North Lewis County Industrial Access Transportation Study (NLCIATS)

North Lewis County Industrial Access Transportation Study Final Summary Report

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WSDOT

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December 8, 2023

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Acronyms and Abbreviations

Acronym / Abbreviation	Definition
ADA	Americans with Disabilities Act
BLTS	Bicycle Level of Traffic Stress
FHWA	Federal Highway Administration
HSM	Highway Safety Manual
I-5	Interstate 5
LEP	Limited English Proficiency
LOS	level-of-service
LTS	Level of Traffic Stress
NB	northbound
NCHRP	National Cooperative Highway Research Program
NLCIATS	North Lewis County Industrial Access Transportation Study
OD	origin-destination
PDO	property damage only
PLTS	Pedestrian Level of Stress
PSAP	Puget Sound and Pacific Railroad
RCW	Revised Code of Washington
SB	southbound
Study	North Lewis County Industrial Access Transportation Study
TRMW	Tacoma Rail Mountain Division
TRPC	Thurston Regional Planning Council
WSDOT	Washington State Department of Transportation

WASHINGTON STATE DEPARTMENT OF TRANSPORTATION
SOUTHWEST REGION

North Lewis County Industrial Access Transportation Study

Approved By:

10/05/2023

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1 INTRODUCTION

This study was initiated as legislative proviso L2000204, effective May 18, 2021, and is being completed and coordinated through the Washington State Department of Transportation (WSDOT). The proviso language reads as follows:

> The study shall examine new, alternate routes for vehicular and truck traffic at the Harrison interchange (Exit 82) in North Centralia and shall allow for a site and configuration to be selected and feasibility to be conducted for final design, permitting, and construction of the I-5/North Lewis County Interchange project.
>
> It is the intent of the legislature that, for the I-5/North Lewis County Interchange project, the department develop and design the project with the objective of significantly improving access to the industrially zoned properties in North Lewis County. The design must consider the county's process of investigating alternatives to improve such access from Interstate 5 that began in March 2015.

The legislature advanced funds from Connecting Washington to conduct this study in recognition of the challenges that currently exist for freight vehicles accessing industrial properties from I-5 in North Lewis County. Industrially zoned lands in North Lewis County currently lack direct access to I-5. The nearest interchange to the Port of Centralia industrial parks is Exit 82, at Harrison Avenue and I-5. To access I-5, freight traffic to and from the Port of Centralia must travel through the congested Harrison Avenue commercial corridor or travel several miles to the Grand Mound interchange in the north.

Although Connecting Washington allocates $50 million to improving access to industrial properties in North Lewis County, this funding cannot accomplish the full suite of improvements identified in this report. This funding environment was communicated at stakeholder meetings three and four, and acknowledged by members of the stakeholder team; which endorsed the list of projects. The initial Connecting Washington investment will nonetheless provide a critical budget foundation for stakeholders to leverage in the future.

1.1 Purpose and Need

With input and approval from the study’s stakeholder team, WSDOT adopted a Purpose and Need statement for the study, as outlined below.

Purpose

The purpose of the North Lewis County Industrial Access Transportation Study (NLCIATS) is to examine new, alternate routes for vehicular and truck traffic in the proximity of the Harrison Avenue interchange at I-5 (Exit 82) that will lead to identification of a recommended set of strategies to improve access to the industrially zoned properties in North Lewis County.

Need

The study will address the current conflicts between freight traffic and local road users of all modes. In executing the work to achieve the study's Purpose and Need, the project team will strive to achieve the following goals and objectives:

Take a Holistic View of Transportation in North Lewis County

- Enhance connectivity between South Thurston County and North Lewis County
- Acknowledge the value of working across jurisdictional boundaries to accomplish common safety, operations, and economic development goals
- Identify solutions by reaching consensus with support from stakeholders, recognizing that there will be give and take to achieve our vision
- Coordinate with the County-led project on Reynolds Avenue and Harrison Avenue to identify a suite of solutions that reduce crash potential and increase mobility for all users

Reduce Crash Potential and Injury Severity Levels

- Reduce crash potential and injury severity levels for all users through viable solutions, with a focus on vulnerable users such as school children, pedestrians, and cyclists
- Prioritize community needs adjacent to Harrison Avenue, including schools, housing, services, and commercial areas that currently share roadways with freight traffic

Identify Potential Solutions for Improved Traffic and Multimodal Operations

- Provide solutions that enhance mobility, reduce fatal and serious injury crash potential, and improve access for all modes; support economic development and accommodate future development
- Identify solutions that are forward compatible with the ultimate vision for the corridor, acknowledging that it cannot all be built at once
- Consider Lewis County's process of investigating alternatives to improve industrial access to I-5 that began in March 2015
- Apply "dig once" principles where possible

1.2 Prior Studies

1.2.1 2009 North Lewis County Interchange Feasibility Study

WSDOT's Southwest Region Design Office completed a study in 2009 to examine the feasibility of a new interchange on I-5 between the existing Harrison Avenue Interchange and Grand Mound interchange. This study did not identify a preferred interchange location nor conduct detailed travel modeling or engage in preliminary design work. The study concluded that design and construction of a new interchange on I-5 is technically possible but is not likely to be supported or approved by the Federal Highway Administration (FHWA).

1.2.2 2017 NLCIA Study, Strategic Framework and Action Plan

From March 2015 through July 2017, Lewis County conducted a study that focused on transportation improvements as a catalyst for economic development in North Lewis County. A key goal of this study was to improve industrial access from the TransAlta site to I-5.

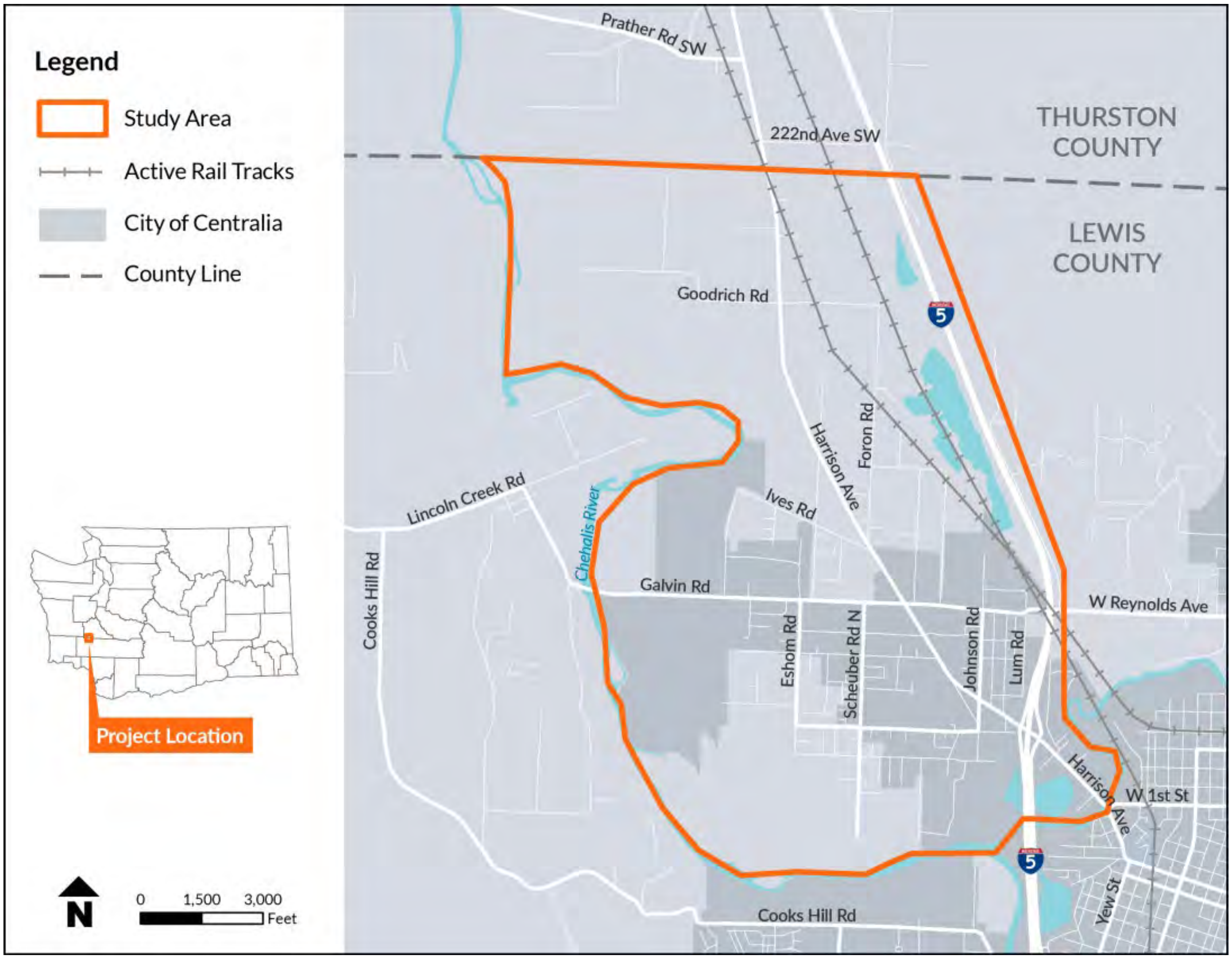
One of the key deliverables of the 2017 NLCIA Study was a Strategic Framework and Action Plan document. Several of the recommended strategies have now been completed, including increasing bicycle and pedestrian facilities, and replacing the aging Grand Prairie Elementary School. The central recommendation of the 2017 study was to extend the I-5 collector-distributor lanes north to Reynolds Avenue, effectively creating a new interchange at Reynolds Avenue. WSDOT had concerns regarding the feasibility of the phasing of improvements that was identified in this study.

1.3 Study Area

As shown in Figure 1-1, the study area is focused on I-5 and the industrial lands to the west of the interstate. The northern boundary of the study area is the Lewis County/Thurston County line. The western and southern boundaries track the Chehalis River between the county line in the north and I-5 in the east.

The stakeholder team adopted the study boundary at its second meeting in December 2022, with the caveat that the project team analyzes some intersections and potential project locations outside of this boundary.

Figure 1-1: Study Area Map

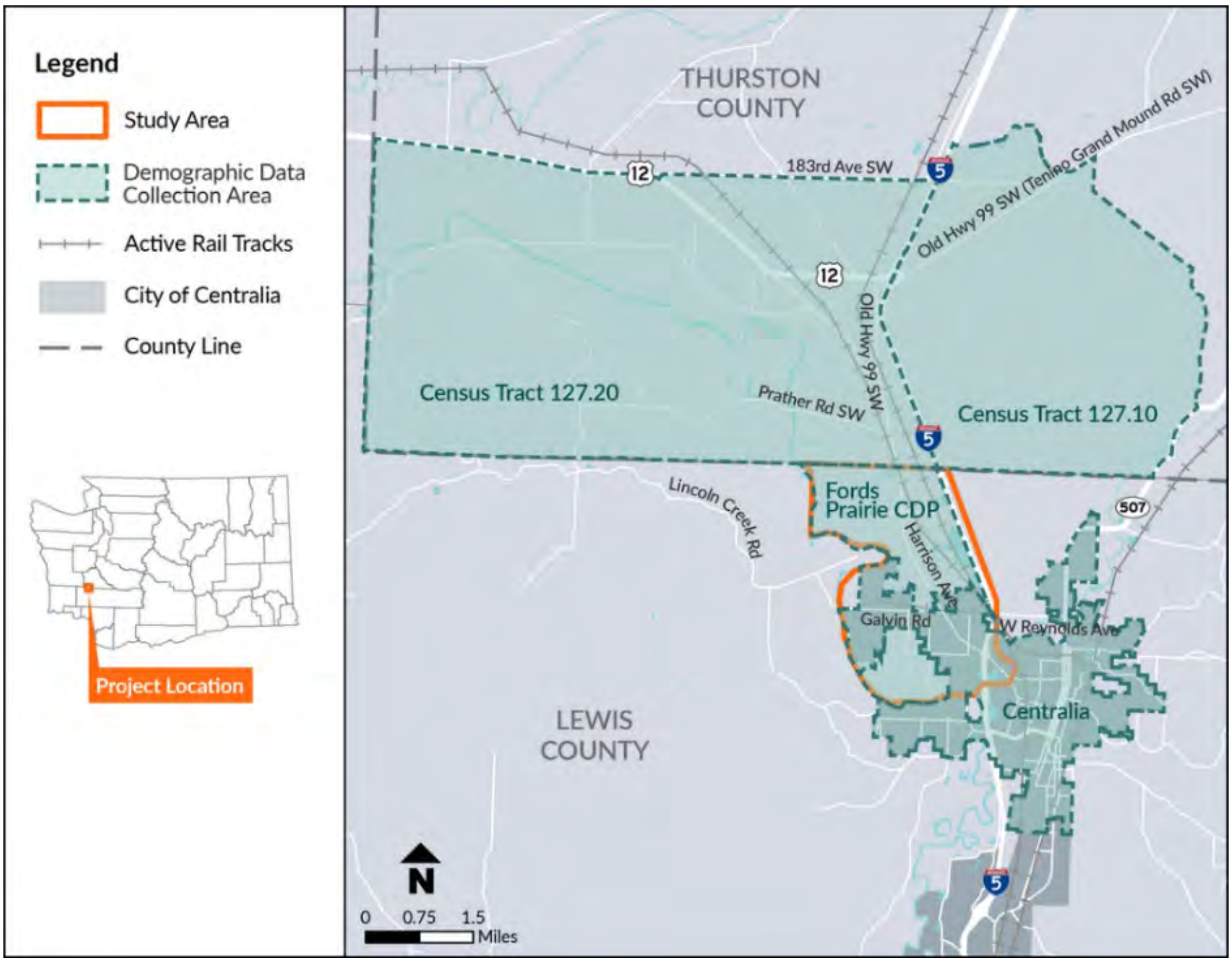


2 BASELINE AND FUTURE CONDITIONS

2.1 Demographic Trends

As transportation issues within the study area also affect those who live in peripheral, surrounding areas, the demographic analysis included populated areas surrounding the study area. As shown in Figure 2-1, the demographic analysis area included Centralia, Fords Prairie, and two census tracts in south Thurston County.

Figure 2-1: Demographic Analysis Area



2.1.1 Demographic Overview

Between 2010 and 2020, the demographic analysis area population grew by over 2,500 residents. The median household income also grew significantly, increasing by 38 percent. Table 2-1 summarizes demographic trends within the analysis area and statewide between 2010 and 2020. Table 2-2 compares demographic data within the analysis area to statewide data in 2019.

Table 2-1: Demographic Trends from 2010 to 2020

Target Measure	2010	2020	% Change
Total population	26,941	29,494	+9.48%
Median household income	$37,938	$52,517	+38%
People of color	5,465	8,337	+53%
Children (younger than 18, percent)	6,846	6,712	-1.96%
Seniors (65 and older)	4,153	5,272	+26.94%

Source: US Census

Table 2-2: Comparison of Area and Statewide Demographic Data, 2019

Target Measure	Demographic Analysis Area	Washington State
Total population	28,442	7,614,893
People of color (percent)	22%	25%
Median household income	$52,960	$82,400
Seniors (65 and older, percent)	18%	15%
Children (younger than 18, percent)	24%	22%
Total LEP	6%	8%
- Spanish LEP	5%	3%
- Asian/Pacific Island languages LEP	0.4%	3%

Source: American Community Survey, 2019 5-Year Estimates
Note: LEP = Limited English Proficiency

The demographic analysis area shows a higher proportion of children and seniors than the statewide average. The median household income is also significantly lower than the statewide average, and the study analysis area is less racially diverse than the state as a whole.

Limited English Proficiency (LEP) households are those that report another language as being primarily spoken in that household with English “not spoken well.” Within the demographic analysis area, Spanish speakers are the largest group of non-English speakers, which account for 5 percent of the demographic analysis area total population. Speakers of Asian and Pacific Islander languages are the second-largest group, which make up 0.4 percent of the demographic analysis area total population. These percentages are consistent with statewide trends.

2.1.2 Economic Health

As shown in Table 2-3, the demographic analysis area provides a total of 10,710 jobs in 2019. Compared to statewide data, lower-income jobs make up a larger share of all jobs in the area. Within the analysis area, 23 percent of jobs are low-income ($1,250 per month or less), which is a 6 percent larger share than the statewide average. Low-medium income jobs represent 38 percent of jobs ($1,251 to $3,333 per month), which is a 10 percent larger share than the statewide average.

Table 2-3: Analysis Area and Statewide Employment Data, 2019

Target Measure	Study Analysis Area	Washington State
Total jobs	10,710	3,282,974
Low-income jobs ($1,250 per month or less)	23%	17%
Low-medium income jobs ($1,251 to $3,333 per month)	38%	28%

Source: LEHD Origin-Destination Employment Statistics (LODES), Census on the Map, 2019

The U.S. Environmental Protection Agency's Environmental Justice Screening and Mapping Tool (EJSCREEN) includes socioeconomic indicators and compares the data to statewide and nationwide levels. For the demographic analysis area, the unemployment rate is at 7 percent and in the 77th percentile statewide and in the 74th percentile nationally. A percentile above 50 percent indicates that unemployment within the analysis area is higher than the state or national averages.

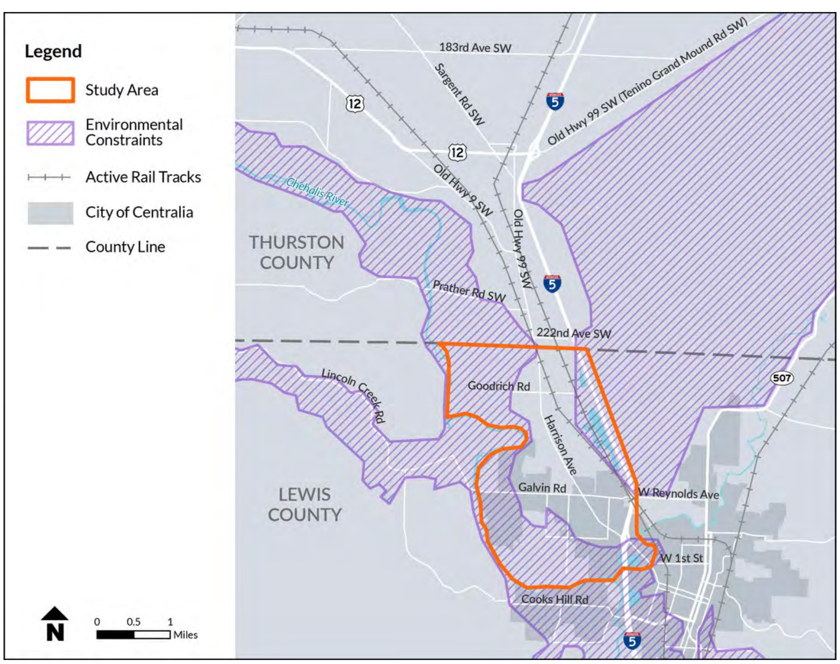
2.1.3 Environmental Justice and Community Health Indicators

As shown in Appendix A.1, environmental justice indexes that are in a higher percentile nationally include air toxics cancer risk, Superfund proximity, air toxics respiratory hazard index, and underground storage tanks.

2.2 Environmental Screening

The study area and its surroundings contain many environmental constraints, which are concentrated in two areas, as shown in Figure 2-2. Because of the construction complications of working in environmentally constrained areas, any future transportation project proposed in these areas would require additional time and coordination and would likely incur additional costs.

Figure 2-2: Environmental Constraints Summary Map



2.2.1 Critical Areas

The State of Washington’s Growth Management Act requires all cities and counties to adopt development regulations that protect critical areas. These critical areas include geologically hazardous areas, wetlands, fish and wildlife habitat conservation areas, critical aquifer recharge areas, and frequently flooded areas.

Figure 2-3 illustrates the geohazards in the study area, and Figure 2-4 shows other critical areas. For additional detail regarding critical areas and other environmental considerations in the study area, refer to Appendix A.1, Section 3.1.

