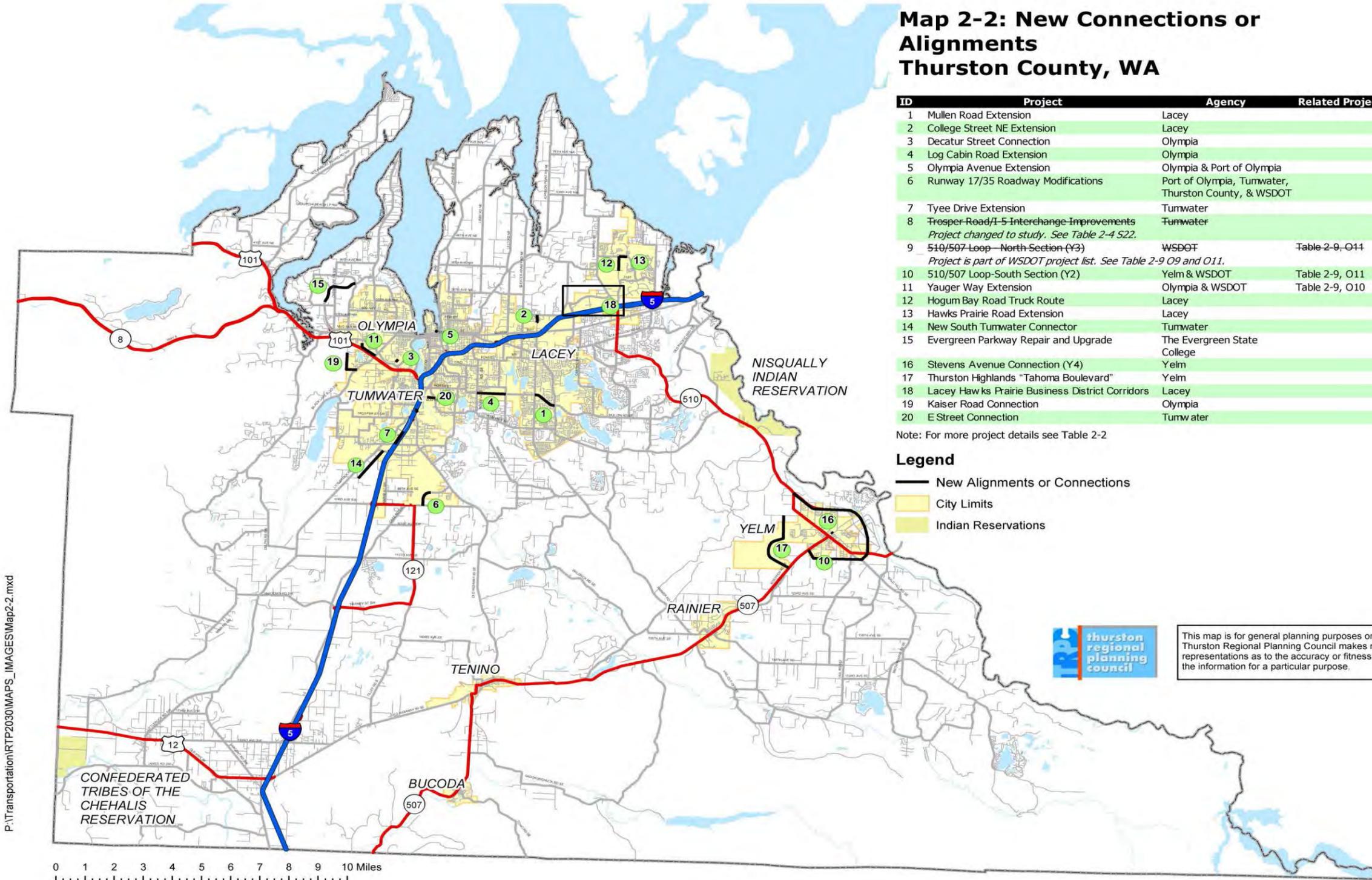
**Map 2-2: New Connections or Alignments  
Thurston County, WA**

ID	Project	Agency	Related Projects
1	Mullen Road Extension	Lacey	
2	College Street NE Extension	Lacey	
3	Decatur Street Connection	Olympia	
4	Log Cabin Road Extension	Olympia	
5	Olympia Avenue Extension	Olympia & Port of Olympia	
6	Runway 17/35 Roadway Modifications	Port of Olympia, Tumwater, Thurston County, & WSDOT	
7	Tyee Drive Extension	Tumwater	
8	Froster Road/I-5 Interchange Improvements <i>Project changed to study. See Table 2-4 S22.</i>	Tumwater	
9	510/507 Loop—North Section (Y3) <i>Project is part of WSDOT project list. See Table 2-9 O9 and O11.</i>	WSDOT	Table 2-9, O14
10	510/507 Loop—South Section (Y2)	Yelm & WSDOT	Table 2-9, O11
11	Yauger Way Extension	Olympia & WSDOT	Table 2-9, O10
12	Hogum Bay Road Truck Route	Lacey	
13	Hawks Prairie Road Extension	Lacey	
14	New South Tumwater Connector	Tumwater	
15	Evergreen Parkway Repair and Upgrade	The Evergreen State College	
16	Stevens Avenue Connection (Y4)	Yelm	
17	Thurston Highlands "Tahoma Boulevard"	Yelm	
18	Lacey Hawks Prairie Business District Corridors	Lacey	
19	Kaiser Road Connection	Olympia	
20	E Street Connection	Tumwater	

Note: For more project details see Table 2-2

**Legend**

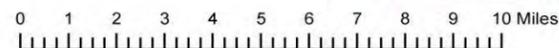
- New Alignments or Connections
- City Limits
- Indian Reservations



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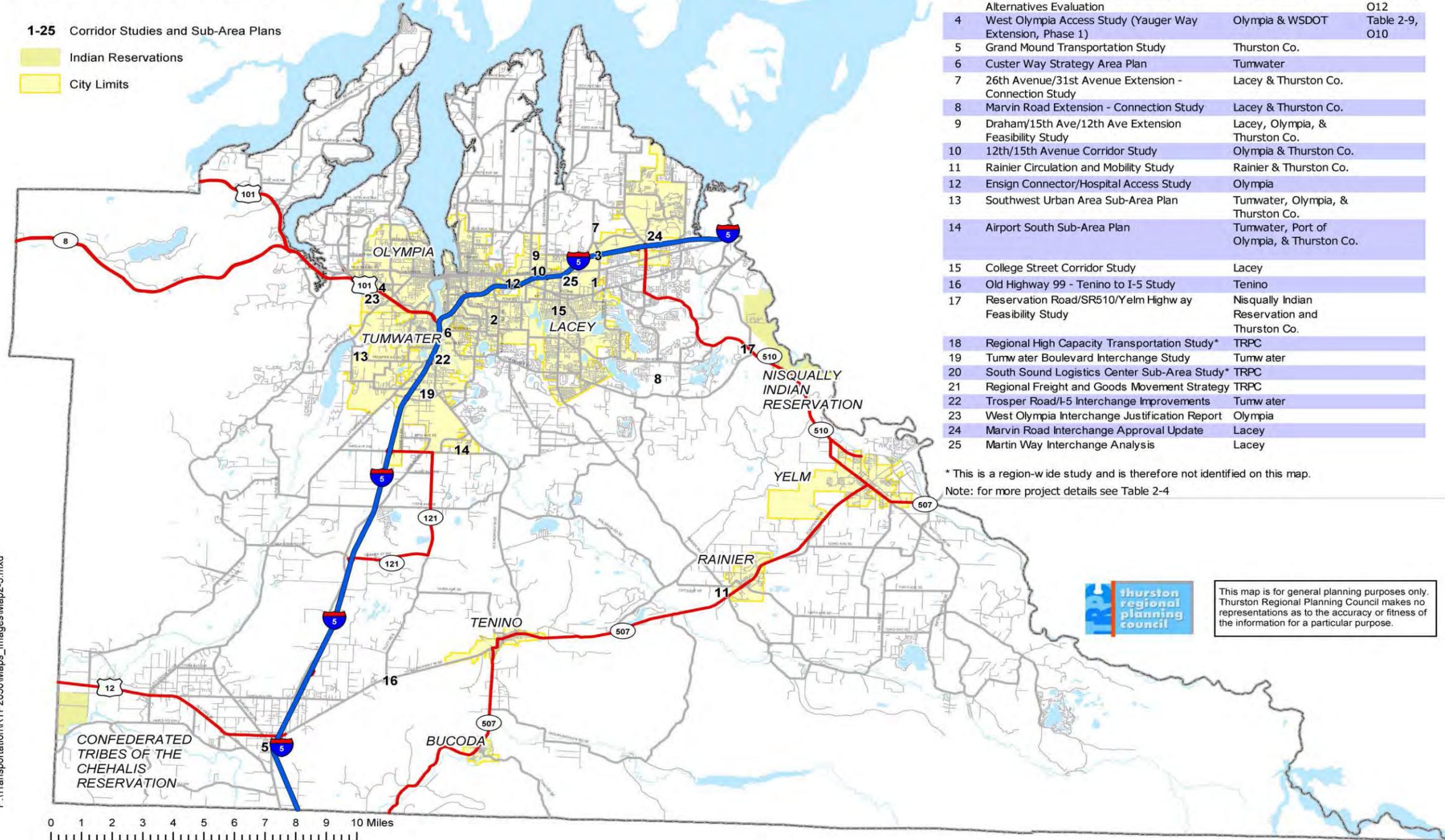