Figure 2-3: Geohazards Map

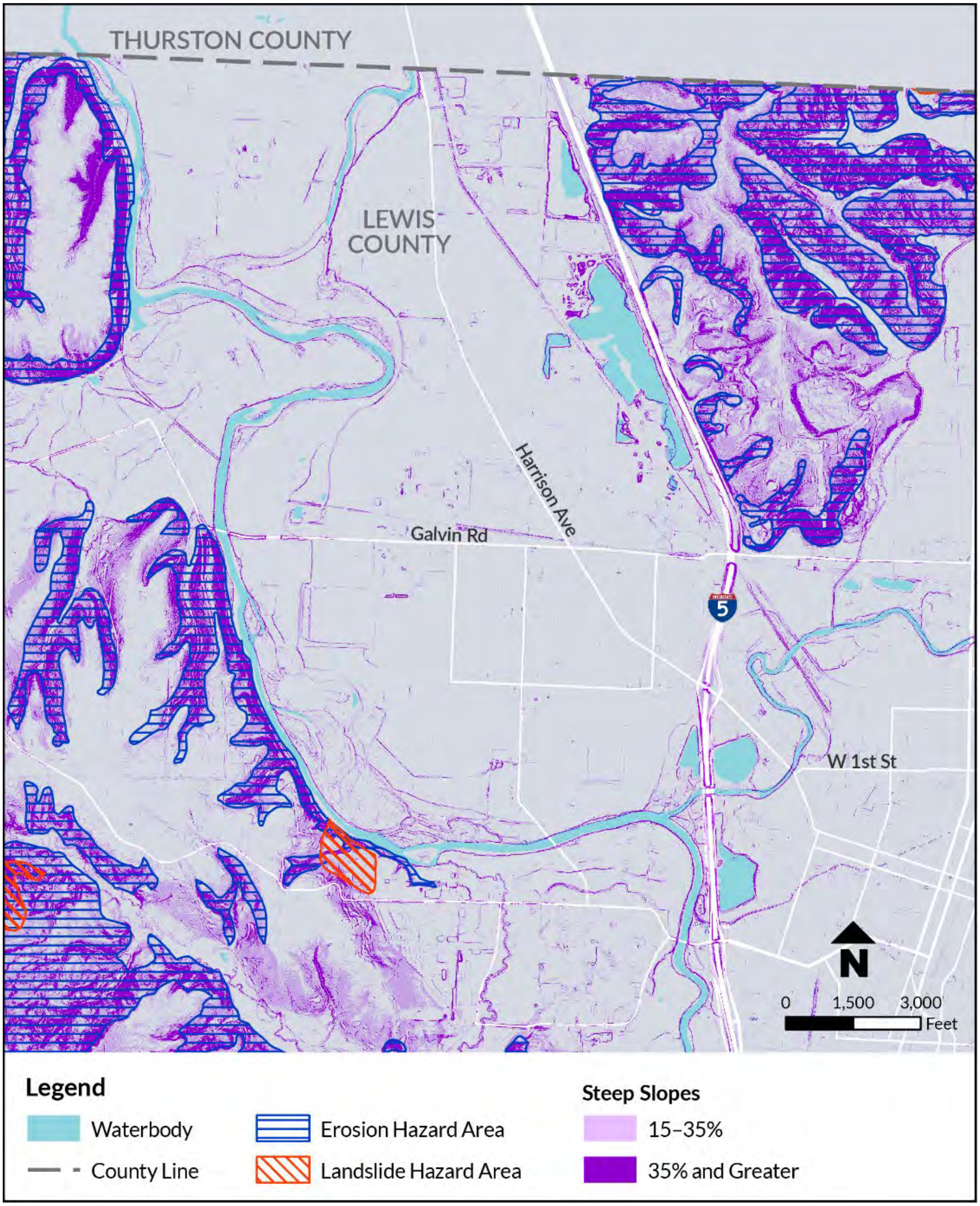
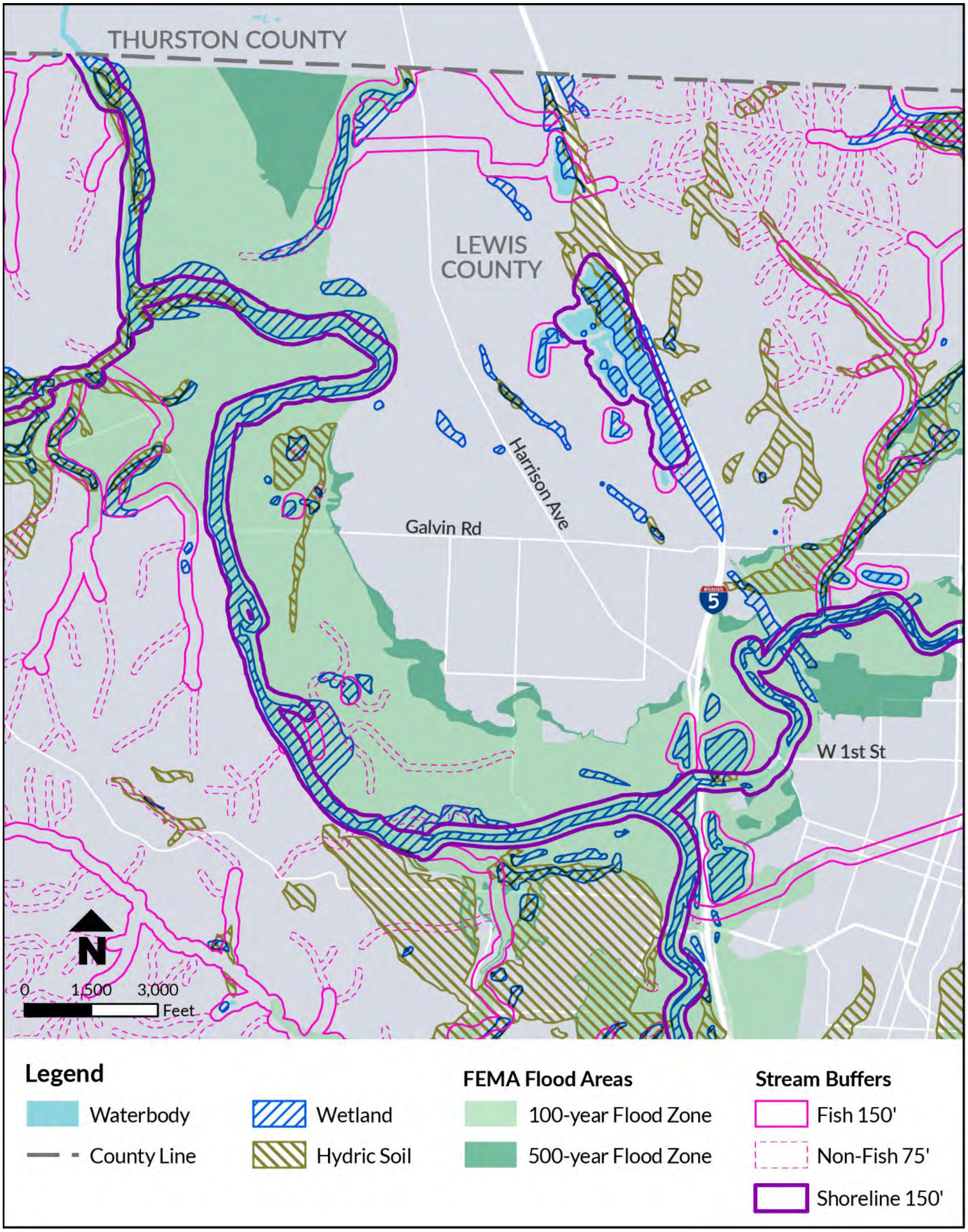


Figure 2-4: Aquatic Critical Areas Map



2.2.1.1 Floodplain and Climate Vulnerability

Both the Skookumchuck and Chehalis Rivers lack flood control infrastructure, leaving the study area particularly vulnerable to flood risk. Including its Urban Grown Area, 26% of the land within the City of Centralia lies within a floodplain (City of Centralia 2022). Much of the land owned by the Port of Centralia also lies within the Chehalis River floodplain, including land recently developed.

Centralia has experienced at least 24 flood events between 1887 and 2009. In the winters of 1996, 2007, and 2009, flooding was caused by heavy rain and snowmelt. The 1996 flood was particularly severe and affected large tracts of land outside of the Federal Emergency Management Agency floodplain. As climate changes continue to accelerate, flood risk is commensurate and expected to increase.

2.2.1.2 Fish Passage Barriers

Currently no corrected fish passage barriers are located within the study area. One corrected fish passage barrier was noted near Mellen Street, where China Creek flows under I-5. Another corrected barrier is located just north of the Lewis County line, where an unnamed stream flows under I-5.

In addition, no uncorrected fish passage barriers are located within the study area. One uncorrected barrier is located south of the study area, at the I-5 southbound off-ramp to State Route 6. Another uncorrected barrier is located just north of the Lewis County line and south of 216th Avenue SW where an unnamed stream flows under I-5. This uncorrected barrier is approximately one-third mile northwest of the second corrected barrier referenced above.

2.3 Existing and Proposed Land Use

Within the study area, zoning is largely commercial and industrial. However, distinct pockets of residentially zoned land occur throughout the study area, including parcels zoned for commercial or industrial use that include pre-existing homes.

In terms of growth, recent large-lot residential development has occurred just east of I-5 and north of Reynolds Avenue. New developments have also occurred at the Port of Centralia-owned industrial parks within the study area, most notably the large distribution center at Port Park 1 just south of Galvin Road and east of the Chehalis River. Some recent residential development has occurred just east of I-5 and north of Reynolds Avenue. Additional industrial developments since 2019 include Stihl NW in Port Park 2 at Kuper Road and Foron Road, Walmart Storage and Transfer Yard in Port Park 2 at Foron Road, and Midway Logistics at Harrison Avenue just south of Kuper Road.

Future industrial development is also planned at Port Park 1 on Northpark Drive and on Reynolds Avenue adjacent to I-5.

2.3.1 City of Centralia

Land use along Harrison Avenue near I-5 is zoned Highway Commercial or General Commercial. East of I-5, parcels along Reynolds Avenue are zoned Light Industrial, with some residential pockets. Several large parcels are zoned Heavy Industrial adjacent to the Port of Centralia's Park 2, in the immediate vicinity of I-5 and north of Reynolds Avenue. In addition, a number of parcels zoned Heavy Industrial are adjacent to the Park 2 and are located north of Galvin Road and east of the Chehalis River. The City of Centralia's current zoning map and comprehensive plan map can be viewed online.

2.3.2 Lewis County

Much of the land within Lewis County currently zoned for Light or Heavy Industrial is currently residential, vacant, or open space. As demand for industrial land near I-5 continues to increase, development of these industrially zoned parcels is anticipated to accelerate Lewis County's current zoning map and comprehensive plan map can be viewed online.

2.3.3 Port of Centralia

In February 2021, the Port of Centralia updated its Master Plan. This Master Plan is largely focused on development standards on the Port's properties. The plan also includes maps of the Port's three industrial parks, two of which are in the study area.

Park 1 is located near Galvin Road, east of the Chehalis River. All parcels in Park 1 are zoned Heavy Industrial. It is close to non-Port-owned parcels zoned Light Industrial. Park 2 is just west of I-5 and is accessed via Harrison Avenue to Kuper Road, Robert Thompson Road, and Hoss Road. The Port-owned property and a map of truck routes associated with each Port-owned industrial park can be viewed in the Master Plan.

2.4 Access and Circulation

2.4.1 State and Federal Standards

WSDOT owns, operates, and maintains I-5, which is aligned through the study area with the Harrison Avenue interchange providing study area access. Any changes to existing access points or requests for new access are governed by the WSDOT Design Manual Chapter 530 – Limited Access Control. This chapter provides guidance for WSDOT to establish access control to arterial roadways within its jurisdiction.

Although WSDOT owns and operates I-5, the formal interstate status of the corridor requires approval from the FHWA for any changes to existing access points or the construction of new access points. The technical guidance for creating or changing access to the limited access roadways can be found in National Cooperative Highway Research Program (NCHRP) Report 687 – Guidelines for Ramp and Interchange Spacing.

Chapter 550 of the WSDOT Design Manual addresses freeway access revisions. Per Section 550.05:

> The goal of this first step in the access revision process is to look at the non-access transportation network to determine if improvements can be made that address performance gaps for all modes. Non-access improvements are solutions that do not impact the gore points to/from the mainline of the freeway. Examples are changes to the local street network, travel demand management, traffic operations enhancements, crossroads, ramp meters, minor geometric ramp modifications, transit, and minor ramp terminal modifications.

Per Section 550.05(2)(e), if non-access improvements can completely address the performance gaps, then the access revision process does not move forward. If non-access improvements do not completely address performance gaps, but do show value, then they should be carried forward into the Access Revision Report.

2.4.2 Local Access Management

Along Harrison Avenue in the vicinity of Exit 82, numerous driveways serve commercial properties. This corridor experiences frequent traffic backups, which increases congestion and the probability of crashes. As shown in Figure 2-11 in Section 2.8, Harrison Avenue near Exit 82 experiences the greatest volume of crashes in the study area. Section 2.8 also provides additional details on crash data within the study area.

2.5 Railroad Facilities

The rail system through Centralia is vital to local and statewide freight transportation systems. Currently, three freight railroads are located within the study area, two of which are active. Daily Amtrak passenger rail service is provided at the Centralia station located outside the study area in downtown Centralia.

2.5.1 Description and Inventory

The two active railroads within the study area are owned by Puget Sound and Pacific Railroad (PSAP) and Tacoma Rail Mountain Division (TRMW) (Figure 2-5). Both railroads access the study area in a north-south direction and closely follow the alignment of I-5. These railroads also converge at the I-5 underpass at Blakeslee Junction, which is the only at-grade rail crossing intersecting a high-volume roadway (Reynolds Avenue) within the study area.

Figure 2-5: Railroad Facilities Map

In 2021, Washington State's Freight and Goods Transportation System was updated. It classifies freight corridors into distinct categories based on annual freight tonnage moved. It defines tonnage thresholds for truck, rail, and waterway freight corridors and identifies heavily used freight transportation networks within the state.

Rail corridors are classified into five tiers based on annual gross freight tonnage:

- R-1: More than 5 million tons per year
- R-2: 1 million to 5 million tons per year
- R-3: 500,000 to 1 million tons per year
- R-4: 100,000 to 500,000 tons per year
- R-5: Less than 100,000 tons per year

Both active railroads in the study area are classified as freight corridors. PSAP is classified as an R-1 corridor with TRMW classified as an R-4 corridor. BNSF is classified as an R-1 corridor.

2.5.2 Freight Rail Assessment

The following issues constrain the current rail network within the study area:

- At-grade crossings, track curves, surrounding land uses, or speed limits that require trains to travel at slower speeds

- Rail facilities and existing rail-related infrastructure, such as freight terminals or marshaling yards, that are too small or require reversing maneuvers
- Insufficient numbers and insufficient capacities for rail cars
- Insufficient numbers of tracks or passing sidings

These constraints also affect vehicular traffic flow within the roadway network, particularly near the at-grade crossing at Blakeslee Junction. During peak hours, rail crossings at this location interrupt traffic flow, not only at the crossing location but at other critical intersections within the roadway network. An increase in future volumes of both rail and vehicle traffic will further stress the existing system, especially at rail/roadway interfaces. Any expansion to the railroads will require evaluation of the capacity at the crossing at Blakeslee Junction. The City of Centralia and Lewis County have secured grant funds for adding a secondary storage track and upgrading the switching capabilities at Blakeslee Junction.

2.6 Multimodal Facilities

Washington State legislation in Revised Code of Washington (RCW) 47.24 directs WSDOT to incorporate "Complete Streets" on all WSDOT projects with an estimated cost of $500,000 or more that are to be constructed on state highways within incorporated cities and population centers, and where the design phase of the project begins on or after July 1, 2022. Addressing Complete Streets principles in the study area would benefit pedestrians, bicyclists, and transit users.

Complete Streets is an approach to planning, designing, building, operating, and maintaining streets that enables access along and across the street for all people, including pedestrians, bicyclists, motorists, and transit riders of all ages and abilities. Complete Streets prioritizes more comfortable and equitable, context-sensitive network connectivity for all roadway users through close coordination with local partners and stakeholders. This aligns with WSDOT's policy and commitment to develop and maintain an interconnected and integrated multimodal transportation system that provides all Washington travelers with safe, sustainable, and equitable access.

WSDOT's existing statutory authority, including RCW 47.01.260, RCW 47.30.030, and RCW 47.01.078, also allows it to incorporate the principles of Complete Streets in the design and construction of projects on state limited access highways, on city streets that are not designated as state highway that pass through a state limited access facility, and on state routes within counties.

It is the stated policy of WSDOT to incorporate the principles of Complete Streets with facilities that provide street access with all users in mind, including pedestrians, bicyclists, and public transportation users, on projects to be constructed on state highways consistent with Engrossed Substitute Senate Bill 5974 and with existing statutory authority.

2.6.1 Pedestrian Assessment

2.6.1.1 Existing Pedestrian Facilities

The presence of pedestrian facilities was reviewed along each of the functionally classified roadways in the study area, as shown in Figure 2-6.

Figure 2-6: Existing and Proposed Pedestrian Facilities

Existing recreational trails in the study area include the Chehalis Discovery Trail, which follows the Chehalis River for approximately 1.5 miles, and the Fort Borst Park trails. Existing and proposed trails are shown in Figure 2-7.

Figure 2-7: Existing and Proposed Trails

2.6.1.2 Existing Pedestrian Usage

Major Pedestrian Volume Generators

The main pedestrian volume generators in the study area include local and regional public schools (Fords Prairie Elementary, Centralia Middle School, and Centralia High School), shopping centers (including the Centralia Factory Outlets and Safeway), and parks (most notably, Fort Borst Park). Major volume generators outside the study area include Centralia College and the Downtown Centralia Business District.

2.6.1.3 Proposed Pedestrian Facilities

In Appendix A.1, Table 7-1 summarizes proposed pedestrian projects in the study area, and Table 7-2 summarizes proposed trail projects in the study area.

2.6.2 Bicycle Assessment

2.6.2.1 Existing Bicycle Facilities

The presence of bicycle facilities was reviewed along each of the functionally classified roadways in the study area, as shown in Figure 2-8.

Figure 2-8: Existing and Proposed Bicycle Facilities

2.6.2.2 Existing Bicycle Usage

Major Bicycle Volume Generators

The main bicycle volume generators in the study area include the three main public schools (Fords Prairie Elementary, Centralia Middle School, and Centralia High School) and parks (including Fort Borst Park). Major volume generators outside the study area include Centralia College and the Downtown Centralia Business District.

Proposed Bicycle Facilities

Figure 2-8 summarizes proposed bicycle projects in the study area.

2.6.3 Transit Assessment

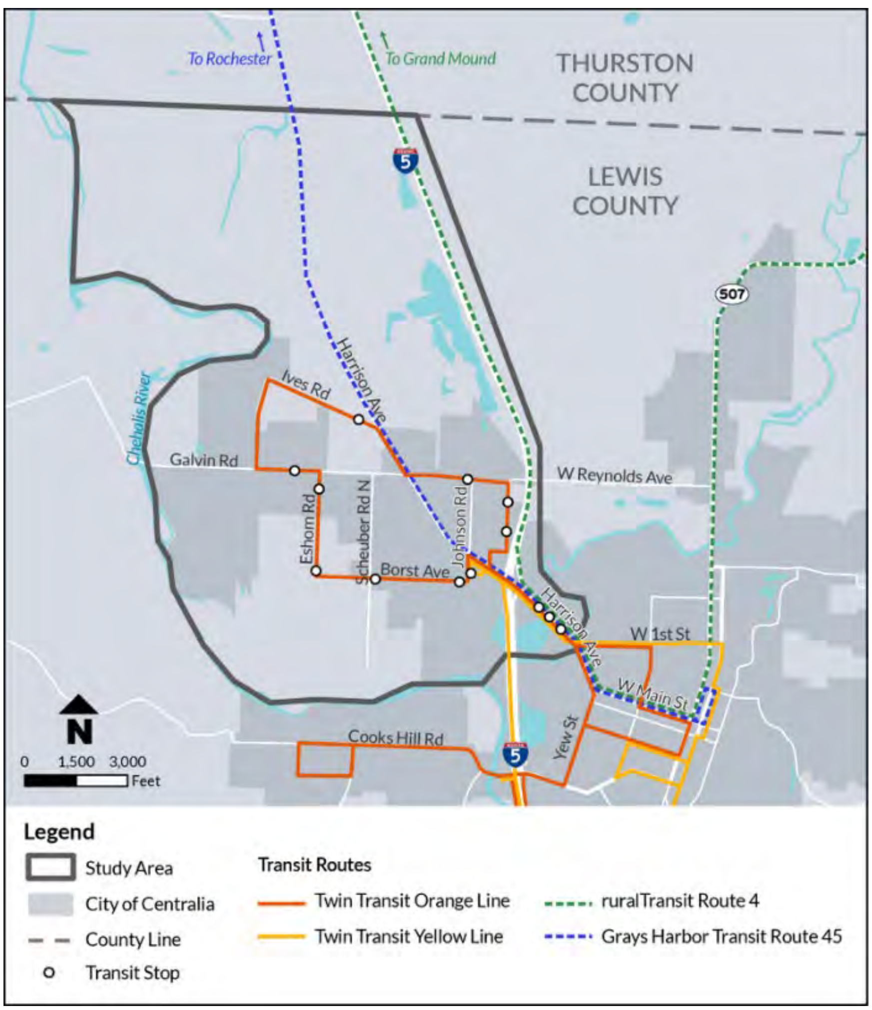
2.6.3.1 Existing Transit Providers and Services

Twin Transit is the primary operator for local bus service in the study area. Services include fixed-route bus service, dial-a-ride (DARTT), and paratransit (LIFTT). Fixed-route services in the study area include the Orange and Yellow lines.

In addition to local services, Twin Transit is establishing a new system of zero-emission public transit along the currently underserved 50-mile section of the I-5 corridor between Thurston, Lewis, and Cowlitz Counties.

Thurston Regional Planning Council (TRPC) provides one ruralTRANSIT (rT) service in the study area. Route 4 travels between the Centralia Amtrak station, the Grand Mound Park-and-Ride, the Tenino Library, and Bucoda. Existing transit services in the study area are highlighted in Figure 2-9.

Figure 2-9: Existing Transit Services



2.6.3.2 Existing Transit Facilities

Twin Transit maintains 80 signed bus stops/shelters throughout its overall service area with 13 of these 80 bus stops located within the study area.

2.6.3.3 Existing Transit Ridership

In 2021, Twin Transit provided an estimated 18,147 hours of fixed-route service and 94,337 trips to residents and visitors. In addition, Twin Transit provided 6,864 demand response trips through its dial-a-ride (DARTT) and paratransit (LIFTT) services. Also in 2021, the total ridership for Twin Transit was 101,201 passengers, including both fixed-route and paratransit trips. In 2020, total ridership was 106,353 passengers. These metrics reflect the entire Twin Transit service area, including the study area.

2.6.3.4 Major Transit Volume Generators

In May 2021, Twin Transit updated and enhanced its fixed-route services to support local K-12 school districts, the community college, and local businesses through targeted post-pandemic adjustments. Major destinations for transit services in the study area include the Centralia Safeway, Centralia Outlets, Centralia Middle and High Schools, community facilities such as Fort Borst Park, and various medical facilities. Transit services also connect users to locations outside the study area, including downtown Centralia, the City of Chehalis, the Centralia Amtrak station, and Centralia College.

2.6.3.5 Proposed Transit Providers, Services, and Facilities

Twin Transit recently installed a bus pullout near the intersection of Borst Avenue and Scheuber Road. Twin Transit is targeting installation of shelters at the top 25% of its most active stops, and benches at 50% of the most active stops by 2025. Over the next five years, Twin Transit plans to expand weekend service hours to increase off-peak access to services and adjust bus schedules to match ridership needs. It also plans to encourage improvements to pedestrian amenities and transit-related development within the community.

In addition, Twin Transit plans to expand its I-5 corridor e-Transit initiative with the construction of five additional e-Transit Stations within the next two years, located along a 40-mile section of I-5. Twin Transit plans to transition its fleet to 100% zero-emission vehicles by 2030.

Figure 2-9 includes additional future proposed transit projects in the study area.

2.6.4 Multimodal Assessment

2.6.4.1 Overview of Facility Gaps in the Nonmotorized Network

Major gaps in pedestrian and bicycle facilities include missing segments in the overall pedestrian and bicycle networks, especially near schools, and connections outside the study area. These gaps primarily involve arterial roadways. Additional pedestrian gaps include lack of Americans with Disabilities Act (ADA) policy-compliant ramps and crossings, and a general absence of pedestrian facilities. Expanding and enhancing bicycle facilities as well as appropriate modifications at intersections and access points would reduce pedestrian crossing times and increase the visibility of people walking and biking, and improve connectivity for bicyclists.

Major gaps for transit services are rooted in the limited scale of transit services and ridership in the study area, lack of route efficiency, minimal geographic coverage, and infrequent service during weekdays and on weekends. The lack of bus stop amenities, such as shelters and benches, are additional gaps.

Gaps in nonmotorized facilities and transit services may reduce nonmotorized transportation use. Reducing modal conflicts within shared-use space and providing appropriate separation may be a means to encourage usage. High-volume mixed-use locations should be prioritized for multimodal improvements consistent with priority programming laws and processes.

2.6.4.2 Identification of Major Volume Generators

Major volume generators in the study area include the public schools (Fords Prairie Elementary, Centralia Middle School, and Centralia High School), shopping centers (including the Centralia Factory Outlets and Safeway), community facilities (including Fort Borst Park), and various medical facilities.

2.7 Maintenance and Preservation

State law directs that WSDOT "…must ensure the preservation of the existing highway system" (RCW 47.05) and that preservation is a priority transportation policy goal (RCW 47.04.280). As such, WSDOT's Maintenance division fully supports meeting these preservation and maintenance obligations in accordance with RCW 47.05, prior to expanding the system, as the equitable and sustainable way to meet this direction.

WSDOT, the City of Centralia, and Lewis County are responsible for roadway maintenance within the study area. The low-cost maintenance option employed for the low volume roadways has been bituminous surface treatment, also known as chip sealing. The higher volume collectors and arterial roadways within the study area have been maintained primarily with the grind and asphalt inlay method. Spot maintenance, such as crack sealing and pothole repair, is addressed on an as-needed basis by all three agencies. Figure 2-10 provides an overview of the existing roadway network. For additional details on roadway maintenance and preservation in the study area, refer to Appendix A.1, Chapter 8.

Figure 2-10: Existing Roadway Network

2.8 Safety Analysis

2.8.1 Existing Safety Analysis

A review of the crash history was conducted to analyze crash patterns and frequency. The most recent five-year crash history was obtained from WSDOT for the period of 2017 to 2021 for the following intersections:

1. Old Highway 99 and Elderberry Street (Thurston County)
2. Old Highway 99 and I-5 SB Ramp (Thurston County)
3. Old Highway 99 and I-5 NB Ramp (Thurston County)
4. Old Highway 99 and Prather Road (Thurston County)
5. Harrison Avenue at the Lewis County Line
6. Harrison Avenue and Kuper Road
7. Harrison Avenue and Foron Road

8. Harrison Avenue and Reynolds Avenue
9. Reynolds Avenue and Industrial Drive
10. Harrison Avenue and Belmont Avenue
11. Harrison Avenue and I-5 SB Ramps
12. Harrison Avenue and I-5 NB Ramps
13. Reynolds Avenue and Lum Road

The intersections with the highest number of reported crashes were at Harrison Avenue and the I-5 SB ramps with 66 crashes, followed by Harrison Avenue and the I-5 NB ramps with 59 crashes (Figure 2-11).

Figure 2-11: Heat Map of Study Area Crashes (2017-2021)

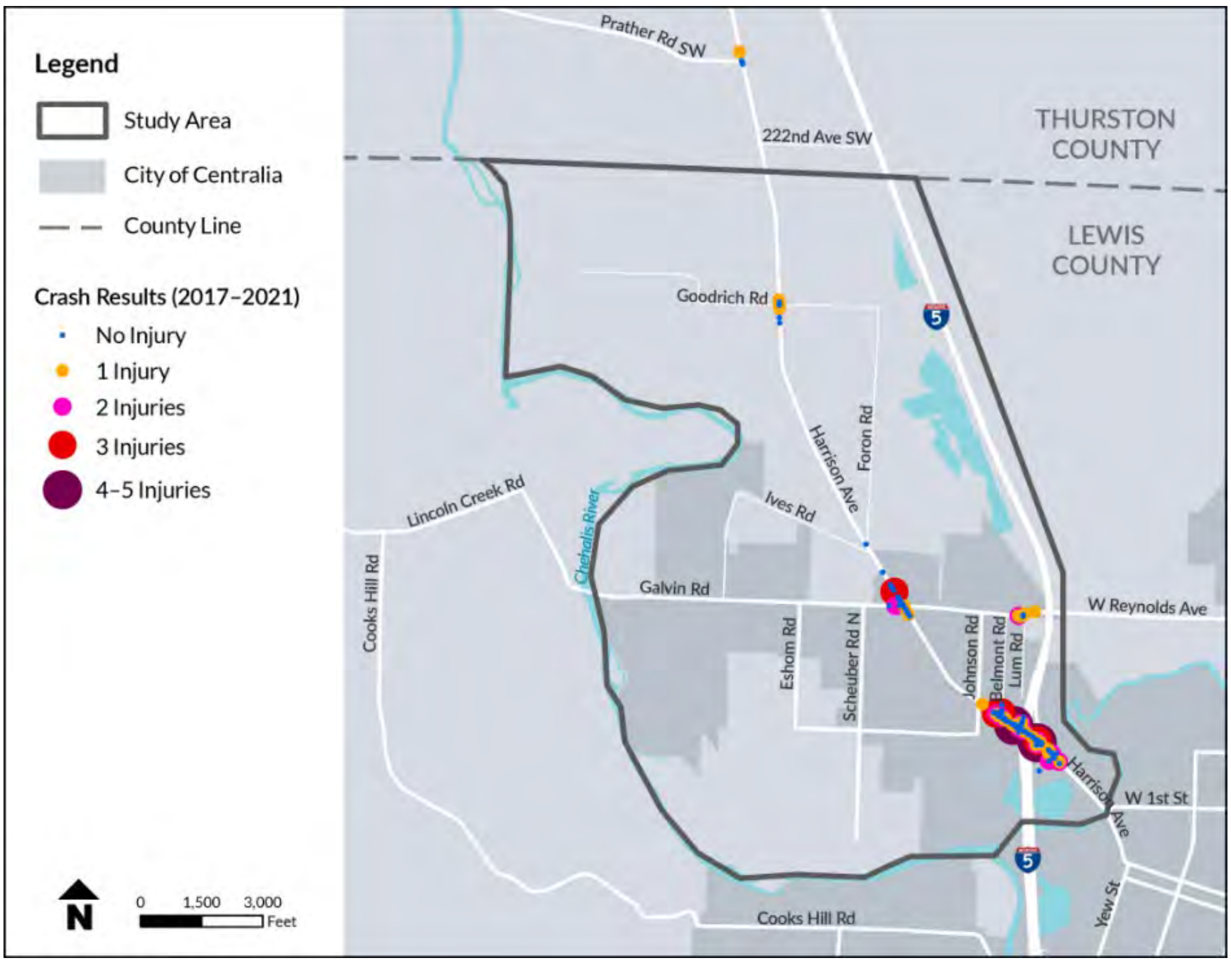


Table 2-4 presents the crash total for each intersection for the five-year period. Appendix A.2 provides the full crash data obtained from WSDOT.

Table 2-4: Crash Summary by Intersection, 2017-2021

Intersection	2017	2018	2019	2020	2021	Total
Old Hwy 99 and Elderberry St	8	8	9	7	11	43
Old Hwy 99 and I-5 SB Ramp	7	4	10	4	10	35
Old Hwy 99 and I-5 NB Ramp	4	2	8	3	4	21
Old Hwy 99 and Prather Rd	-	-	-	-	-	-
Harrison Ave at Lewis County Line	-	-	-	-	-	-
Harrison Ave and Kuper Rd	3	1	--	3	2	9
Harrison Ave and Foron Rd	-	-	-	-	-	-
Harrison Ave and Reynolds Ave	2	3	7	8	5	25
Reynolds Ave and Industrial Dr	-	-	-	-	1	1
Harrison Ave and Belmont Ave	13	10	10	9	12	54
Harrison Ave and I-5 SB Ramps	11	19	10	11	15	66
Harrison Ave and I-5 NB Ramps	7	16	15	14	7	59
Reynolds Ave and Lum Rd	1	2	-	-	1	4
Total	56	65	69	59	68	317

Source: WSDOT Public Records (see Appendix A.2)
Under 23 U.S. Code § 148 and 23 U.S. Code § 409, safety data, reports, surveys, schedules, lists compiled or collected for the purpose of identifying, evaluating, or planning the safety enhancement of potential crash sites, hazardous roadway conditions, or railway-highway crossings are not subject to discovery or admitted into evidence in a Federal or State court proceeding or considered for other purposes in any action for damages arising from any occurrence at a location mentioned or addressed in such reports, surveys, schedules, lists, or data.

2.8.1.1 Crash Severity

Most crashes at the targeted study intersections resulted in property damage only (PDO) or possible injury. One crash at the intersection of Harrison Avenue and the I-5 SB ramps resulted in a fatality—documented as a single vehicle crash due to wrong way travel on the freeway ramp. Another crash at this same intersection resulted in a serious injury involving a vehicle striking a bicyclist on a right hook angle type crash. See Appendix A.1, Table 9-2 for a summary table of crashes by severity.

2.8.1.2 Crash Type

Rear-end collisions are the most common type of crash at all study intersections. However, the intersection at Harrison Avenue and Belmont Avenue observed more than double the number of angle crashes in the five-year lookback period than rear-end crashes. The intersections at Harrison Avenue and the I-5 SB ramps and Harrison Avenue and the I-5 NB ramps also showed a significant number of angle type crashes. See Appendix A.1, Table 9-3 for a summary of crashes by type.

2.8.1.3 Crashes by Vehicle Type

Most crashes involved pickups or small trucks under 10,000 pounds and passenger cars at 144 and 141 incidents, respectively. Nineteen crashes involved heavy vehicles such as truck tractors and semi-trailers; three crashes involved motorcycles; and 10 crashes involved vehicles that do not fall under these classifications or were not stated in the data. The intersection of Old Highway 99 and Elderberry Street showed the highest incidence of heavy vehicle crashes (5) and motorcycle crashes (2). See Appendix A.1, Table 9-4 for a summary of crashes by vehicle type.

2.8.1.4 Pedestrian Crashes

Two reported crashes involved pedestrians: one each at the intersections of Harrison Avenue and Belmont Avenue, and Harrison Avenue and the I-5 SB ramps. In both events, pedestrians were struck by a vehicle making a right turn. The pedestrian crash at Harrison Avenue and Belmont Avenue resulted in an injury, and the crash at Harrison Avenue and the I-5 SB ramps resulted in a suspected minor injury.

2.8.1.5 Bicycle Crashes

Three reported crashes involved bicyclists, one at the intersection of Harrison Avenue and Belmont Avenue and two at the intersection of Harrison Avenue and the I-5 SB ramps. The bicyclist crash at Harrison Avenue and Belmont Avenue resulted in an injury, and the crashes at Harrison Avenue and the I-5 SB ramps resulted in a suspected minor injury. All bicyclist crashes were right hook angle type crashes. At the intersection of Harrison Avenue and the I-5 SB ramps, both crashes occurred from vehicles making a right turn from the north leg of the intersection.

2.8.2 Highway Safety Manual Predictive Analysis

Safety analysis for existing 2022 conditions and long-range 2045 conditions included calculations of predicted and expected crash frequencies (number of crashes) for the study intersections using the Highway Safety Manual (HSM) Part C methodology (American Association of State Highway and Transportation Officials 2010), which was further updated by WSDOT. The number of *predicted* crashes indicates the number of crashes a similar intersection is anticipated to experience on average. The number of *expected* crashes is the number of crashes the study intersection is anticipated to experience based on physical variables, volumes, and crash history. The number of predicted and expected crashes is reported in decimal form since it represents a calculation over time—for example, a 0.2 crash could, on average, be defined as one crash occurring in a five-year period. This methodology estimates predicted and expected crash frequency as a function of traffic volume and roadway characteristics (e.g., number of lanes, median type, intersection control, number of approach legs) and crash history at each intersection.

The analysis was conducted for Existing Conditions (2022) and Future Baseline Conditions (2045). The safety analysis was conducted using projected turn-movement volumes for the study facilities, expanded to daily volume based on 24-hour counts collected throughout the study area. The following sections describe the HSM results for Existing Conditions (2022) and Future Baseline Conditions (2045).

2.8.2.1 HSM Analysis Existing Conditions Year (2022)

Intersections with the most potential for improvement include Harrison Avenue and the I-5 SB ramps, Harrison Avenue and the I-5 NB ramps, and Harrison Avenue and Belmont Avenue. The project has the potential to reduce the number of fatal and injury crashes on average per year by 10.7 and PDO by 19.9 throughout all study intersections in this analysis. See Appendix A.1, Table 9-5 for a summary of the predicted number of crashes versus the expected number of crashes for each intersection, by severity, for Existing Conditions Year (2022).

2.8.2.2 HSM Analysis Future Baseline Conditions (2045)

Intersections with the most potential for improvement between existing and future conditions are Old Highway 99 and the I-5 SB ramps, Old Highway 99 and the I-5 NB ramps, and Old Highway 99 and Elderberry Street. The project has the potential to reduce the expected number of fatal and injury crashes by 5.5 per year on average and PDO by 10.5 throughout all study intersections, from Existing Conditions Year (2022) to Future Baseline Conditions Year (2045). Additional future baseline analysis can be found in Appendix A.1, Table 9-6.

2.9 Origin-Destination Study

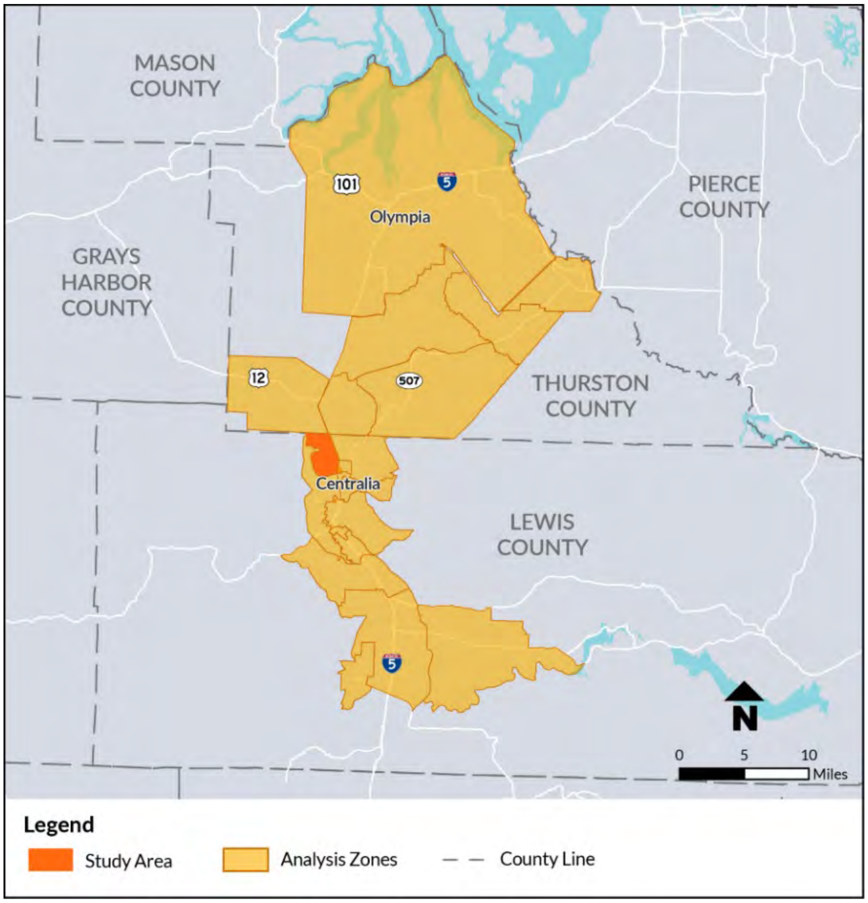
2.9.1 Methodology

The origin-destination (OD) study uses data extracted from StreetLight Data's InSight online platform. StreetLight is a web-based, on-demand mobility data analytics platform that leverages anonymized personal cellular-device location data (location-based services data), connected vehicle data, and commercial vehicle GPS data that are processed into origin/destination matrices, travel time, and routing information. It provides insight into travel patterns otherwise unavailable through traditional data collection, but there are limitations due to varying sample sizes and the normalization and expansion of sample data. There may also be some inherent biases from the data sources, which come from smart devices and GPS tracking. A proportion of certain demographic groups may not use smart devices; therefore, these groups could be underrepresented in StreetLight data.

2.9.2 Origin-Destination Analysis

The OD analysis from/to the study area was conducted using the zones shown in Figure 2-12. Origin-destination trips extracted from StreetLight include inbound and outbound trips between the study area and analysis zones.

Figure 2-12: Origin-Destination Analysis Zones



StreetLight provides data on both all vehicles (mode agnostic) and freight vehicles. The two data types are derived from different data sources: data for all vehicles come from anonymized smart device location-based services data while freight data come from in-vehicle GPS tracking data. Both types of data are extracted and analyzed. Below are some key insights for OD patterns.

- For all vehicle trips within the areas examined, more than 50 percent of trips going to the study area are local and come from urbanized areas and adjacent areas in Lewis County.
- Freight trips generally travel farther than general-purpose vehicle trips, with top origins/destinations in the Olympia-Lacey-Tumwater area (about 25 to 30 percent) and Port of Chehalis area (heavy trucks about 35 to 40 percent; medium trucks about 7 to 8 percent).

2.9.3 Travel Shed Analysis

The travel shed analysis examines trips originating from/terminating in the study area by the roadways they travel on. It sheds light on the origin/destination of trips as well as the path travelers use to access/exit the study area.

As with the OD analysis, the travel shed analysis also uses two types of data: all vehicles and freight. Below is the results summary.

- Most vehicle trips enter the study area via I-5 (32 percent from the north and 18 percent from the south), followed by local arterials such as Harrison Avenue, Reynolds Avenue, and W 1st Street (17 percent, 12 percent, and 7 percent, respectively). About 85 to 90 percent of trips are within the region between Olympia and Napavine.
- Heavy truck trips to/from the area have a larger travel shed compared to all vehicle trips, spanning from Salem to Seattle. More trips enter/exit south of the study area via I-5 (54 percent of trips to the study area and 48 percent of trips from the study area).
- Medium truck trips are generally shorter than heavy truck trips but more dispersed and travel on more local roadways.
- Freight trips entering/exiting the study area from the north use both I-5 and Old Highway 99. For southbound truck trips entering the area, more tend to use I-5 (heavy trucks: 24 percent on I-5 vs 21 percent on Old Highway 99; medium trucks: 34 percent on I-5 vs 18 percent on Old Highway 99). For northbound truck trips leaving the area, more heavy trucks tend to use Old Highway 99 before accessing I-5 at Grand Mound, whereas medium trucks still favor I-5 (heavy trucks: 19 percent on I-5 vs 31 percent on Old Highway 99; medium trucks: 30 percent on I-5 vs 21 percent on Old Highway 99).