Source: TRPC Geographical Information System

### Map 2-3: Corridor Studies and Sub-Area Plans, Thurston County, WA

1-25 Corridor Studies and Sub-Area Plans

- Indian Reservations
- City Limits



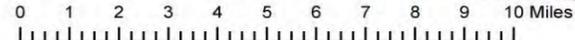
ID	Study Areas	Agency	Related Project
1	Carpenter Road Corridor Study	Lacey	
2	Boulevard Road Corridor Study	Olympia	
3	Lacey Transportation Systems Analysis and Alternatives Evaluation	Lacey & WSDOT	Table 2-9, O12
4	West Olympia Access Study (Yauger Way Extension, Phase 1)	Olympia & WSDOT	Table 2-9, O10
5	Grand Mound Transportation Study	Thurston Co.	
6	Custer Way Strategy Area Plan	Tumwater	
7	26th Avenue/31st Avenue Extension - Connection Study	Lacey & Thurston Co.	
8	Marvin Road Extension - Connection Study	Lacey & Thurston Co.	
9	Draham/15th Ave/12th Ave Extension Feasibility Study	Lacey, Olympia, & Thurston Co.	
10	12th/15th Avenue Corridor Study	Olympia & Thurston Co.	
11	Rainier Circulation and Mobility Study	Rainier & Thurston Co.	
12	Ensign Connector/Hospital Access Study	Olympia	
13	Southwest Urban Area Sub-Area Plan	Tumwater, Olympia, & Thurston Co.	
14	Airport South Sub-Area Plan	Tumwater, Port of Olympia, & Thurston Co.	
15	College Street Corridor Study	Lacey	
16	Old Highway 99 - Tenino to I-5 Study	Tenino	
17	Reservation Road/SR510/Yelm Highway Feasibility Study	Nisqually Indian Reservation and Thurston Co.	
18	Regional High Capacity Transportation Study*	TRPC	
19	Tumwater Boulevard Interchange Study	Tumwater	
20	South Sound Logistics Center Sub-Area Study*	TRPC	
21	Regional Freight and Goods Movement Strategy	TRPC	
22	Trosper Road/I-5 Interchange Improvements	Tumwater	
23	West Olympia Interchange Justification Report	Olympia	
24	Marvin Road Interchange Approval Update	Lacey	
25	Martin Way Interchange Analysis	Lacey	

\* This is a region-wide study and is therefore not identified on this map.  
 Note: for more project details see Table 2-4