2.9.4 Port of Centralia Travel Patterns

The Port of Centralia owns three industrial parks, two of which are in the study area. This analysis only examines trips to and from Port Industrial Parks 1 and 2. Travel sheds are examined and compared from both 2019 and 2022 to account for the impact of the pandemic.

2.9.4.1 Heavy Truck Trips

Overall, heavy trucks with origins or destinations at the Port of Centralia industrial parks have the largest travel sheds of all vehicle types examined in this study. Below are the key findings.

- For both inbound and outbound trips, heavy truck trips have shifted from being more concentrated in the north to the south of the study area from 2019 to 2022.
- Outbound heavy truck trips shifted significantly away from Old Highway 99 to I-5 in the northbound direction from 2019 to 2022. In 2019, the split of northbound outbound trips between Old Highway 99 and I-5 was 51 percent and 6 percent; in 2022, the split became 19 percent and 26 percent, respectively.
- Similarly, inbound heavy truck trips shifted away from Old Highway 99 to I-5 from 2019 to 2022. In 2019, the split of southbound inbound trips between Old Highway 99 and I-5 was 50 percent and 16 percent; in 2022, the split became 16 percent and 17 percent, respectively.
- Inbound heavy truck trips to the Port originating from Olympia decreased significantly, from 44 percent in 2019 to 17 percent in 2022. For outbound trips, this shift is not as prominent – a slight decrease from 29 percent in 2019 to 25 percent in 2022.

- Conversely, outbound heavy truck trips to south of Vancouver, Washington, and farther south increased from 9 percent in 2019 to 23 percent in 2022. Similarly, inbound trips experienced a large increase from 5 percent in 2019 to 30 percent in 2022.
- The distribution of both inbound and outbound trips has expanded farther east and west from 2019 to 2022.

2.9.4.2 Medium Truck Trips

Compared to heavy trucks, outbound and inbound medium trucks from/to the Port of Centralia have a smaller travel shed. Medium trucks are defined as two- or three-axle freight vehicles that do not fall under the semi-trailer combination category. Below are the key findings.

- Compared to heavy trucks, medium truck trips are more dispersed on local roads and travel shorter distances.
- Medium truck trip pattern changes from 2019 to 2022 are similar to those of heavy truck trip patterns.
  - Both inbound and outbound medium truck trips have shifted from more concentrated in the north to the south of the study area.
  - Both inbound and outbound trips have shifted from Old Highway 99 to I-5.
- The travel shed for inbound medium trucks expanded between 2019 and 2022, to the north, south, and east. However, the western extent of the travel shed contracted somewhat.

2.9.4.3 Average Travel Times and Speeds to Access I-5 and State Highways

- In general, heavy trucks require the longest travel times to access I-5 ramps and travel at the slowest average speed out of all modes.
- For all modes to/from the industrial parks, outbound trips to access I-5 interchanges take longer compared to inbound trips from I-5.
- Heavy truck travel times to/from I-5 are relatively consistent compared with all vehicles and medium trucks. Given similar starting points, traveling to the I-5 ramps at Harrison Avenue requires approximately 13 to 15 minutes, whereas traveling to Grand Mound takes about 19 to 22 minutes.
- In general, for trips to/from state highways, outbound trips take slightly longer than inbound trips.

2.9.5 Bicycle and Pedestrian Origin-Destination Patterns

This section focuses on key destinations that generate bicycle and pedestrian traffic, including three schools and two commercial areas within the study area. The schools examined were Centralia High School, Centralia Middle School, and Fords Prairie Elementary. The commercial areas are concentrated around the I-5 interchange and divided into east and west of I-5 to better capture OD patterns. The analysis zones used are 2020 Census block groups.

Due to the small sample size, the total volume estimates for some of the analyses are low, especially the bicycle origin-destination analyses. The OD patterns still indicate general travel patterns otherwise unavailable. Key findings are summarized in bullet points below.

- Both bicycle and pedestrian trips to/from schools concentrate in the areas on the same side of I-5 or major arterial as the schools due to short travel shed of active modes.
- Almost all pedestrian school trips originate from/end at census block groups west of I-5 and have similar origin and destination patterns.
- Bicycle school trips have relatively different origin and destination patterns, potentially due to after school activities away from home. Bicycle trips originate closer to schools and tend to be from the same side of I-5, whereas destinations are more dispersed and have a higher percentage on the other side of I-5.
- Pedestrian trips to commercial areas also tend to remain on the same side of I-5 as the commercial area, while bicycle trips are more distributed but still concentrate more east/west along Harrison Avenue and Reynolds Avenue.

A detailed OD Study is provided in Appendix A.1, Chapter 10.

2.10 Existing Intersection Operations

2.10.1 Transportation Inventory and Geometrics

For traffic analysis purposes, the study area within the North Lewis County Industrial Area is bound by Old Highway 99/US 12 to the north and Harrison Avenue/I-5 to the south with key industrial access points captured along Old Highway 99, Harrison Avenue, and Reynolds Avenue. Critical roadways represented in the study area are listed and defined in Table 2-5.

Table 2-5: Study Area Key Roadway Characteristics

Roadway	Jurisdiction	Federal Functional Classification	Freight and Goods Transportation System[1]	Speed Limit (mph)
I-5	WSDOT	Interstate	T-1	60/70
US 12/Old Hwy 99 (I-5 to Elderberry Street)	WSDOT	Freeway/Expressway	T-2	40
Elderberry Street	Grand Mound	Major Collector	T-3	35
Old Highway 99 (US 12 to south county line)	Thurston County	Major Collector	T-2	40
Harrison Avenue (I-5 to Yew St)	Centralia	Principal Arterial	T-2	30
Harrison Avenue (I-5 to north city limit)	Centralia	Minor Arterial	T-2	30
Harrison Avenue (north city limit to county line)	Lewis County	Minor Arterial	T-2	40
Reynolds Avenue	Centralia	Minor Arterial	T-3	25-35
Johnson Road	Centralia	Major Collector	T-3	25
Belmont Avenue	Centralia	Local Roadways	N/A	25

Notes:
Source: Lewis County Comprehensive Plan; City of Centralia Comprehensive Plan Transportation Element Update; Thurston County Comprehensive Plan; Washington State Freight and Goods Transportation System
[1] FGTS T-1 stands for over 10 million gross tons annually; T-2 stands for 4 to 10 million gross tons annually; T-3 stands for 300,000 to 4 million gross tons annually.

To assess traffic impacts associated with background growth and potential future alternatives, 17 intersections were identified and evaluated. These intersections include most of the study locations evaluated for the safety analysis, in addition to several others. West 1st Street and Harrison Avenue was added to the list of traffic analysis study intersections per stakeholder request. The analysis study intersections are shown in Table 2-6.

Table 2-6: Traffic Analysis Study Intersections

ID	Intersection	Intersection Control	Jurisdiction	Mobility Standard (LOS)
1	Elderberry St SW and Old Hwy 99 SW/US 12	Signal	WSDOT/Thurston County	D
2	I-5 SB Ramps and Old Hwy 99	Signal	WSDOT	D
3	I-5 NB Ramps and Old Hwy 99	Signal	WSDOT	D
4	Old Hwy 99 SW and 216th Ave SW[1]	TWSC	Thurston County	C
5	Old Hwy 99 SW and Prather Rd SW[1]	TWSC	Thurston County	C
6	Harrison Ave and Goodrich Rd/Kuper Rd	TWSC	Lewis County	D
7	Harrison Ave and Foron Rd	TWSC	Lewis County	D
8	Harrison Ave and Galvin Rd/W Reynolds Ave	Signal	Centralia	D
9	Johnson Rd and W Reynolds Ave	TWSC	Centralia	D
10	Lum Rd and W Reynolds Ave	TWSC	Centralia	D
11	Industrial Dr and W Reynolds Ave	TWSC	Centralia	D
12	N Pearl St (SR 507) and W Reynolds Ave	Signal	Centralia	D
13	Johnson Rd and Harrison Ave	Signal	Centralia	D
14	Belmont Ave and Harrison Ave	Signal	Centralia	D
15	I-5 SB Ramps and Harrison Ave	Signal	WSDOT/Centralia	D
16	I-5 NB Ramps and Harrison Ave	Signal	WSDOT/Centralia	D
17	W 1st St and Harrison Ave	OWSC	Centralia	D

Notes:
[1] Old Hwy 99 SW and 216th Ave SW and Old Hwy 99 SW and Prather Rd SW intersections are within Rural Strategy Corridor. The intersections may exceed the adopted LOS standard per the Thurston County Comprehensive Plan 2019 Update.
LOS = level-of-service; TWSC: Two-way stop control intersection; OWSC: One-way stop control intersection

2.10.2 Traffic Operations Analysis

Synchro 11 traffic analysis software was used to analyze all study intersections for both the AM and PM peak hours. A morning peak hour of 7:15 to 8:15 AM and an afternoon peak of 4:00 to 5:00 PM were identified from the existing traffic count data as the peak periods to be analyzed.

The existing inputs for Synchro model development included traffic count data collected at the intersections in May and July 2022. A full summary of volumes and intersection geometry (channelization) is provided in Appendix A.4. Due to the timing of data collection activities in 2022 when schools were not in session, comparisons of the collected count data to previous volumes compiled from 2017 and 2019 were made to adjust volumes slightly upward and account for school-related demand (mainly inbound in the morning). The key corridors targeted for these volume adjustments were Harrison Avenue and Galvin Road. Signal timing and phasing data were provided by WSDOT and Lewis County, except for the Harrison Avenue and Galvin Road/West Reynolds Avenue intersection, which used optimized signal cycle and phase split times due to lack of signal timing data availability.

Key measures of effectiveness collected from the Synchro analysis include average intersection delay, level-of-service (LOS), volume to capacity ratio, and 95th percentile queue length.

2.10.2.1 Intersection Capacity Results

Under 2022 existing conditions, all study intersections in either the AM or PM peak hours meet jurisdictional mobility standards (LOS D as described previously). In Appendix A.1, Table 11-3 and Table 11-4 summarize the intersection operations for existing conditions. A full version of intersection delay and LOS by lane group is provided in Appendix A.5.

2.10.2.2 Summary of Intersection Queueing Results

Queue lengths by intersection lane groups were determined based on Synchro 11 analysis output for the study intersections. The 95th percentile queue lengths were compared against the available upstream storage in turn pockets or between intersections for each lane group as applicable.

Under 2022 existing conditions, queueing impacts are shown to occur at four approaches in the AM peak hour: the southbound approach at the Elderberry Street SW and Old Highway 99 SW/US 12 intersection, the eastbound approach at the I-5 northbound ramps and Old Highway 99 intersection, the northbound approach at the Harrison Avenue and Galvin Road/W Reynolds Avenue intersection, and the westbound approach at the Johnson Road and Harrison Avenue intersection.

During the PM peak hour, queueing impacts occur at both the Grand Mound interchange area and Harrison Avenue interchange area. Queue spill-back was noted for eastbound and westbound Old Highway 99 and eastbound Harrison Avenue due to heavy traffic activity crossing and accessing I-5. See Appendix A.1, Table 11-5 for a summary of key intersection movements where queueing impacts are expected.

2.11 Forecasting, Future Intersection Operations and Safety Performance

2.11.1 Traffic Forecasts

Travel demand forecasts for this study were provided by and coordinated through the TRPC and based on the current TRPC EMME travel demand model that reflects a base year of 2017 and future horizon year of 2045 with current and projected land use. All raw traffic forecast plot volumes were post-processed using 2022 existing turning movement volumes and NCHRP 765 volume adjustment techniques to develop the 2045 baseline intersection turning movement volumes.

Table 2-7 summarizes the AM and PM peak hour traffic volumes for the various study intersections under existing 2022 and future 2045 forecast years. A full summary of the future year turning movement volumes and channelization are provided in Appendix A.4.

Table 2-7: Intersection Volumes: Existing vs 2045 Baseline Conditions – AM Peak and PM Peak

ID	Intersection	AM Peak			PM Peak		
		2022 Existing	2045 Baseline	Growth%	2022 Existing	2045 Baseline	Growth%
1	Elderberry St SW and Old Hwy 99 SW/US 12	1,960	2,810	43%	2,545	3,215	26%
2	I-5 SB Ramps and Old Hwy 99	1,755	2,940	68%	2,245	2,930	31%
3	I-5 NB Ramps and Old Hwy 99	1,280	2,170	70%	1,550	2,215	43%
4	Old Hwy 99 SW and 216th Ave SW	450	715	59%	810	1,045	29%
5	Old Hwy 99 SW and Prather Rd SW	465	745	60%	765	1,070	40%
6	Harrison Ave and Goodrich Rd/Kuper Rd	480	710	48%	825	1,100	33%
7	Harrison Ave and Foron Rd	520	710	37%	935	1,165	25%
8	Harrison Ave and Galvin Rd/W Reynolds Ave	990	1,330	34%	1,485	1,935	30%
9	Johnson Rd and W Reynolds Ave	470	660	40%	685	855	25%
10	Lum Rd and W Reynolds Ave	625	875	40%	930	1,130	22%
11	Industrial Dr and W Reynolds Ave	600	835	39%	890	1,085	22%
12	N Pearl St (SR 507) and W Reynolds Ave	720	1,110	54%	1,280	1,835	43%
13	Johnson Rd and Harrison Ave	1,330	1,785	34%	2,015	2,425	20%
14	Belmont Ave and Harrison Ave	1,830	2,410	32%	2,915	3,660	26%
15	I-5 SB Ramps and Harrison Ave	2,200	2,800	27%	3,595	4,445	24%
16	I-5 NB Ramps and Harrison Ave	1,885	2,315	23%	3,135	3,975	27%
17	W 1st St and Harrison Ave	1,236	1,525	23%	1,768	2,255	28%

2.11.2 Traffic Operations Analysis

The transportation network for the 2045 baseline scenarios was updated to include all proposed background projects. For information on these proposed projects, refer to Appendix A.1, Section 12.2.

All future traffic demands used for the analysis were based on the traffic forecast post-processing performed for this study. Signalized intersection phasing splits were optimized based on future demand levels while existing cycle lengths were retained.

2.11.2.1 Intersection Capacity Results

Intersection operational analysis was completed using Synchro software as previously described in the discussion of existing conditions. Under 2045 baseline conditions, 14 of 16 study intersections in either the AM or PM peak hour are expected to meet jurisdictional mobility standards. Intersections that do not meet mobility standards under 2045 baseline conditions are listed below.

- 1 – Elderberry Street SW and Old Highway 99/US 12: **LOS F, PM Peak**
- 3 – I-5 NB Ramps and Old Highway 99: **LOS E, AM Peak**

See Appendix A.1, Tables 12-2 and 12-3 for a summary of intersection operations for existing and 2045 baseline conditions at the AM peak and PM peak, respectively.

2.11.2.2 Summary and Findings

Under 2045 baseline conditions, queue lengths are expected to be longer than 2022 existing conditions. Based on the traffic analysis results, queueing exceeds storage length at the following locations under the 2045 baseline conditions.

- 1 – Elderberry Street SW and Old Highway 99 SW/US 12: NBR (AM/PM) and SBL (AM/PM)
- 2 – I-5 SB Ramps and Old Highway 99: WBL (AM/PM)
- 3 – I-5 NB Ramps and Old Highway 99: EBL (AM/PM), WBTR (AM), and NBL (PM)
- 8 – Harrison Avenue and Galvin Road/W Reynolds Avenue: NBL (AM/PM), SBL (PM)
- 13 – Johnson Road and Harrison Avenue: WBL (AM/PM)
- 14 – Belmont Avenue and Harrison Avenue: WBTR (PM), SBL (PM), SBLTR (PM)
- 15 – I-5 SB Ramps and Harrison Avenue: EBR (PM)
- 16 – I-5 NB Ramps and Harrison Avenue: EBL (PM)

Based on the analysis results, future queueing activity would affect traffic flow at the Grand Mound interchange during both the AM and PM peak hour. Extensive queueing is also expected to occur at the Harrison Avenue interchange during the PM peak hour, with significant queue spill-back from the I-5 ramp terminals to Harrison Avenue that affects traffic flow and operational access into and out of the study area.

To further investigate traffic congestion along Harrison Avenue, a SimTraffic model was developed for future baseline conditions as a validation tool for the Synchro models. Overall, SimTraffic validated Synchro's findings with SimTraffic providing slightly higher queueing results and spill-back effects. During the AM peak hour, overall queue lengths are anticipated to be about the same or slightly worse (longer) compared with Synchro queueing results. During the PM peak hour, overall queue lengths are estimated to be worse (longer) compared with Synchro queueing results, especially for the Harrison Avenue interchange area. SimTraffic simulations show queues backing up from the I-5 ramp terminal to Johnson Road and beyond. A full version of SimTraffic key intersection queueing by lane group is provided in Appendix A.6.

Although most intersections are anticipated to meet the LOS D mobility standard, both the Synchro queueing and SimTraffic queueing results indicate elevated congestion levels at the Grand Mound interchange and Harrison Avenue interchange areas.

See Appendix A.1, Tables 12-4 and 12-5 for a summary of key intersection movement queueing results whose queues near or exceed storage length in the AM peak and PM peak, respectively.

Based on the Synchro analysis for future baseline conditions, most of the targeted study intersections for either the AM or PM peak hour are expected to meet jurisdictional mobility standard, except for Elderberry Street SW and Old Highway 99/US 12 under the PM peak hour, and I-5 NB Ramps and Old Highway 99 under the AM peak hour. Per the Synchro queueing analysis, several locations have anticipated queues that could exceed the available storage length, especially in the Grand Mound interchange area during both peak hours. Similar findings were noted for the Harrison Avenue interchange during the PM peak hour. Additionally, a SimTraffic queueing analysis was performed to validate the Synchro findings with SimTraffic providing slightly higher queueing results and spill-back effects. In general, although most intersections are anticipated to meet the LOS D mobility standard, both the Synchro queueing and SimTraffic queueing results indicate potential congestion and traffic backups at the Grand Mound interchange and Harrison Avenue interchange areas.

WSDOT's Active Transportation Plan designates roadway segments or intersections with Level of Traffic Stress (LTS) scores of 3 or 4 as gaps within the active transportation network. Based on the active transportation existing conditions assessment, most study area roadways currently have Bicycle Level of Traffic Stress (BLTS) scores of 3 or 4, except for the Belmont Avenue segment. As for Pedestrian Level of Stress (PLTS), most roadways have PLTS scores of 3 or 4, except for the four-lane Harrison Avenue segment, the Johnson Road segment, and the Belmont Avenue segment. In general, most roadways within the study area currently do not meet WSDOT LTS goals for active transportation, showing significant gaps in the pedestrian and bicycle networks.

2.11.3 Future Safety Summary

Based on the safety analysis conducted for Existing Conditions Year (2022) and Future Baseline Conditions Year (2045), the estimated predicted crash frequency has the potential to reduce 5.5 fatal and severe crashes and 10.5 PDO crashes across all 13 intersections. Intersections with the greatest potential for improvement in predicted crash frequency between 2022 and 2045 include Old Highway 99 and the I-5 SB ramp, and Old Highway 99 and I-5 NB ramp with an estimated 4.2 and 3.7 total crash-reduction opportunity, respectively.

Additionally, the intersection at Harrison Avenue and Belmont Avenue had a significant proportion of angle type crashes in the five-year period that may indicate a distinct type of intersection deficiency. Further analysis of the crash data is recommended to discern crash patterns at these intersections in more detail and identify crash-reduction strategies that could lower the number of observed and predicted crashes.

2.12 Level of Traffic Stress Assessment

The WSDOT Active Transportation Plan sets agency goals and performance metrics that apply to how facilities for bicyclists and pedestrians on state highways are designed in population centers. A new data-driven method was recently adopted by WSDOT for evaluating state right-of-way for active transportation use: Level of Traffic Stress (LTS).

LTS provides an objective, quantitative assessment of roadway characteristics that may affect safety, mobility, and access for active transportation use. LTS can be used to determine essential design characteristics of active transportation facilities, including design elements, target speed, features, dimensions, and configuration of highway facilities. BLTS provides an indication of the performance and relative comfort with respect to bicycle riders, while PLTS applies to people who are neither on a bicycle nor in a motor vehicle.

Basic LTS is calculated based on the posted speed of a facility, the average traffic volumes, and the cross-section characteristics. It is expressed as an integer from 1 to 4, where a lower number indicates a greater willingness for active travelers to use the facility. Basic LTS is determined by referring to tables from the WSDOT Development Division Multimodal Development and Delivery Designing for Level of Traffic Stress Bulletin #2022-01.

The design goals according to WSDOT guidelines call for a LTS value for both BLTS and PLTS of 1 or 2.

Under existing conditions, most roadway segments have BLTS scores of 3 or 4 except Belmont Avenue from Harrison Avenue to Haviland Street. Highway 99 in the Grand Mound interchange area and Harrison Avenue in the Harrison Avenue interchange area were scored and highlighted as significant gaps in the bicycle network.

See Appendix A.1, Tables 13-1 and 13-2 for a summary of BLTS and PLTS for key roadways under existing conditions.