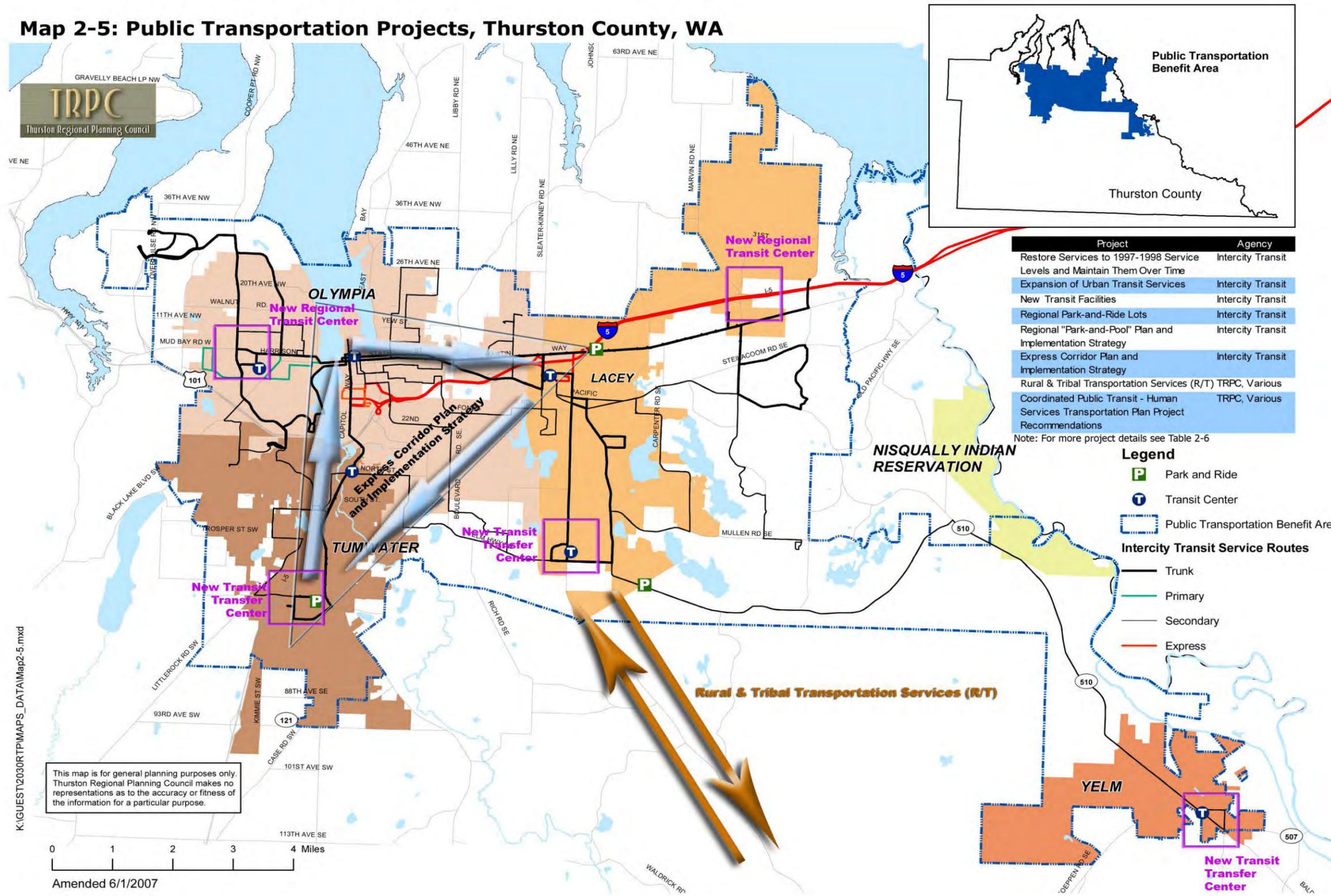
This map is for general planning purposes only. Thurston Regional Planning Council makes no representations as to the accuracy or fitness of the information for a particular purpose.

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Source: TRPC Geographical Information System

Map 2-5: Public Transportation Projects, Thurston County, WA



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This map is for general planning purposes only. Thurston Regional Planning Council makes no representations as to the accuracy or fitness of the information for a particular purpose.

0 1 2 3 4 Miles  
Amended 6/1/2007

## Policy Point 6: Future Interchanges

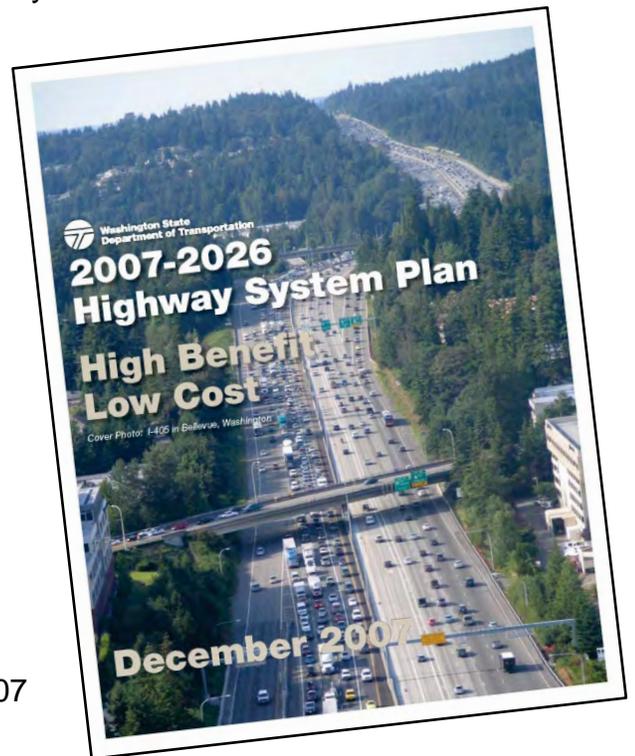
### **IS THE PROPOSED ACCESS POINT REVISION COMPATIBLE WITH A COMPREHENSIVE NETWORK PLAN?**

There is no comprehensive network plan for this section of I-5 and there are no new interchanges proposed within five miles of the proposed interchange improvements at the Martin Way and Marvin Road interchanges.

The I-5/Martin Way and I-5/Marvin Road interchange improvements are consistent with other proposed interstate improvements, as identified by WSDOT in their Highway System Plan 2007-2026.

In addition, there are on-going studies to improve interchanges at US 101 (Exit 104) and in the Joint Base Lewis-McChord (JBLM) area (Exit 119 to Exit 123), however no recommended improvements have been identified. There is also a corridor study currently underway for the JBLM area of I-5 that is considering adding a variety of improvements to reduce congestion along I-5. The proposed interchange improvements at Martin Way and Marvin Road are compatible with the improvements under consideration in the JBLM area.

WSDOT has identified various interstate improvements within or near the Martin Way and Marvin Road interchanges in their current *Highway System Plan 2007-2026*, completed in December 2007 and updated in 2008.



The Highway System Plan (HSP) organizes projects into three tiers and also identifies projects that require further analysis. These levels are as follows:

- **Tier I:** Low cost projects with a high return on investment and short delivery schedules.
- **Tier II:** Moderate to Higher cost projects with potential network benefits.
- **Tier III:** Higher cost projects with corridor-wide benefits.
- **Solutions that Require Further Analysis:** This section of the HSP lists other projects that require further analyses before a recommendation can be made.

Study area projects listed in the HSP are summarized in Table 6-1.

**TABLE 6-1: Study Area Projects from WSDOT’s Highway System Plan**

Projects	Improvement	Project Completed	Consistent with IJR
<b>TIER I</b>			
I-5/Pacific Avenue Interchange – NB Off-ramp Double Left-turn	Widen the I-5 NB off-ramp for double left-turn lanes to WB Pacific Avenue and modify the existing EB Pacific Avenue roadway section to create double left-turn lanes toward the I-5 NB on-ramp terminal.		Yes
I-5/Martin Way Interchange – SB Off-ramp Double Right-turn:	Add a SB right-turn lane to create two right-turn lanes and extend the storage length of the existing left-turn lane at the SB off-ramp terminal.		Yes
I-5/Marvin Road Interchange Improvements	Add right-turn Lane to SB Off-ramp and create double left-turn Lanes:	Constructed in 2007	Yes
<b>TIER II</b>			
I-5/Sleater-Kinney Interchange – SB Acceleration Lane on Sleater-Kinney Road:	Add a SB acceleration taper and/or auxiliary lane on Sleater-Kinney Road to allow free right-turns at the ramp terminal (EB right-turn movement).		Yes
I-5/Martin Way Interchange – NB Off-ramp Deceleration Lane Extension:	Add a 0.3 mile NB deceleration lane into the Martin Way Interchange off-ramp.		Yes
I-5/Pacific Ave Interchange – Collector Distributor Lanes or Extend Auxiliary Lanes:	Add one Collector-Distributor or Auxiliary Lane in both the NB and SB directions.		Yes
I-5 Marvin Road I/C to Nisqually Interchange – SB Climbing Lanes:	Add a SB climbing lane from the Nisqually on-ramp past the crest of a three percent vertical curve near the Marvin Road (SR 510) Interchange.		Yes
<b>TIER III</b>			
None Listed			NA

TABLE 6-1: Study Area Projects from WSDOT’s Highway System Plan Continued

Projects	Improvement	Project Completed	Consistent with IJR
<b>Solutions Requiring Further Analysis</b>			
Martin Way Interchange	Add additional lane on Martin Way to double the length of left-turn storage in both directions and install a bike path behind bridge columns	Constructed in 2011	Yes
I-5/Martin Way Interchange – Expand Park and Ride Lot and Consider Transit Only Right-turn Lane to NB On-ramp:	Expand the existing Martin Way park and ride lot by about 150 spaces and consider a “transit only” right-turn drop lane between the existing Martin Way park and ride lot and the I-5 NB on-ramp. (Note: the project will be designed to allow future construction of a transit only off connection from the NB on-ramp)		Yes
I-5/Marvin Road Interchange – Single Point Urban I/C:	Re-construct the interchange into a single point urban interchange and possibly add ramp meters on the on-ramps.		Yes
I-5/Lilly Road Vicinity – Park and Ride Lot	Construct a new 80 space park and ride lot near Lilly Road undercrossing.		
I-5/Trosper Road Interchange to Pierce County Line – Urban Intelligent Transportation Systems Master Plan:	Develop a Master Plan for I-5 ITS improvements other than ramp metering.		Yes
I-5/College Street Vicinity – High Capacity Transit Ramps:	Study high capacity transit ramps (NB off-ramp and SB on-ramp) between Sleater-Kinney undercrossing and College Street undercrossing.		Yes