Overall, pedestrian LTS conditions are generally more favorable than the bicycle network. However, the following roadway segments have PLTS scores of 3 or 4 under existing conditions:

- Old Highway 99: I-5 NB Ramps to Elderberry Street, Ivan Street SW to I-5 NB Ramps, 216th Avenue SW to Prather Road SW
- Elderberry Street: Old Highway 99 to 196th Avenue SW
- Harrison Avenue: Reynolds Avenue to Johnson Road, Foron Road to Reynolds Avenue
- Reynolds Avenue: Johnson Road to Lum Road

3 ENGAGEMENT SUMMARY

WSDOT engaged local stakeholders and the public to solicit input on potential improvements and inform them of the Purpose and Need as the study progressed. The project team established and implemented a multifaceted approach of open communication, stakeholder engagement, public meetings, and implementation of an ongoing communication strategy that informed the public, outlined impacts and timelines, and answered questions in a meaningful way.

3.1 Stakeholder Engagement

A stakeholder team was formed at the outset of the study to provide technical guidance, recommend preferred improvements, and disseminate information to their organizations and communities as the study progressed. Members of the stakeholder team represented FHWA, TRPC, Cowlitz-Wahkiakum Council of Governments, Twin Transit, Lewis County, Thurston County, Port of Centralia, City of Centralia, and Centralia College. Over the duration of the study, four meetings were held with the stakeholder team (see Appendix B.1 for detailed summaries of each stakeholder meeting).

The first meeting introduced the team to the study timeline, provided legislative and funding background information, summarized the study purpose and goals, and developed a shared vision for the future of the study area. Stakeholders provided feedback on the draft charter that outlined the roles and responsibilities of the group, the draft Purpose and Need statement, and the geographic scope of the study area.

At the second stakeholder meeting, the project team outlined and summarized the base conditions in the area to provide context on the needs and constraints in the area. Through discussions with the stakeholder team, evaluation criteria were outlined to assess the need and efficacy of each potential improvement project. Sixteen measures of success were selected to inform the preferred alternative selection process.

The third stakeholder meeting was held in advance of the online open house to refine the list of proposed alternatives before sharing more broadly to the community. The meeting focused on reviewing the initial list of proposed alternatives: Westside Connector, Lum Road, county line I-5 interchange improvements, bike and pedestrian improvements, and access management. The stakeholder team engaged in a workshop activity to provide feedback on each alternative and proposed additional alternatives based on the study priorities. The stakeholder team shared important financing and infrastructure barriers to consider for some of the alternatives.

The fourth and final stakeholder meeting was held after the public survey was administered to share the results of the survey. The project team provided an overview of the study improvements and how they were evaluated. A summary of the traffic analysis methodology was also provided for three potential improvements: a new interchange at 222nd Avenue, the Westside Connector, and the Gallagher Road Extension. The team described why these three potential improvements were chosen for the traffic analysis. The project team then shared its recommendation that all potential improvements be carried forward, other than the Blair Road - Hobson Road connection and the interchange options at Kuper Road and 222nd

Avenue. The stakeholder team engaged in a discussion to build consensus around the recommended list of improvements to carry forward.

3.2 Public Engagement

Broad public involvement was a critical aspect of the study. Community-wide public outreach focused on promoting an understanding of the need for the study. The project team provided information through a project website that was created for the study and updated three times as the study progressed to share details as they were refined and invite the public to upcoming opportunities for engagement.

After the project team and stakeholder team further refined the list of potential improvements, an online open house was hosted to inform the local community about the study, share findings from the existing conditions assessment, and solicit input on the improvements being considered. In addition to highlighting the open house on the project website, the project team invited the public to attend and engage with the online open house through an informational postcard that was mailed to approximately 15,000 properties within a five-mile radius of the study area. The open house received 82 unique emails providing comments on the proposed alternative improvements. Many participants shared their support for the proposed improvements and provided additional context about the need for the specific improvements. A few participants expressed concerns about the possible negative impacts of some improvements, specifically congestion impacts at the proposed Lum Road roundabout and restricted business access on Harrison Avenue (see Appendix B.2 for details).

Additionally, the project team attended an in-person open house for the Reynolds Avenue and Harrison Avenue corridor improvements project that is considering corridor-wide improvements that lie within the NLCIA study area. The project team shared the study schedule and proposed alternatives with the open house attendees. Approximately 100 people attended the in-person open house.

Approximately two months after the online open house, an online survey was conducted to gather further input about community priorities for the potential improvements. In advance of the survey launch, a postcard was mailed to 15,000 properties within a five-mile radius of the study area to invite broad participation. The survey asked participants to rank their preferred potential improvement under consideration and also provided an open-ended comment form for additional suggestions for WSDOT to consider. Preferred potential improvements that participants were asked to consider were: Westside Connector, bike and pedestrian improvements, constructing a new I-5 interchange, connect existing roads, and traffic flow improvements to Harrison Avenue. Approximately half (54 percent) of the survey respondents indicated that their preferred improvement was a new I-5 interchange.

The project team provided two briefings each to elected officials of the City of Centralia and Lewis County. The team briefed the Centralia City Council on March 28, 2023, and July 11, 2023, and briefed the Lewis County Board of Commissioners on March 29, 2023, and July 12, 2023. At these briefings, the team updated elected officials on the status of the study. The spring briefings were focused on the draft alternatives and stakeholder team updates, and the summer briefings were focused on the recommended improvements.

4 ALTERNATIVES DEVELOPMENT AND SCREENING

4.1 Alternatives Development

4.1.1 Initial Alternatives

Between the second and third stakeholder meetings, the consultant team held an internal workshop to draft an initial list of improvement alternatives for consideration. This workshop was informed by the Baseline and Future Conditions analysis, as well as input received from stakeholders at the first two meetings. Additional detail on the initial list of alternatives is provided in Appendix C.1. These initial alternatives are as follows:

- Traffic flow improvements to Harrison Avenue
  - Access consolidation on Harrison Avenue west of I-5, near Exit 82
  - Signal enhancements along Harrison Avenue in the vicinity of Exit 82
- Improvements to Lum Road to accommodate freight traffic and connect Harrison Avenue to Reynolds Avenue
- New I-5 interchange near the Lewis County/Thurston County line
  - Option 1: Kuper Road in Lewis County
  - Option 2: 222nd Avenue in Thurston County
  - Option 3: 216th Avenue in Thurston County
- Westside Connector
  - Bridge across the Chehalis River west of I-5, which would connect neighborhoods north and south of the river
  - Upgrades to Oakland Avenue and Scheuber Road
- Bike and pedestrian improvements
  - Shared-use path on Harrison Avenue north of Kuper Road
  - Connect and/or complete sidewalks on Galvin Road
  - Add pedestrian signals at key intersections, especially near schools

4.1.2 Refined Alternatives

Based on input at the third stakeholder meeting in February 2023, the project team added the following alternatives to the screening list:

- Extend Gallagher Road to the northeast to provide a direct connection from industrial properties on Galvin Road to northbound Harrison Avenue
- Connect Blair Road and Hobson Road east of I-5 to complete a local loop route across I-5

The team also modified the scope of the access consolidation alternative to extend east of I-5 on Harrison Avenue.

Additional detail on the refined list of alternatives is provided in Appendix C.1.

4.2 Alternatives Screening

4.2.1 Level 1 Screening

In March 2023, the consultant team held a second internal workshop to conduct a Level 1 screening of the refined alternatives. The study's Purpose and Need served as the basis for this screening. Each project was assigned a score of 1 to 3 points based on how well it addressed each goal in the Purpose and Need. The Level 1 screening matrix is provided in Appendix C.2.

At the third stakeholder meeting in February 2023, several stakeholders expressed apprehension about changing the configuration of Lum Road. As a result, in the Level 1 screening process, these alternatives received lower scores and the Lum Road improvements were removed from further consideration.

4.2.2 Traffic Analysis

After the Level 1 screening process was completed, the project team analyzed the traffic impacts of three alternatives using the TRPC regional model. The three alternatives analyzed were the Westside Connector, Gallagher Road Extension, and a new I-5 interchange near the Lewis County/Thurston County line.

Due to known traffic peaking characteristics in the study area, the focus of the analysis work was the on PM peak period. A summary of the projected traffic impacts of each alternative in the 2045 PM peak period is provided below. Supporting AM and PM peak period results are shown in Appendix C.2.

Westside Connector

The projected traffic impacts of the Westside Connector project during the 2045 PM peak period, as shown in Figure 4-1, are as follows:

- Decrease in traffic volumes on both the northbound and southbound I-5 auxiliary lanes south of Harrison Avenue
- Decrease in volumes on Harrison Avenue between Johnson Road and the Harrison Avenue/I-5 interchange
- Increase in volumes on the Westside Connector bridge over the Chehalis River up Oakland Avenue/North Scheuber Road to Borst Avenue
- Modest increase in volumes on North Scheuber Road
- Virtually no change in volumes on Galvin Road

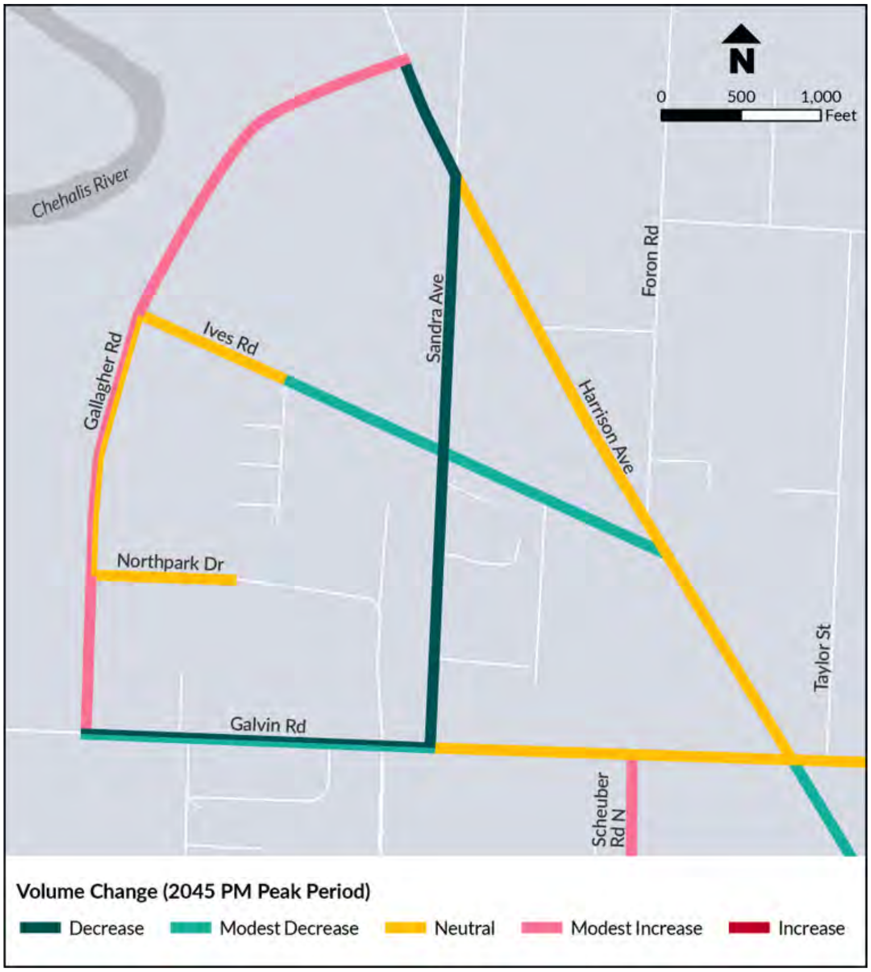
Figure 4-1: Westside Connector Traffic Volume Changes (2045 PM Peak Period)

Gallagher Road

The projected traffic impacts of the Gallagher Road Extension project during the 2045 PM peak period, as shown in Figure 4-2, are as follows:

- Decrease in traffic volumes on Sandra Avenue
- Decrease in volumes on Galvin Road, between Gallagher Road and Sandra Avenue
- Modest increase in volumes on Gallagher Road

Figure 4-2: Gallagher Road Extension Traffic Volume Changes (2045 PM Peak Period)

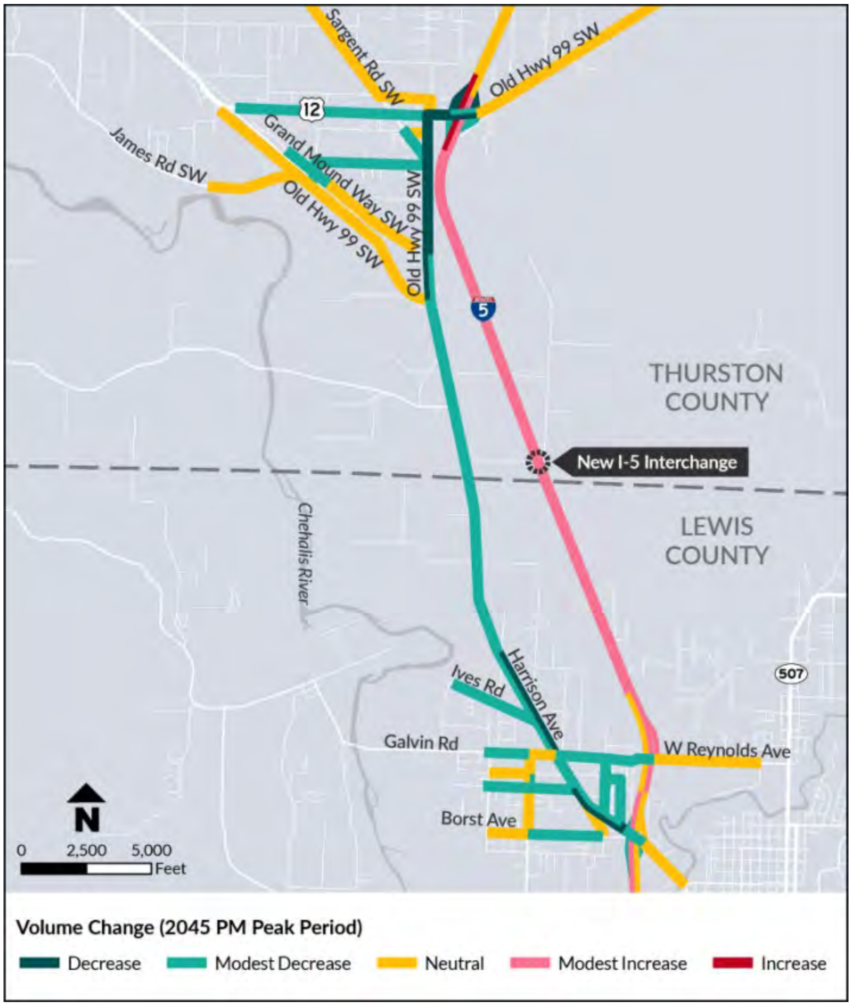


I-5 Interchange

Figure 4-3 summarizes the projected traffic impacts of a new I-5 interchange near the Lewis County/Thurston County line during the 2045 PM peak period. The project team chose the 222nd Avenue interchange option as the location for this high-level analysis, as it is located between Kuper Road and 216th Avenue. In terms of the performance of the TRPC travel demand model, these results should be comparable for each of the three interchange locations.

- Decrease in traffic volumes on Harrison Avenue near the Harrison Avenue/I-5 interchange in the peak directions
- Decrease in volumes on Old Highway 99 SW near the Grand Mound interchange
- Modest increase in volumes on I-5 between the Grand Mound and Harrison Avenue interchanges
- Either a modest decrease in traffic or no change on Reynolds Avenue and Galvin Road

Figure 4-3: I-5 Interchange Traffic Volume Changes (2045 PM Peak Period)



4.2.3 Level 2 Screening

After completing the Level 1 screening, WSDOT staff and stakeholders reviewed the screening matrix and concurred with the consultant team's recommendation to eliminate the Lum Road alternatives from further consideration.

The Level 2 screening used evaluation criteria that were developed in cooperation with WSDOT staff and presented to stakeholders at their third meeting in February 2023. Scores were not weighted in the Level 2 screening process. The full Level 2 screening matrix is included in Appendix C.2.

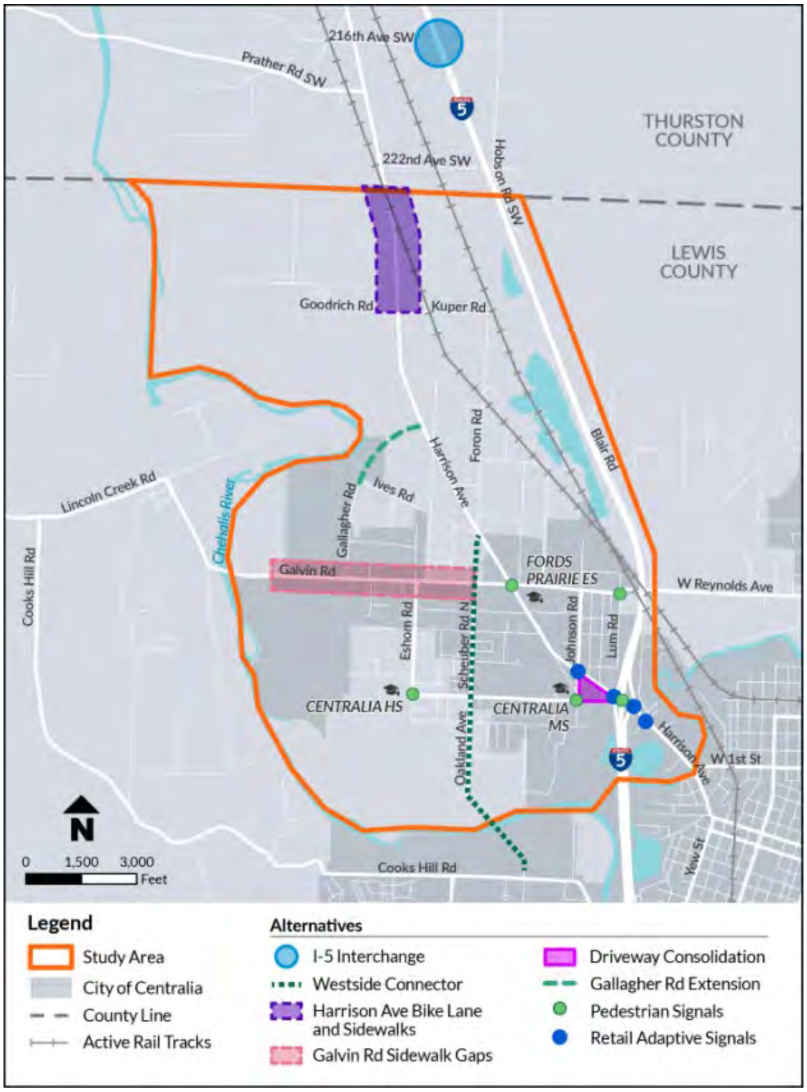
The active transportation improvements and traffic flow improvements on Harrison Avenue scored very highly in the Level 2 screening. The lowest-scoring alternative was the Blair Road – Hobson Road connection, largely due to its constructability issues and limited benefits to industrial properties west of I-5. While the combined effects of the Blair Road extension and a new I-5 interchange were not explicitly examined, the benefits of each showed merit and independent utility.

5 RECOMMENDATIONS

Recommendations from this study were developed and presented based on the detailed evaluation of alternatives, public outreach efforts and stakeholder input and feedback. Moving forward, the list of recommended projects needs to be considered within a framework of available funding as well as legislative and WSDOT policy guidance to prioritize safety, preservation and resiliency. At the final stakeholder team meeting on June 22, 2023, some members of the stakeholder team said they would like to see freight-focused recommendations given higher priority than other recommendations. However, other stakeholders countered that the holistic recommendations still benefit freight interests. For example, separating bicyclists and pedestrians from vehicle travel lanes reduces crashes—a net positive for the safety-conscious freight industry.

Based on this feedback from stakeholders, the project team grouped the recommended improvements by function, but no one group is prioritized over the other. Figure 5-1 provides an overview map of all recommended improvements.

Figure 5-1: Recommendations Overview Map



Additional work to evaluate whether local improvements to the Grand Mound interchange may be necessary before seeking approval for a new I-5 access. According to Chapter 550 of WSDOT's Design Manual, new or revised access to interstate freeways requires collaboration with and approval from FHWA.

The estimated project costs presented in this report should be considered as starting points for further planning and design work. These estimates will grow in the future due to factors such as inflation, environmental challenges, and other unforeseen costs. Final project costs will include 0.5% of capital costs allocated for maintenance and operations. Any implemented projects will follow all applicable WSDOT guidance and regulations including, but not limited to, stormwater, maintenance, operations, and Complete Streets. Additionally, maintenance agreements should be in place before construction begins on any recommended projects. These agreements should address maintenance responsibility for roadways, paths, trails, bicycle facilities, special use lanes, and sidewalks.

Additional information on the recommendations is provided in Appendix D.1 through Appendix D.3. Appendix D.1 contains a detailed recommendations matrix; Appendix D.2 contains 5% design plan sheets; and Appendix D.3 contains cost estimate worksheets.