### ARE THE PROPOSED IMPROVEMENTS COMPATIBLE WITH OTHER KNOWN IMPROVEMENT PROJECTS ALONG I-5?

There are other interstate improvement projects currently underway or recently completed that analyzed and evaluated improvements along the I-5 corridor in Thurston County and Pierce County. These projects include:

- A transportation study is currently underway at the I-5/SR 101 Interchange to the south. This transportation study and this *I-5/Martin Way Interchange and I-5/Marvin Road Interchange IJR* utilize the same TRPC travel demand model for traffic forecasting.
- A proposed transportation feasibility study and corresponding IJR for I-5 and four interchanges in the vicinity of Joint-Base Lewis McChord to the north will be started in January 2013. Information from this IJR will be incorporated in the feasibility study.
- The previous LTSAAE Study evaluated and analyzed potential improvements to existing I-5 interchanges in the vicinity of the study area. The study area for the LTSAAE Study extended from the Nisqually (Martin Way) Interchange (Exit 114) to the Sleater-Kinney Road Interchange (Exit 108) and recommended improvements to the I-5/Martin Way Interchange and the I-5/Marvin Road Interchange. Work from this study was incorporated into the *I-5/Martin Way Interchange and I-5/Marvin Road Interchange IJR*.
- Moving Washington is a three-pronged approach to reduce congestion on Washington's primary urban corridors by improving travel time and reliability, increasing safety, using existing roadways more effectively, and reducing single occupancy vehicles by improving transit reliability and efficiency. Moving Washington strategies include the following:
  - Managing demand by providing various mobility choices
  - Operating existing roadways efficiently through preservation and maintenance and low-cost investments
  - Adding capacity strategically



## **Policy Point 7: Coordination**

### **ARE ALL COORDINATION PROJECTS AND ACTIONS PROGRAMMED AND FUNDED?**

The proposed modifications at the I-5/Martin Way Interchange and the I-5/Marvin Road Interchange are being considered in conjunction with other programmed local projects to improve traffic flow throughout the project area.

The analysis completed for this IJR was consistent with planned land use proposed by the City of Lacey and documented in both the City's comprehensive plan and the TRPC's *2025 Regional Transportation Plan*.

In the LTSAAE Study, several local projects were identified that could provide significant benefit to the study area. Although it was determined that these improvements alone would not accommodate all regional traffic growth, some projects were shown to provide significant benefit to traffic operations.

The LTSAAE Study and this IJR recommends the following local street improvements projects to be coordinated with the I-5/Martin Way and I-5/Marvin Road interchange improvements:

- Widening Carpenter Road from 2 to 4 lanes – Britton Parkway to Pacific Avenue.
- Constructing College Street Extension (1 lane each direction) from 6th Ave NE to 15th Ave NE.
- Widening Britton Parkway from 2 to 4 lanes, Gateway Boulevard to Carpenter Road (Widening has already been completed from Marvin Road to Gateway Boulevard).
- Constructing a roadway grid in the Hawks Prairie Business District.
- Widening 15th Avenue to complete a 4/5 lane corridor generally parallel to and north of Interstate 5 between Orion Drive and Sleater-Kinney Road.
- Operation of the signal at the intersection of Martin Way and College Street.

Central Boulevard in the Hawks Prairie Business District will be completed from Main Street or Britton Parkway to the I-5 right of way before the collector/distributor road is completed.

All revisions to the signal timing on Martin Way shall incorporate the intersection of Martin Way / College Street and both ramps signals at I-5 as a complete signal system. The Martin Way / College Street signal timing optimization process will ensure that the SB off-ramp queue does not extend back the SB I-5 mainline. The signal timing will be optimized to minimize delay and shall be done with concurrence of both the City of

## Policy Point 7: Coordination

Lacey and the Washington State Department of Transportation. The timing plan will pay particular attention to the congestion and queue length of the SB off-ramp.

The Martin Way NB on – ramp to I-5 is designed to not preclude future addition of a transit only off connection from the on-ramp to the park and ride lot located adjacent to the interchange. Provisions for an on connection from the park and ride lot will not be considered.

These street improvements will improve local circulation within the study area to reduce travel on I-5 for local trips. These local street improvement projects were programmed and adopted into the *City of Lacey's 2012-2017 Transportation Improvement Program (TIP)* and *Thurston County's Six-Year (2012-2017) Transportation Improvement Program*. The City of Lacey and Thurston County developed their TIP projects to support the City and County's land use concepts.