5.1 Freight-Focused Recommendations

5.1.1 I-5 Interchange at 216th Avenue Southwest

Of the three potential interchange options considered, the 216th Avenue Southwest location is recommended to be carried forward. This option has the fewest environmental constraints for construction and has an existing, permitted crossing over the R-4 railroad and I-5. Although this option is farthest from the industrial properties in North Lewis County, the Port of Centralia has expressed that the distance of approximately 1.5 miles from the northern Port properties and approximately 4 miles from the Galvin Road Port properties is acceptable for freight trips. In addition, the City of Centralia plans to route all industrial traffic that currently uses Harrison Avenue to access the north industrial areas to the new interchange.

The total estimated cost to construct this interchange is $100,000,000 (2023 dollars, rounded), which includes a substantial contingency (i.e., cost range buffer). However, this estimate does not include the potential cost of re-constructing the existing bridge crossing over the R-4 railroad and I-5 nor potential downstream improvements to 216th Avenue between Old Highway 99 and I-5. Given recent Complete Streets legislation, additional analysis may be needed as well as additional funding to rebuild the existing crossing or retrofit the existing structure to comply with Complete Streets requirements.

Although the Kuper Road interchange location was preferred by some stakeholders, including the City of Centralia, the project team deemed this option infeasible based on severe design constraints, construction risks, and cost implications. The 216th interchange would still provide access benefits to industrial properties in North Lewis County, is projected to reroute trips away from Harrison Avenue, and does not have the feasibility concerns of the Kuper Road option.

Figure 5-2 provides a vicinity map for all three interchange options, and Figure 5-3 illustrates a possible 5% design concept for the recommended location at 216th Avenue.

Figure 5-2: I-5 Interchange Vicinity Map

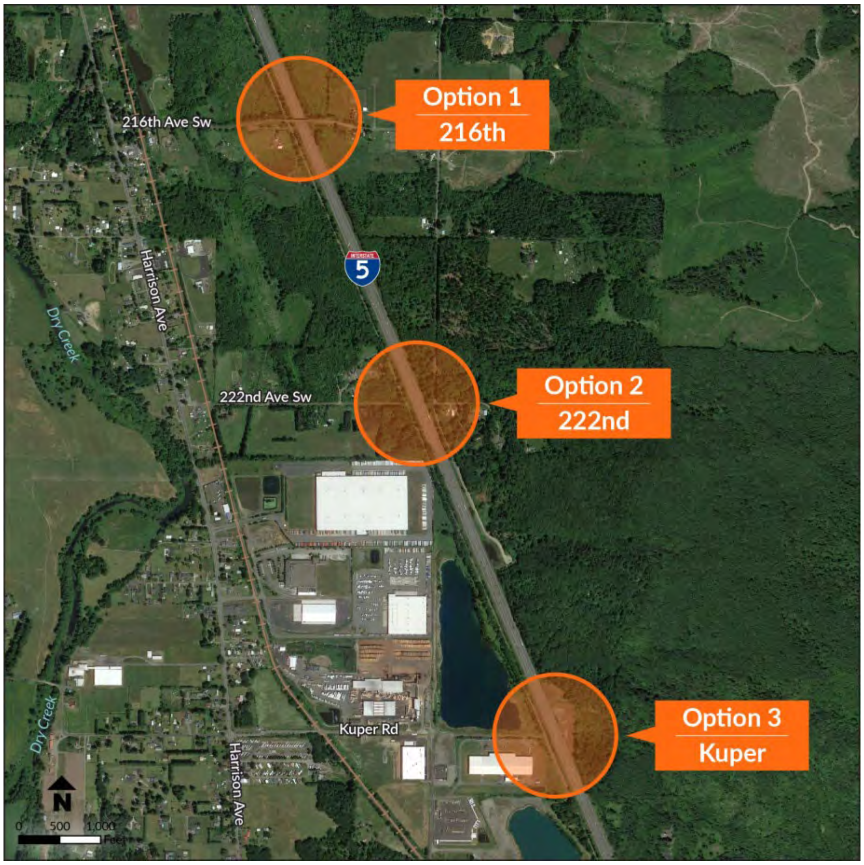
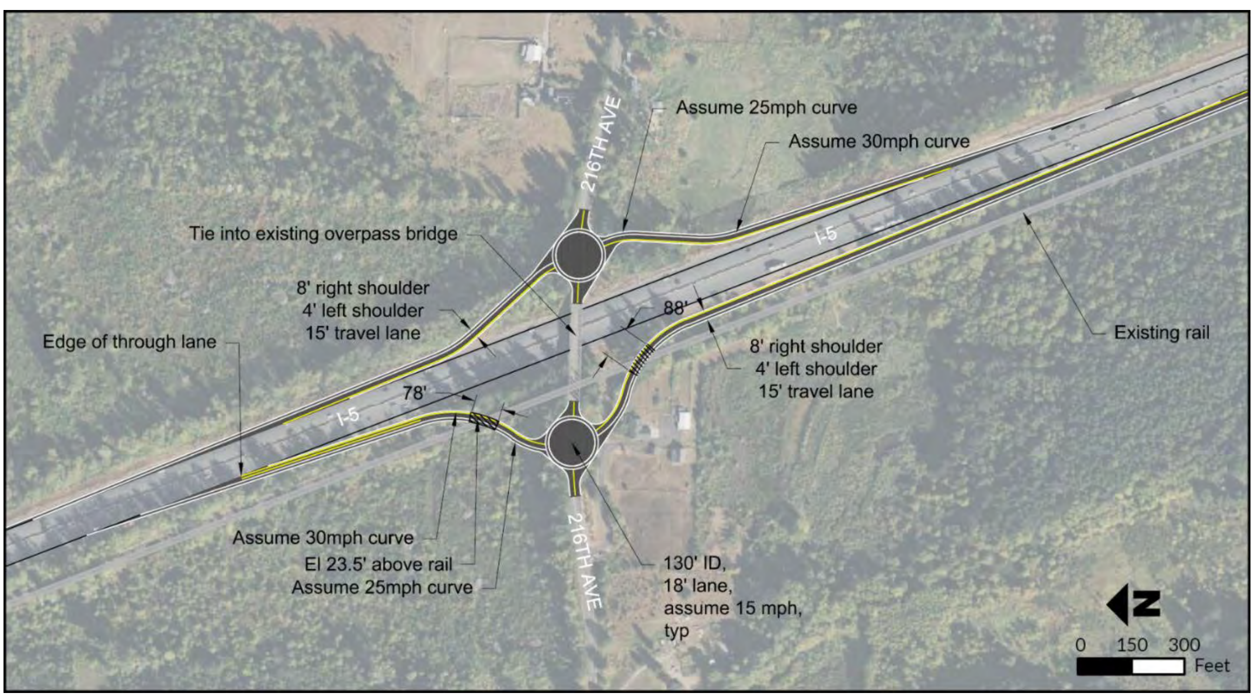


Figure 5-3: 216th Avenue / I-5 Interchange 5% Design

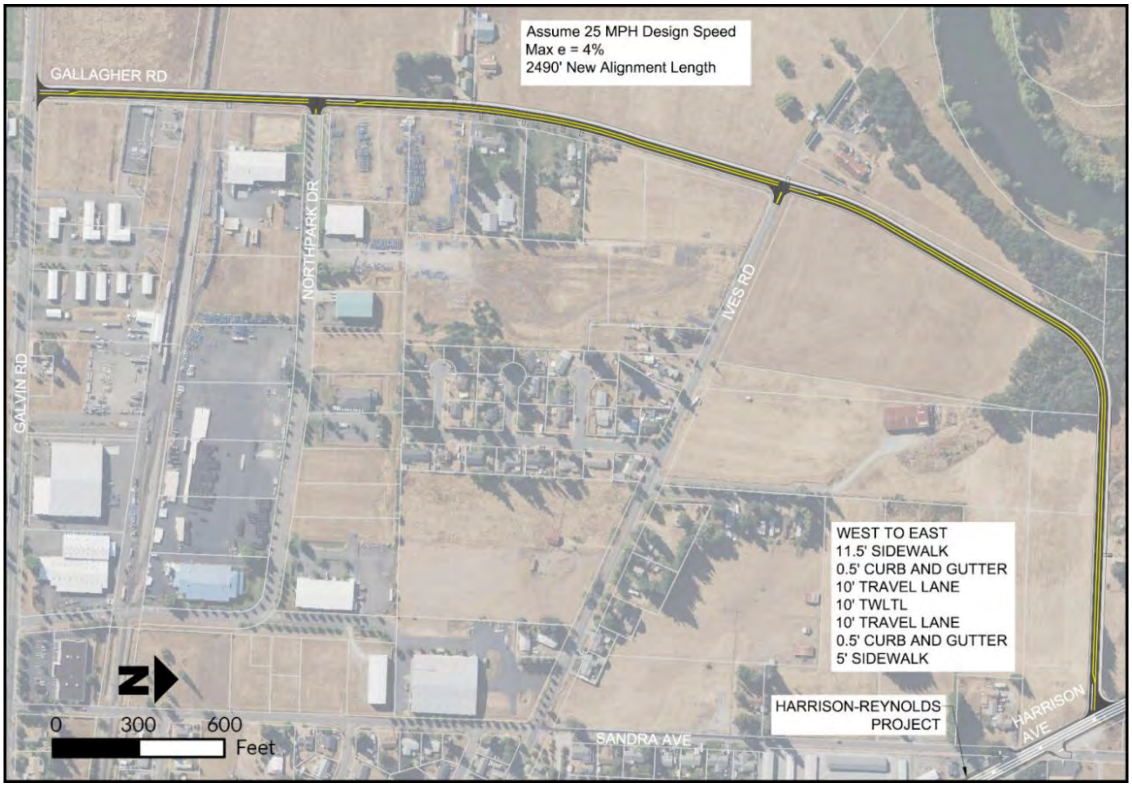


5.1.2 Gallagher Road Extension

This improvement would be most effective in combination with a new I-5 interchange, but it could be implemented beforehand. Per traffic analysis using the TRPC regional model, the Gallagher Road Extension is expected to re-route some freight trips that currently use the Harrison Avenue/I-5 interchange up to the Grand Mound interchange. The Port of Centralia concurred with this analysis, stating that freight trips will often choose a longer, easier route over a shorter, more difficult route. The total estimated cost to construct the Gallagher Road Extension is $20,000,000 (2023 dollars, rounded). Figure 5-4 provides a vicinity map of the Gallagher Road Extension, and Figure 5-5 provides a summary of the 5% design.

Figure 5-4: Gallagher Road Extension Vicinity Map

Figure 5-5: Gallagher Road Extension 5% Design



5.2 Holistic Transportation System Recommendations

The holistic recommendations contained in this section are focused on meeting the study's Purpose and Need statement, as adopted by the stakeholder team in December 2022. The proposed initial designs for the improvements identified in this section may differ slightly from existing designs developed by local agencies. Roadway improvements to Harrison Avenue and Reynolds Avenue near the I-5 interchange were not recommended because this study assumes that the improvements identified in the County-led Reynolds Avenue/Harrison Avenue Corridor Improvements Project will be constructed as funding is available.

5.2.1 Traffic Flow Improvements to Harrison Avenue

To reduce turning movements on Harrison Avenue and reduce angle and rear-end crashes, the project team recommends consolidating commercial driveways in the vicinity of Exit 82 on Harrison Avenue. Figure 5-6 indicates the area proposed for access consolidation in yellow. The total estimated cost for access consolidation in this area is $260,000 (2023 dollars, rounded).

The project team also recommends the installation of adaptive signal controller technology at five intersection locations near Exit 82 on Harrison Avenue, as indicated with the traffic signal symbols in Figure 5-6. The total estimated cost to install these adaptive signals is $940,000 (2023 dollars, rounded). However, this estimate does not include operations and maintenance costs nor funding needed to install additional improvements that may be necessary as part of the signal upgrade, such as ADA infrastructure.

Figure 5-6: Harrison Avenue Traffic Flow Improvements Vicinity Map

Based upon input from the City of Centralia, the project team also recommends the installation of center curb medians and two-way center left-turn lanes and the removal of left-turn pockets in key locations along Harrison Avenue. Closing driveways can be expensive, time consuming, and impact businesses, as well as reduce turning movements on the corridor. The project team did not prepare estimates for these strategies, as the city has already begun some of this work.

Alone or in combination, these recommended improvements on Harrison Avenue are expected to reduce congestion and decrease crashes in the vicinity of Exit 82. The project team recommends that the city undertake a traffic operations study to identify the best integration of the adaptive signal control and driveway consolidation.

5.2.2 Westside Connector

The Westside Connector project has been included in local plans for decades. Currently, any north-south trips west of I-5 are routed onto I-5, as there are no local crossings of the Chehalis River. The Westside Connector would add a new bridge connecting North Scheuber Road to South Scheuber Road, upgrade North Scheuber Road, and extend North Scheuber Road northward to Harrison Avenue. The total cost estimate for this project is $60,000,000 (2023 dollars, rounded).

This project would provide a much-needed local road connection between Fords Prairie and the south side of the Chehalis River, where Providence Hospital and several other medical offices are located. It would also provide an alternate route to I-5 in the event of severe flooding, which is an important consideration for this flood-prone area.

Both the City of Centralia and Lewis County have expressed feedback indicating a desire to avoid freight trips directed onto Oakland Avenue, Scheuber Road, or a new bridge crossing. However, by diverting local trips off of I-5, the Westside Connector is anticipated to reduce congestion in the vicinity of Exit 82 on Harrison Avenue, thus benefiting freight activity into and out of the study area.

Figure 5-7 provides a vicinity map of the Westside Connector, and Figure 5-8 provides a summary of the 5% bridge design concept. Figure 5-9 provides a summary of the 5% design for the Scheuber Road North extension.

Figure 5-7: Westside Connector Vicinity Map

Figure 5-8: Westside Connector 5% Design

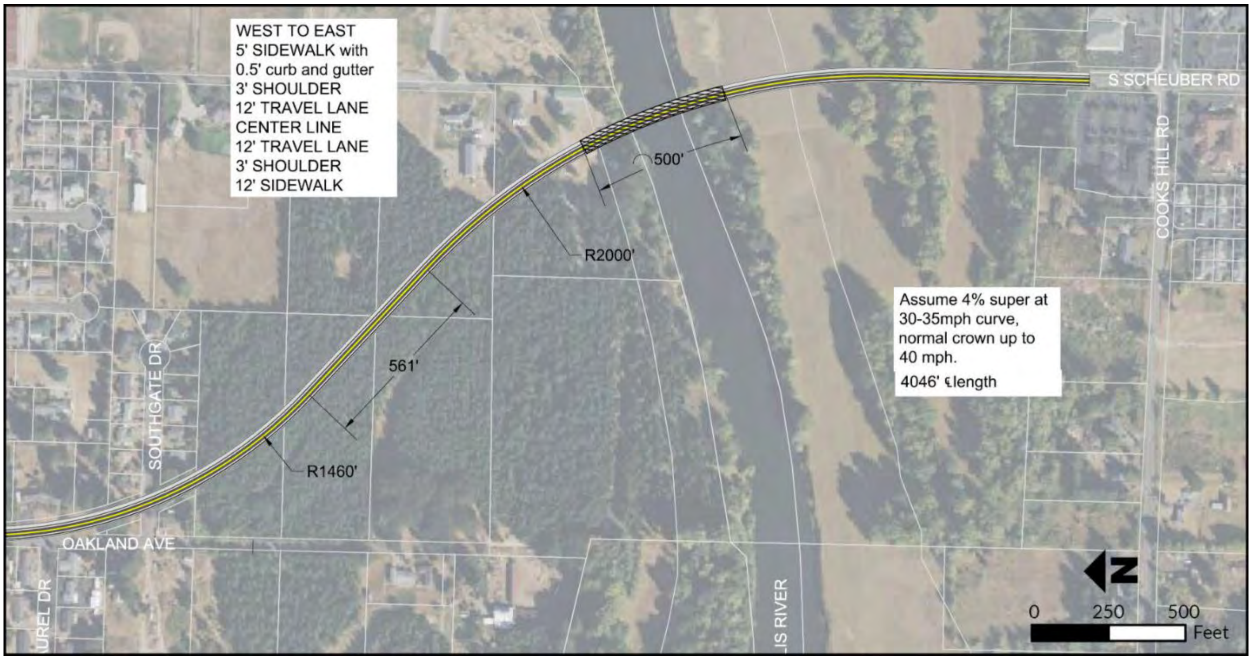
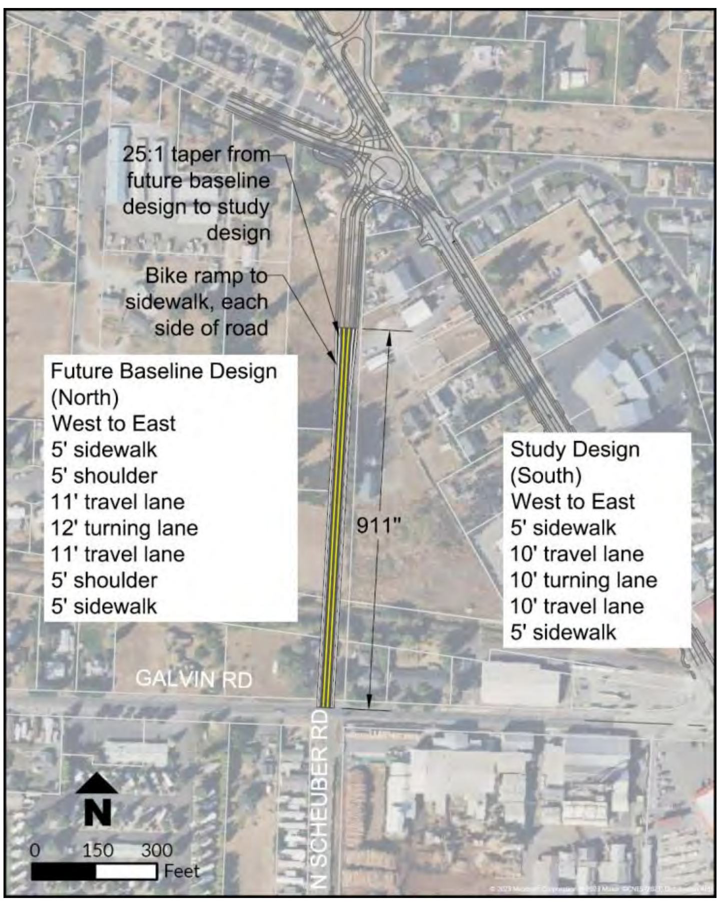


Figure 5-9: Scheuber Road North Extension 5% Design



5.2.3 Active Transportation Improvements

The project team recommends three distinct active transportation improvements in the study area that are focused on reducing crash potential for vulnerable road users. These recommendations are intended to complement the City of Centralia's ongoing efforts to improve active transportation infrastructure within the study area, including recent grant applications to WSDOT's Active Transportation Division to fund sidewalk and bicycle infrastructure. Figure 5-10 provides a summary map of recommended improvements.

Figure 5-10: Active Transportation Improvements Vicinity Map

Galvin Road Sidewalks

Although new sidewalks have been installed in recent years on Galvin Road as a condition of development permits, notable gaps still remain. Shoulders are also narrow, creating dangerous conditions for pedestrians. Several large apartment complexes are located near Galvin Road, in addition to social services and several industrial employers.

The project team recommends addressing the sidewalk gaps to support pedestrian access along the roadway. This would significantly reduce the risk of a pedestrian-involved crashes on Galvin Road, which will become even more important as Galvin Road continues to develop with industrial land uses that necessitate increased freight traffic. The total estimated cost to complete the sidewalk network on Galvin Road is $1,100,000 (2023 dollars, rounded).

Figure 5-11 provides a summary of the 5% design highlights for the recommended Galvin Road sidewalks.