The City is committed to construct these local improvement projects. Currently, traffic mitigation funds are being collected from new developments and the City is actively seeking additional funds from outside sources. As area development occurs and when funding becomes available, the City will move forward with implementation of these improvements.

## Policy Point 8: Environmental Processes

### WHAT IS THE STATUS OF THE PROPOSAL’S ENVIRONMENTAL PROCESSES?

This policy point highlights the required environmental process for the improvements described by this IJR.

The IJR report is intended to result in a “finding of engineering and operational acceptability.” The IJR report will be “approved” concurrent with a formal decision on the NEPA environmental document prepared concurrently with this report.

A preliminary screening of potential environmental impacts of improvements at the I-5/Martin Way Interchange and the I-5/Marvin Road Interchange was completed as a part of the LTSAAE Study. The screening evaluated each environmental element identified in the Washington State Environmental Policy Act.

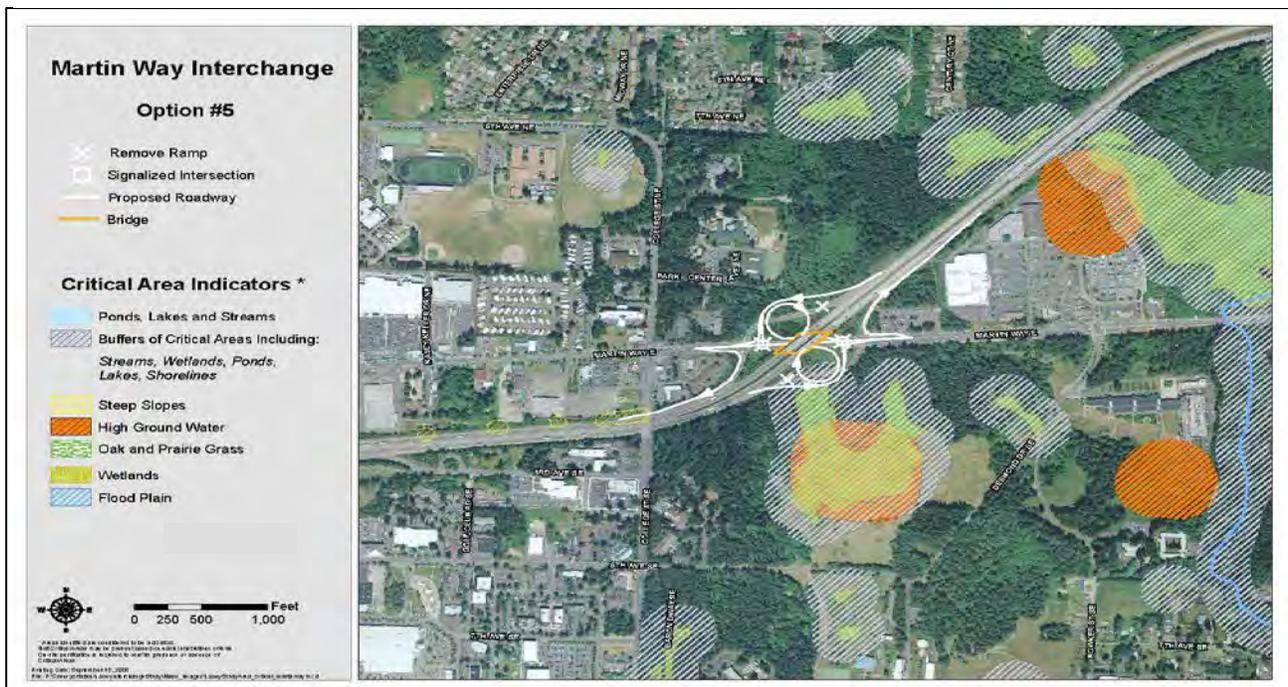
Subsequent to the initial screening a draft NEPA Documented Categorical Exclusion was prepared including appropriate discipline reports. The draft NEPA and SEPA documents are included as Appendix P.

The following summary relates to the preferred improvement for the I-5/Martin Way Interchange and the I-5/Marvin Road Interchange.

#### A. Natural Environment

The natural environment category includes issues related to wetlands, surface waters, floodplains, geology and soils, and air quality. Some of the critical areas are illustrated on Figures 8-1 and 8-2 for the Martin Way and Martin Road areas, respectively.

**FIGURE 8-1: I-5/Martin Way Interchange - Critical Area Indicators**





groundwater area is situated near the SB off-ramp. Separate wetland reports were prepared for each interchange project to prepare an effects determination and recommend countermeasures. .

**Stormwater:** A drainage analyses and preliminary design was prepared and stormwater management methods identified to support development of the environmental documents for the projects.