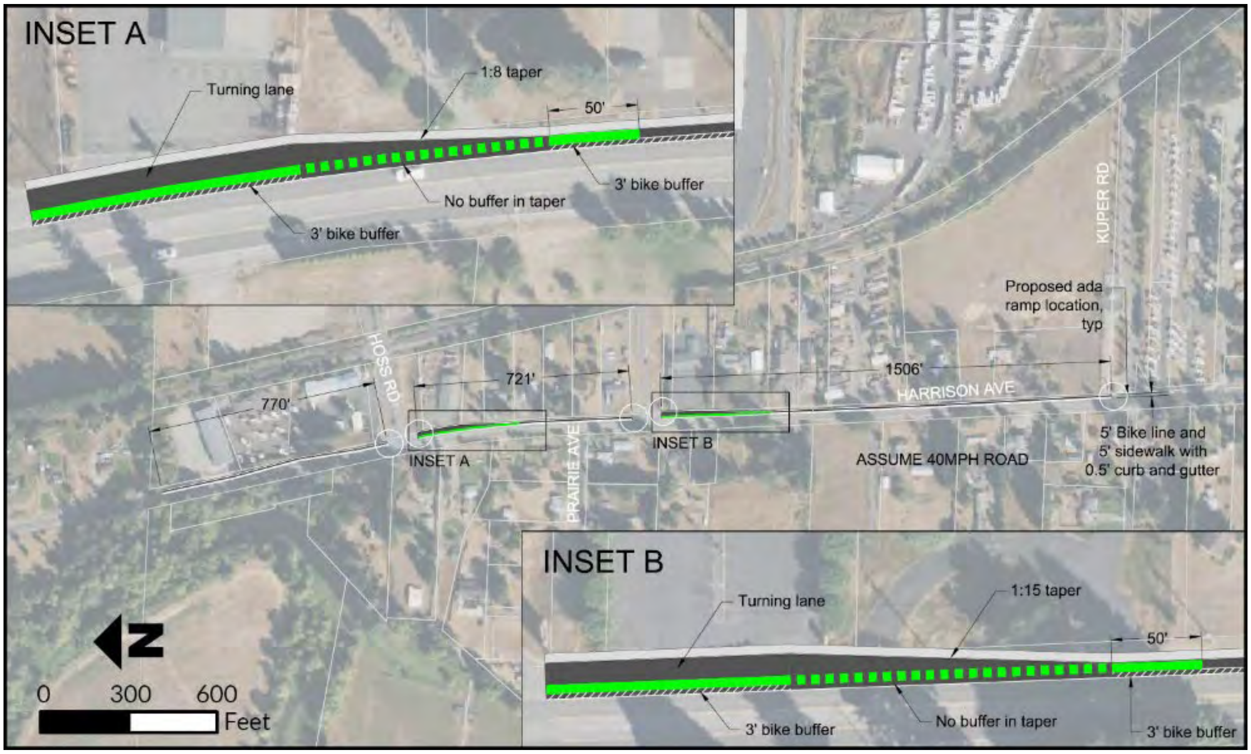
Figure 5-11: Galvin Road Sidewalks 5% Design

Harrison Avenue Bike Lanes and Sidewalks

As described in Chapter 4 of this report, the project team initially considered a shared-use path for both bicyclists and pedestrians on Harrison Avenue between Kuper Road and the Lewis County/Thurston County line. For consistency with the Lewis County-led Harrison Avenue/Reynolds Avenue Corridor Improvements Project, the NLCIA team instead recommends continuing buffered bike lanes and sidewalks up to the Thurston County line. This recommendation is only compliant with statewide Complete Streets regulations if the posted speed is lowered to 30 miles per hour and if volumes do not exceed 7,000 average daily trips. The total estimated cost is $1,300,000 (2023 dollars, rounded).

Figure 5-12 provides a summary of the 5% design for these bike lanes and sidewalks.

Figure 5-12: Harrison Avenue Bike Lanes and Sidewalks 5% Design



Pedestrian Signals

The project team recommends the installation of signalized pedestrian crossings at key locations throughout the study area, especially near schools, as shown with green dots in Figure 5-10. The total estimated cost for this improvement is $900,000 (2023 dollars, rounded). Any future project will need to be adapted to available funding provided by the legislature.

5.3 Next Steps

WSDOT will forward this report to the Washington State Legislature. Although the $50 million in Connecting Washington funding is not anticipated to be available until at least 2030, many of the projects recommended in Section 5.1 of this report are considered strong candidates for state and federal grant funding. Given that freight projects and active transportation projects are typically funded through different grant programs, this study does not present an either/or scenario.

WSDOT will work with local stakeholders to incorporate study findings and recommendations into local and regional transportation plans, where appropriate. Some recommended projects could reasonably be constructed before Connecting Washington funds are available, if initiated and shepherded by the City of Centralia or Lewis County along with their local partners. These projects include access consolidation and adaptive signals on Harrison Avenue, Galvin Road sidewalks, and equipping signals with leading pedestrian intervals. Although these projects are not directly focused on industrial access to I-5, they address the study's Purpose and Need as adopted by stakeholders in 2022, and the project team expects that overall traffic operations in the study area could be enhanced if these projects are implemented.

The recommended project lists in Sections 5.1 and 5.2 of this report are best viewed as a menu of options for elected officials to consider. All recommended projects have value for reducing crash potential, enhancing overall traffic circulation and operations, or improving freight access to industrial properties in the study area. This study provides a foundation for elected officials to move forward with their priorities as funding opportunities are pursued and/or become available before or beyond the appropriation of state funds in 2030.

APPENDIX A.1 BASELINE AND FUTURE CONDITIONS MEMO

North Lewis County Industrial Access Transportation Study (NLCIATS)

Existing and Future Baseline Conditions Technical Memorandum

Work Element 3.14

Prepared for:

WSDOT

Prepared by:

WSP

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Seattle, WA 98154

Review Copy		
Review Phase	**Date**	**Initials**
Originator	12/19/22	LC
Quality Control Checker	12/21/22	TL, NR
WSDOT Review Complete	01/13/23	RW
WSP Revisions Complete	03/01/23	LC, TL
Stakeholder Review Complete	03/17/23	LC, TL
WSDOT Review Complete	03/17/23	RW
Final Edits Incorporated	05/19/23	LC, TL

May 31, 2023

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Acronyms and Abbreviations

Acronym / Abbreviation	Definition
CFR	Code of Federal Regulations
FHWA	Federal Highway Administration
GMA	Growth Management Act
I-5	Interstate 5
IPAT	Industrial Park at TransAlta
LTS	Level of Traffic Stress
OHWM	Ordinary High Water Mark
NEPA	National Environmental Policy Act
NCHRP	National Cooperative Highway Research Program
NOAA-NMFS	National Oceanic and Atmospheric Administration – National Marine Fisheries Service
PSAP	Puget Sound and Pacific Railroad
SEPA	State Environmental Policy Act
SMA	Shoreline Management Act
SMP	Shoreline Management Program
Study	North Lewis County Industrial Access Transportation Study
TRMW	Tacoma Rail Mountain Division
UGA	Urban Growth Area
USFWS	United States Fish and Wildlife Service
WSDOT	Washington State Department of Transportation

1 INTRODUCTION

1.1 Purpose and Need

Purpose

The purpose of the North Lewis County Industrial Access Transportation Study (NLCIATS) is to examine new, alternate routes for vehicular and truck traffic in the proximity of the Harrison Avenue interchange at I-5 (Exit 82) that will lead to identification of a recommended set of improvement strategies to the industrially zoned properties in North Lewis County. This study was initiated as a legislative proviso and is being completed and coordinated through WSDOT.

Need

The study will address the current conflicts between freight traffic and local road users of all modes. In executing the work to achieve the study purpose and need, the project team will strive to achieve the following goals and objectives:

Take a Holistic View of Transportation in North Lewis County

- Enhance connectivity between South Thurston County and North Lewis County.
- Acknowledge the value of working across jurisdictional boundaries to accomplish common safety, operations, and economic development goals.
- Identify solutions by reaching consensus with support from stakeholders, recognizing that there will be give and take to achieve our vision.
- Coordinate with the County-led project on Reynolds Avenue to identify a suite of solutions that enhance safety and mobility for all users.

Improve Safety

- Improve safety for all users through viable solutions, with a focus on vulnerable users such as school children, pedestrians, and cyclists.
- Prioritize community needs adjacent to Harrison Avenue, including schools, housing, services, and commercial areas that currently share roadways with freight traffic.

Identify Short- and Long-Term Solutions for Improved Traffic and Multimodal Operations

- Provide solutions that enhance mobility, safety, and access for all modes and that support economic development and accommodate future development.
- Identify solutions that are forward compatible with the ultimate vision for the corridor, acknowledging that it cannot all be built at once.
- Consider the county's process of investigating alternatives to improve industrial access to I-5 that began in March 2015.
- Apply “dig once” principles where possible.

1.2 Prior Studies

1.2.1 2009 North Lewis County Interchange Feasibility Study

WSDOT's Southwest Region Design Office completed a study in 2009 to examine the feasibility of a new interchange on I-5 between the existing Harrison Avenue Interchange and Grand Mound Interchange. This study did not identify a preferred interchange location, conduct travel modeling, or engage in preliminary design work. The study concluded that, although a new interchange on I-5 is technically possible, it is not likely to be approved by FHWA.

1.2.2 2017 NLCIA Study, Strategic Framework and Action Plan

From March 2015 to July 2017, Lewis County conducted a study that focused on transportation improvements as a catalyst for economic development in north Lewis County. Improving industrial access to I-5 was the key focus of this study.

One of the key deliverables of the 2017 NLCIA Study was a Strategic Framework and Action Plan document. Several of the recommended strategies have now been completed, including increasing bicycle and pedestrian facilities, and reconstructing Grand Prairie Elementary School. The central recommendation of the 2017 study was to extend the I-5 collector-distributor lanes north to Reynolds Avenue, effectively creating a new interchange at Reynolds Avenue. FHWA and WSDOT did not endorse the extension of the collector-distributor lanes to Reynolds Avenue.

1.3 Study Area

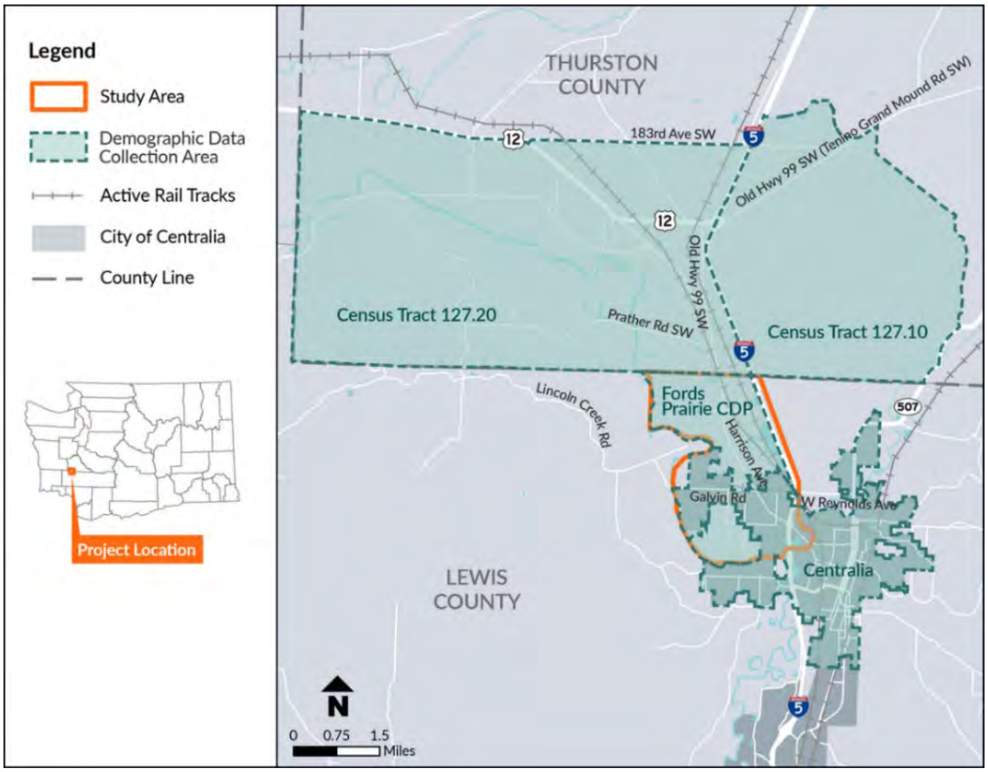
As shown in Figure 1-1, the project study area is focused on I-5 and the industrial lands to the west of the interstate. The northern boundary of the study area is the Lewis County/Thurston County line. The western and southern boundaries track the Chehalis River between the county line in the north and I-5 in the south.

Figure 1-1: Study Area Map

2 DEMOGRAPHIC TRENDS

Because transportation issues within the study area also affect those who live in surrounding areas, this demographic analysis includes populated areas surrounding the study area. As shown in Figure 2-1, the demographic analysis area includes Centralia, Fords Prairie, and two Census tracts in south Thurston County.

Figure 2-1: Demographic Analysis Area



2.1 Demographic Overview

Between 2010 and 2020, the demographic analysis area population grew by 2,553 residents. The median household income also grew significantly, increasing by 38%. Table 2-1 summarizes demographic trends within the analysis area and statewide between 2010 and 2020. Table 2-2 compares demographic data within the analysis area to statewide data in 2019.

Table 2-1: Demographic Trends from 2010 to 2020

Target Measure	2020	2010	% Change
Total population	29,494	26,941	+9.48%
Median household income	$52,517	$37,938	+38%
People of color	8,337	5,465	+53%
Children (younger than 18, percent)	6,712	6,846	-1.96%
Seniors (65 and older)	5,272	4,153	+26.94%

Source: US Census

Table 2-2: Analysis Area and Statewide Demographic Data, 2019

Target Measure	Demographic Analysis Area	Washington State
Total population	28,442	7,614,893
People of color (percent)	22%	25%
Median household income	$52,960	$82,400
Seniors (65 and older, percent)	18%	15%
Children (younger than 18, percent)	24%	22%
Total LEP	6%	8%
- Spanish LEP	5%	3%
- Asian/Pacific Island languages LEP	0.4%	3%

Source: American Community Survey, 2019 5-Year Estimates

The demographic analysis area has a higher proportion of children and seniors than the statewide average. The median household income is also significantly lower than the statewide average, and the study analysis area is less racially diverse than the state as a whole.

Limited English Proficiency (LEP) households are those that report another language as being primarily spoken in that household with English “not spoken well.” Within the demographic analysis area, Spanish speakers are the largest group of non-English speakers, which account for 5 percent of the demographic analysis area total population. Speakers of Asian and Pacific Islander languages are the second-largest group, which make up 0.4 percent of the demographic analysis area total population. This is consistent with statewide trends.

StreetLight Data provides some synthesized demographics data using census data based on the locations of sampled trips and devices. The origin-destination analysis to and from the study area shows that out of all users in the analysis, 15 percent are Hispanic, 5 percent are people with limited English proficiency, and 18 percent are with a disability.

2.2 Economic Health

The demographic analysis area provides a total of 10,710 jobs in 2019. Compared to statewide data, lower-income jobs make up a larger share of all jobs in the area. 23% of jobs are low-income ($1,250 per month or less), which is a 6% larger share than the statewide average. 38% of jobs are low-medium income jobs ($1,251 to $3,333 per month), which is a 10% larger share than the statewide average.

Table 2-3: Analysis Area and Statewide Employment Data, 2019

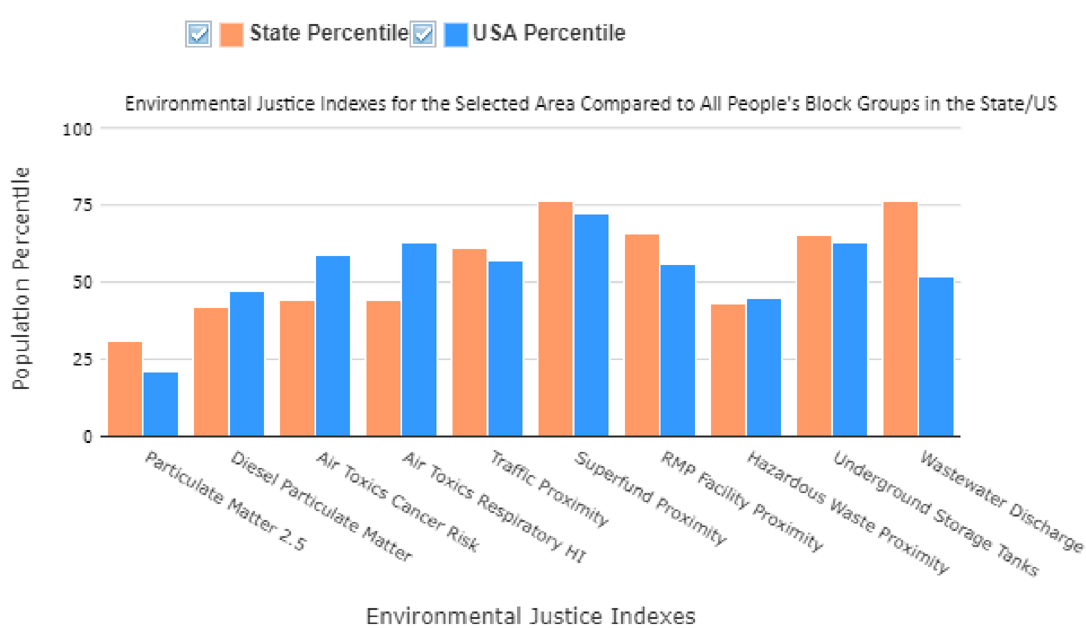
Target Measure	Study Analysis Area	Washington State
Total jobs	10,710	3,282,974
Low-income jobs ($1,250 per month or less)	23%	17%
Low-medium income jobs ($1,251 to $3,333 per month)	38%	28%

Source: LEHD Origin-Destination Employment Statistics (LODES), Census on the Map, 2019

2.3 Environmental Justice and Community Health Indicators

Per EPA's Environmental Justice Screening and Mapping Tool (Version 2.1) (EJSCREEN) (https://ejscreen.epa.gov/mapper/), the demographic analysis area is in the 21st percentile nationally for particulate matter 2.5, in the 72nd percentile nationally for superfund proximity. A higher percentile indicates a higher risk. As illustrated in Figure 2-2 and shown in Table 2-4, other environmental justice indexes that are in higher percentile nationally include Air Toxics Cancer Risk, Air Toxics Respiratory Hazard Index, and Underground Storage Tanks.

Figure 2-2: Environmental Justice Indexes for Demographic Analysis Area



Source: EPA EJSCREEN

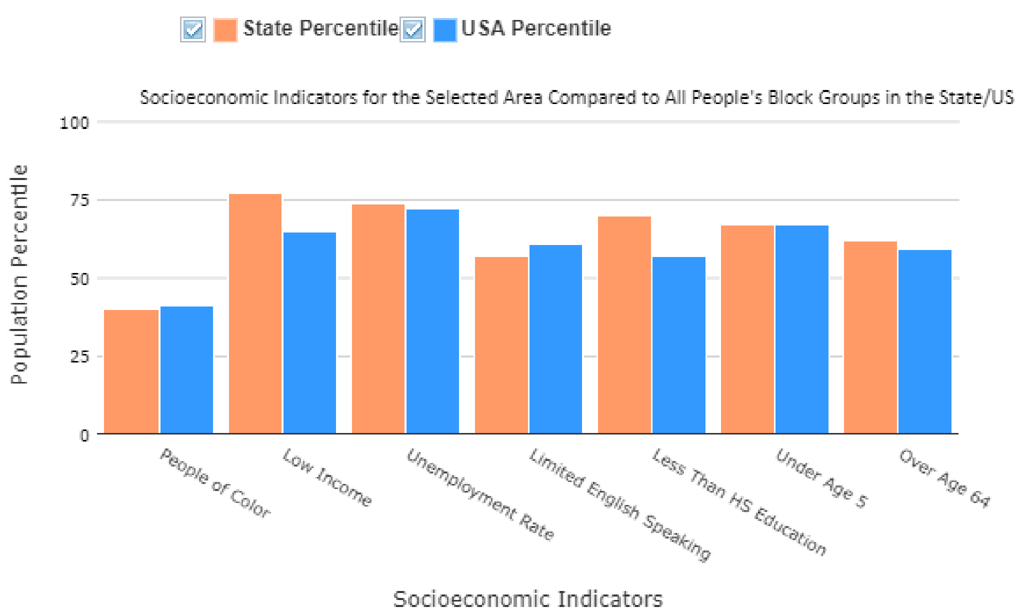
Table 2-4: EJSCREEN Demographic Analysis Area Environmental Justice Indexes in Comparison with Washington State and USA Data

Environmental Justice Index	Percentile in State	Percentile in USA
Particulate Matter 2.5	31	21
Diesel Particulate Matter	42	47
Air Toxics Cancer Risk	44	59
Air Toxics Respiratory Hazard Index	44	63
Traffic Proximity	61	57
Superfund Proximity	76	72
Risk Management Program (RMP) Facility Proximity	66	56
Hazardous Waste Proximity	43	45
Underground Storage Tanks	65	63
Wastewater Discharge	76	52

Source: EPA EJSCREEN

EJSCREEN also includes socioeconomic indicators and compares the data to statewide and nationwide levels as illustrated in Figure 2-3 and Table 2-5. For the demographic analysis area, unemployment rate is at 7% and in the 77th percentile statewide and in the 74th percentile nationally. Most of the other indicators are also in the higher than 50th percentile range both in state and in the country.