**Earth:** According to information provided by Thurston Geodata, the primary soils in the study area consist of gravelly sandy loam material. During the preliminary design and environmental phases of the projects, a geotechnical report was prepared to provide preliminary recommendations for designing and constructing the interchange improvements.

**Plants and Animals:** The proposed project has potential to affect water quality during short-term construction and possibly increase pollutants from stormwater runoff. A separate biological evaluation for each project was completed to document potential impacts to federally-listed, threatened or endangered species.

Neither Puget Sound Chinook salmon nor steelhead have been documented in Woodland Creek in several years; therefore, it is not anticipated that the interchange improvement at Martin Way will adversely affect these populations. The findings of the biological evaluation are that the project will have no effect on endangered species.

## B. Built Environment

The built environment considers impacts to business and residential properties, specifically displacements that would occur as a result of the project. The amount of right-of-way that would be required for the improvement is also a consideration. Impacts to recreational, cultural and historic resources, and environmental justice are also evaluated in this category, as well as any impacts related to noise and hazardous materials sites.

**Property Impacts/Right of Way:** There are no residential properties that would be displaced by either the Martin Way or Marvin Road interchange improvements. There may be possible impacts to commercial properties in the SW quadrant of the existing interchange at Marvin Road. The Thurston County Waste and Recovery Center (WARC), the ramps are designed to minimize impacts to physical property and/or site access.

**Hazardous Materials:** Land uses in the vicinity of both projects were evaluated, and a Hazardous Materials Study conducted to assess environmental impacts of each project. The results of the study are included in the draft NEPA and SEPA documents.

**Noise:** A noise study was prepared to evaluate traffic noise levels at sensitive receptors near the projects and to identify potential mitigation measures. The outcome of the noise study is that no additional mitigation is warranted.

**Land Use/Recreation:** Neither improvement will impact existing recreational opportunities. There will be some land converted for use as roadways, but land uses in the area will remain as currently designated.

**Historic/Cultural Resources:** A Cultural and Historic Resources assessment was prepared as part of the environmental documentation for the project. No cultural resources that can be recommended as eligible for listing in the National Register of Historic Places (NRHP) were found.

### WHAT IS THE ENVIRONMENTAL PROCESS FOR THIS IJR?

Both NEPA and SEPA documentation were prepared for this IJR. For the NEPA documentation that addresses the I-5/Martin Way Interchange and the I-5/Marvin Road Interchange improvements as a Documented Categorical Exclusion (DCE) was prepared.

For SEPA documentation, separate checklists were prepared for each interchange improvement. It is anticipated that each project will receive a Mitigated Determination of Non-Significance.

Preparation of the draft NEPA and SEPA documentation was completed in 2015. The NEPA Environmental Classification Summary and the SEPA Checklist are supported by the following discipline reports:

- Wetland and Stream
- Biological Assessment
- Cultural and Historic Resources
- Air Quality
- Noise
- Hazardous Materials
- Stormwater
- Geotechnical

### WHAT ARE THE ENVIRONMENTAL PERMITS AND APPROVALS NEEDED FOR THESE INTERCHANGE IMPROVEMENT PROJECTS?

The following permits and approvals are anticipated:

- NEPA Documented Categorical Exclusion
- SEPA Mitigated Determination of Non-Significance
- Army Corp of Engineers – Section 404 Permit

- Section 7 (Endangered Species Act) compliance
- Section 106 (Cultural and Archeological Resources) compliance
- Department of Ecology – Section 401 Water Quality Certification
- Department of Ecology – NPDES Construction Permit
- City of Lacey – Wetland Development Permit
- City of Lacey – Land Clearing/Forest Practices Permit

### **WHAT IS THE PUBLIC INVOLVEMENT PROCESS FOR THE PROPOSED IMPROVEMENTS?**

Pursuant to the *WSDOT Design Manual* Chapter 210 and the *WSDOT Environmental Procedures Manual* Chapter 410 and 411, there are no required public involvement activities for a NEPA Documented Categorical Exclusion and/or SEPA Checklist Mitigated Determination of Non-Significance. However, public outreach and public involvement is strongly encouraged as an essential part of the project development process. Public involvement provides an opportunity to increase project awareness and provides opportunities for public input.

FHWA's *Public Involvement Techniques for Transportation Decision-Making* (Sept. 1996) provides guidance on effective public involvement. During the environmental process, a public involvement program will be developed based on the following steps:

- Set goals and objectives
- Identify people to be reached
- Develop a general approach/strategies
- Develop specific techniques

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