Figure 2-3: Socioeconomic Indicators State Percentile and USA Percentile for Demographic Analysis Area



Source: EPA EJSCREEN

Table 2-5: EJSCREEN Demographic Analysis Area Socioeconomic Indicators in Comparison with Washington State and USA Data

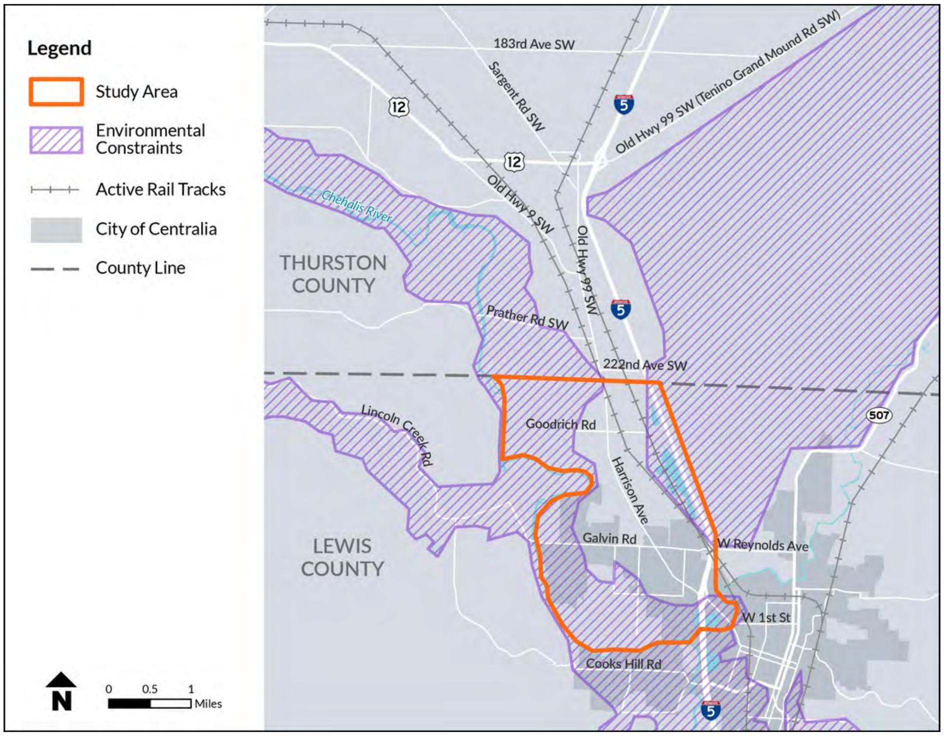
Socioeconomic Indicators	Percent	State Average	Percentile in State	US Average	Percentile in US
People of Color	22%	33%	40	40%	41
Low Income	37%	24%	77	30%	65
Unemployment Rate	7%	5%	74	5%	72
Population with Less Than High School Education	10%	8%	70	12%	57
Population under Age 5	7%	6%	67	6%	67
Population over Age 64	18%	15%	62	16%	59

Source: EPA EJSCREEN

3 ENVIRONMENTAL SCREENING

The study area and its surroundings have many environmental constraints which are concentrated in two areas as shown in Figure 3-1. Any future transportation project proposed in these areas would take additional time and coordination and would likely incur additional costs.

Figure 3-1: Environmental Constraints Summary Map



3.1 Natural Environment

3.1.1 Critical Areas

The State of Washington's Growth Management Act (GMA) requires all cities and counties to adopt development regulations that protect critical areas. These critical areas include geologically hazardous areas, wetlands, fish and wildlife habitat conservation areas, critical aquifer recharge areas and frequently flooded areas. When a proposed project impacts critical areas, the project's impacts and associated mitigation must be addressed in a Critical Area Report, NEPA and SEPA documentation, and the local agency permitting package. Proposed projects may be subject to additional state and/or federal permitting requirements.

Figure 3-2 summarizes geohazards, and Figure 3-3 summarizes other critical areas.

3.1.1.1 Geologically Hazardous Areas

Geologically hazardous areas include lands susceptible to erosion, sliding, earthquakes, and volcanic eruptions. Within the study area, steep slopes, erosive soils and landslides are the most common geologic hazards. The most notable geologically hazardous area within the study area lies to the north of Reynolds Avenue and immediately east of I-5, extending north of the Thurston County line. This area has steep slopes and erosion hazards and is undergoing large-lot residential development.

3.1.1.2 Wetlands

Most of the wetlands within the study area are adjacent to and associated with the Chehalis and Skookumchuck Rivers. However, a wetland complex is also present along I-5, and smaller wetlands are scattered throughout the study area. For additional information about the location of wetland resources, refer to Figure 3-2.

3.1.1.3 Fish and Wildlife Habitat Areas

Similar to wetlands, fish and wildlife habitat areas within the study area are largely adjacent to waterways. Habitat buffers surrounding rivers, streams, and wetlands are required by local code and state and federal laws. If development is approved within these buffers, mitigation may be required.

Local codes at the City of Centralia, Lewis County and Thurston County are concerned with impacts to wetland, stream and habitat buffers. At the state level, the Washington Department of Fish and Wildlife and Department of Ecology are concerned with impacts to habitat buffers. At the federal level, the US Fish and Wildlife Service, National Marine Fisheries Service and US Army Corps of Engineers are concerned with direct impacts to habitat.

3.1.1.4 Critical Aquifer Recharge Areas

Much of the study area is located within a critical aquifer recharge area, or CARA. Additional permitting requirements may apply for projects sited within CARAs to ensure that drinking water quality is maintained.

Figure 3-2: Geohazards Map

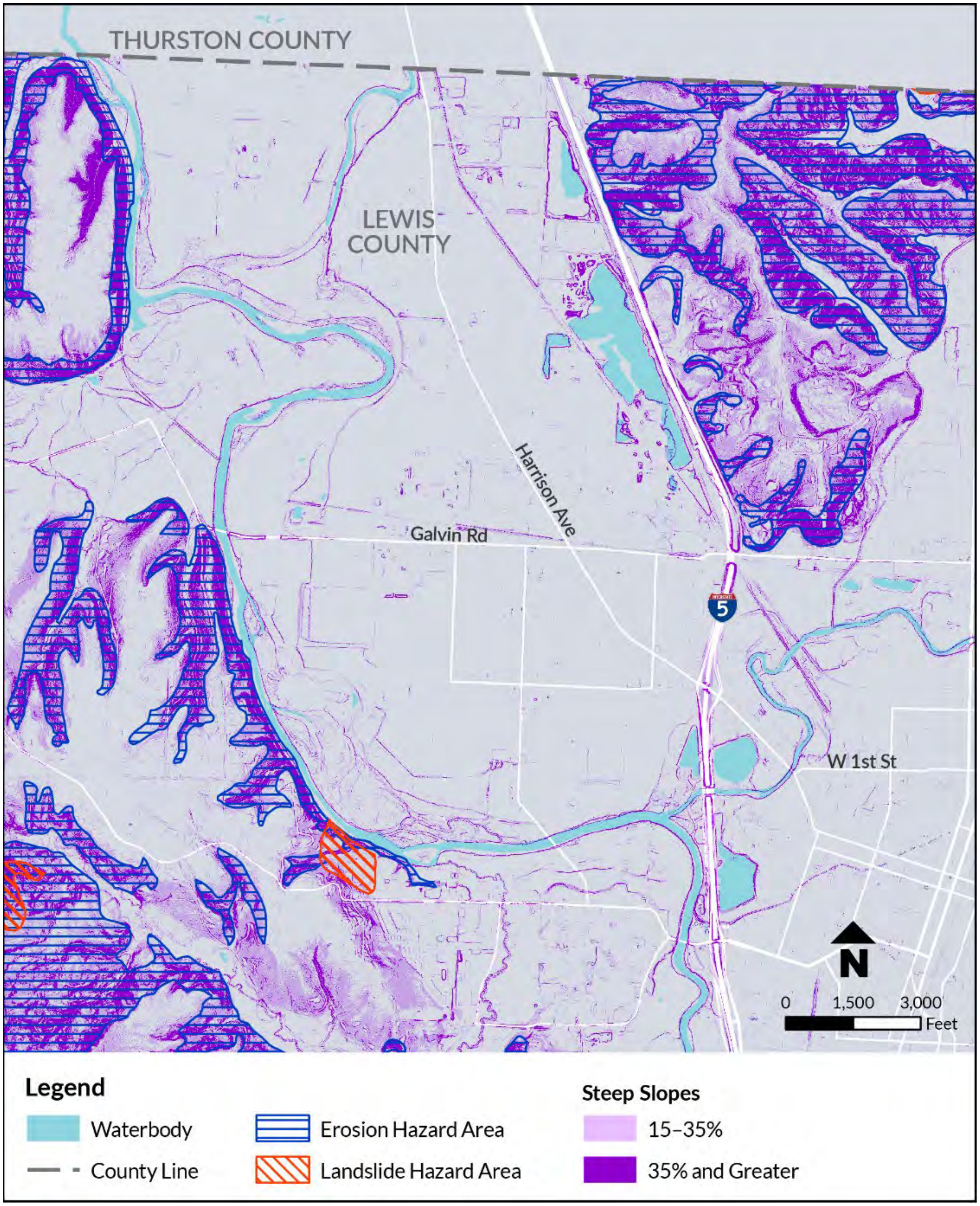
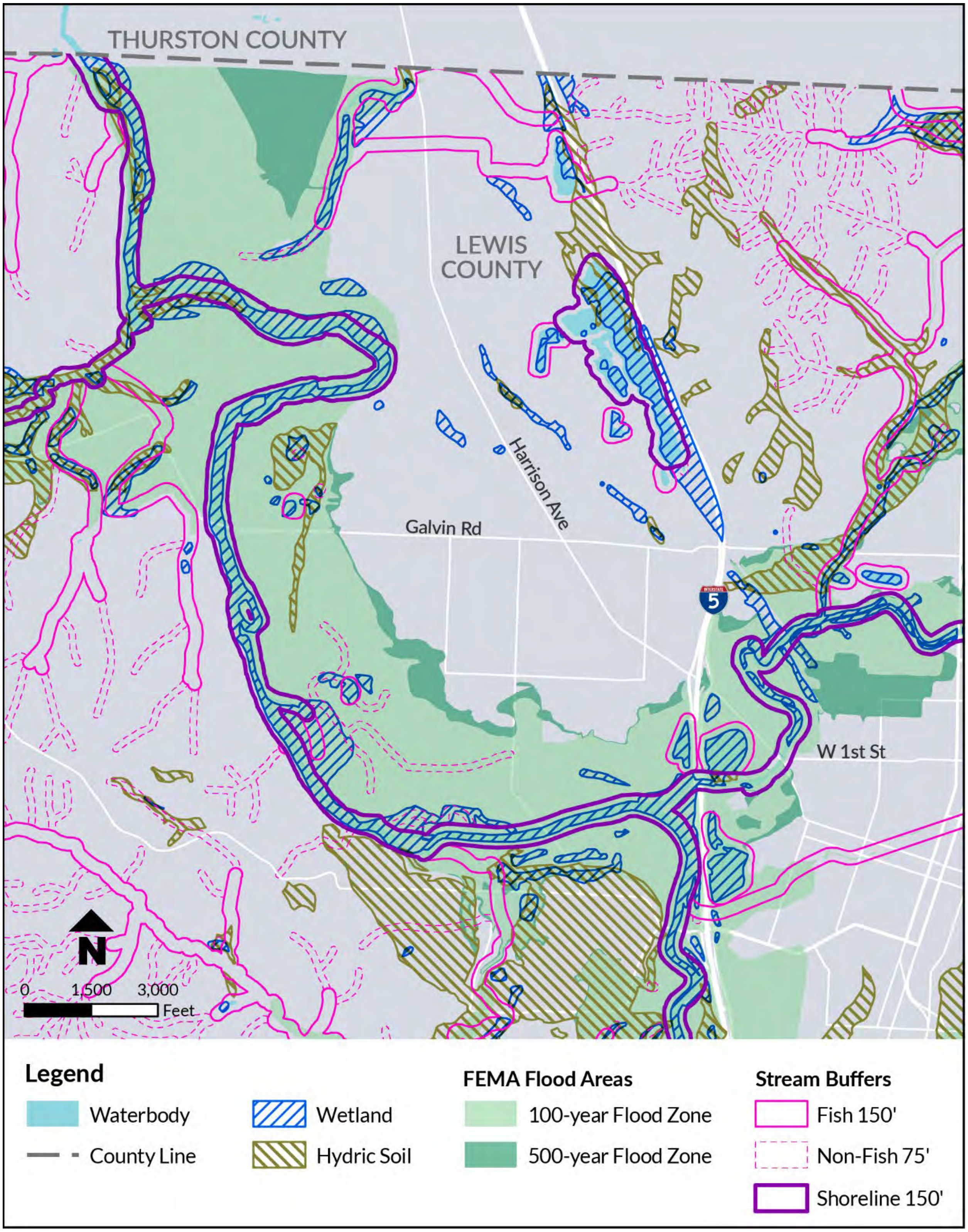


Figure 3-3: Aquatic Critical Areas Map



3.1.2 Shorelines

The State of Washington's Shoreline Management Act (SMA) requires all local jurisdictions with shorelines to develop land use policies and regulations that guide the use of these shorelines. The State Department of Ecology reviews and approves local shoreline regulations, which are known as Shoreline Management Programs (SMPs).

Although SMPs are developed and implemented at the local level, the SMA has core requirements that apply statewide. Lands that are within 200 horizontal feet of a regulated shoreline's Ordinary High-Water Mark (OHWM) are subject to the requirements of the SMA. Within the study area, this impacts lands that are near the Chehalis and Skookumchuck Rivers. Wetlands associated with regulated shorelines also fall under the authority of the SMA.

Both Lewis County and the City of Centralia have SMPs that set shoreline buffers for various land uses within shoreline jurisdiction. These SMPs also lay out the permitting requirements for various kinds of projects. Except maintenance and replacing existing structures, transportation projects such as a new bridge or expanded roadway typically require a Shoreline Substantial Development Permit.

The City of Centralia is currently in the process of updating their SMP, which can be viewed online. Lewis County's SMP was updated in 2021 and can also be viewed online.

3.1.3 Floodplain and Climate Vulnerability

Both the Skookumchuck and Chehalis Rivers lack flood control infrastructure, leaving the study area particularly vulnerable to flood risk. Including its Urban Grown Area (UGA), 26% of the land within the City of Centralia lies within a floodplain (City of Centralia, 2022). Much of the land owned by the Port of Centralia lies within the Chehalis River floodplain, including land that has been recently developed. Impacts to the floodplain are subject to local permitting and Federal Emergency Management Agency floodplain requirements.

Centralia has experienced at least 24 flood events between 1887 and 2009. In the winters of 1996, 2007 and 2009, flooding was caused by heavy rain and snowmelt. The 1996 flood was particularly severe and affected large swaths of land outside of the FEMA floodplain. As climate change continues to accelerate, flood risk is expected to increase.

3.1.4 Fish Passage Barriers

There are currently no corrected fish passage barriers within the study area. There is one corrected fish passage barrier near Mellen Street, where China Creek flows under I-5. There is another corrected barrier just north of the Lewis County line, where an unnamed stream flows under I-5.

There are no uncorrected fish passage barriers within the project area. There is one uncorrected barrier south of the study area, at the I-5 southbound off-ramp to State Route 6. There is another uncorrected barrier just north of the Lewis County line and south of 216th Ave SW, where an unnamed stream flows under I-5. This uncorrected barrier is located approximately 1/3 mile northwest of the second corrected barrier referenced above.

3.1.5 ESA-Listed and Sensitive Species

WSDOT consults with both the US Fish and Wildlife Service (USFWS) and the National Oceanic and Atmospheric Administration – National Marine Fisheries Service (NOAA-NMFS) on the Endangered Species Act (ESA). USFWS maintains the Information for Planning and Consultation online tool (IPaC), which provides a summary of populations that are subject to USFWS regulations. Per the IPaC tool wolverine, marbled murrelet, streaked horned lark, yellow-billed cuckoo, bull trout, Monarch butterfly, Taylor's checkerspot butterfly, golden paintbrush and Kincaid's lupine populations have been identified as potentially occurring in the project area.

According to the Washington State Department of Fish and Wildlife (WDFW), there is one bald eagle nest within the study area, one within 400 feet of the study area, and one within 600 feet of the study area. Bald Eagles are considered a Sensitive Species within the State of Washington, and they are protected by the Bald and Golden Eagle Protection Act.

In addition, Roosevelt elk have been documented within the project area. Roosevelt elk were previously considered a species of concern, but their population west of the Cascade Mountains has rebounded, and they are now considered a game animal within the State of Washington.

There are no documented occurrences of pocket gophers within the study area, but 2011 WDFW data showed gopher soils within the study area. There are known pocket gopher populations in Thurston County that are protected under the ESA. For now, these populations are only known to occur in Thurston County, not Lewis County. Given that there are study intersections in Thurston County, pocket gopher ESA protections and processes could apply to any future ground disturbance activities in Thurston County. If a population is detected in Lewis County in the future, ESA protections and processes could apply to future ground disturbance activities in Lewis County as well.

3.2 Built Environment

3.2.1 Public Lands

No state or federal lands are located within the study area. Public lands within the study area include Fort Borst Park, Pioneer Park, and Riverside Park, all located within and owned by the City of Centralia.

3.2.1.1 Section 6(f) Resources

Section 6(f) is one component of the Land and Water Conservation Fund Act of 1965. This Act created the Land and Water Conservation Fund (LWCF), which is a federal program that provides funding to government agencies to acquire land and water for recreation use. Under Section 6(f), the National Park Service must approve any conversion of property acquired or developed with LWCF grant money to non-recreational use.

As of February 2023, the potential use of Section 6(f) funds towards the aforementioned lands had not been verified by the study team. If Section 6(f) funds were used towards development of a park, and if a transportation project impacts this park, then the National Park Service would need to approve the land use conversion.

3.2.1.2 Section 4(f) Resources

Section 4(f) is one component of the Department of Transportation Act of 1966. Section 4(f) protects historic sites, publicly owned and accessible parks, recreation areas, and wildlife and waterfowl refuges. Per FHWA, "Before approving a project that uses Section 4(f) property, FHWA must determine that there is no feasible and prudent alternative that avoids the Section 4(f) properties and that the project includes all possible planning to minimize harm to the Section 4(f) properties; or FHWA makes a finding that the project has a de minimis impact on the Section 4(f) property."

The City-owned parks mentioned in section 3.2.1 all fall under Section 4(f). There are no wildlife or wildfowl refuges within the study area. There are two cemeteries, one gravesite, and 11 documented archaeological sites within the study area. Section 4(f) resources include all sites eligible for inclusion on the National Register of Historic Places. There are two Section 4(f) historic resources within the study area. One site is the Joseph Borst House, located within Fort Borst Park. The other site is the Wesley Everest gravesite, located at Sticklin-Greenwood Memorial Park.

3.2.2 Noise Walls

Per WSDOT's Community Planning Portal, there are no state-owned noise walls within or near the study area.

3.2.3 Historic Bridges

The Skookumchuck River Bridge was built in 1951 and carries I-5 over the Skookumchuck River in two spans, with one for northbound mainline traffic and one for southbound mainline traffic. This is the only historic bridge within the study area.

3.2.4 Hazardous Materials

The Department of Ecology maintains an interactive Toxics Cleanup Map that shows cleanup sites by status. This map includes many types of cleanup sites, including soil, sediment, water and air contamination. Mapped contaminants include petroleum, heavy metals, chemicals, and persistent organic pollutants.

There are currently four sites within the study area awaiting cleanup and five sites where cleanup has started. There are several additional sites where cleanup is complete.

In addition, I-5 is a major route for the transport of hazardous materials.

3.2.5 Stormwater BMP Sites

Per WSDOT's 2021 Stormwater Report, there are three permanent Best Management Practice (BMP) sites within WSDOT Southwest Region, which includes Lewis County. No new BMPs were built in 2021 within the study area.

3.2.6 Wetland Mitigation Sites

Two wetland mitigation banks are in Lewis County, the Chehalis Basin Wetland Mitigation Bank and the North Fork Newaukum Wetland Mitigation Bank.

Neither site is in the study area, although the NLCIA transportation study area is within the service area for both mitigation banks. Either bank can be used to mitigate wetland impacts resulting from a transportation project in the study area. The North Fork Newaukum bank is a WSDOT bank, not a public bank. As such, it can only be used for mitigating the wetland impacts of WSDOT-led projects.

3.2.7 Ongoing Environmental Deficiencies

A location can qualify as a WSDOT Chronic Environmental Deficiencies (CED) project if WSDOT maintenance crews have repaired the site at least three times in the last 10 years and if this maintenance work negatively affects aquatic fish habitat. Per WSDOT's 2020 CED Annual Report, there are no active or planned CED sites near the study area.

4 EXISTING & PROPOSED LAND USE

Within the study area, zoning is largely commercial and industrial. However, there are pockets of residentially zoned land throughout the study area, plus land that is zoned for commercial or industrial use but has a pre-existing home on the lot.

In terms of recent growth, there has been recent large-lot residential development just east of I-5 and north of Reynolds Avenue. There have also been new developments at the Port-owned industrial parks within the study area, most notably the large distribution center at Port Park 2 just south of Galvin Road and east of the Chehalis River. There has also been some recent residential development just east of I-5 and north of Reynolds Avenue. Additional industrial developments since 2019 include Stihl NW in Port Park 1 at Kuper Road and Foron Road, Walmart Storage and Transfer Yard in Port Park 2 at Foron Road, and Midway Logistics at Harrison Avenue just south of Kuper Road.

There is also planned industrial development in Port Park 1 on Northpark Drive and on Reynolds Road adjacent to I-5.

4.1 City of Centralia

Land use along Harrison Avenue near I-5 is zoned Highway Commercial or General Commercial. East of I-5, parcels along Reynolds Avenue are zoned Light Industrial, with some residential pockets. Several large parcels are zoned Heavy Industrial adjacent to the Port of Centralia's Park 2, in the immediate vicinity of I-5 and north of Reynolds Ave. In addition, a number of parcels zoned Heavy Industrial are adjacent to the Park 2 and are located north of Galvin Road and east of the Chehalis River.

The City of Centralia's current zoning map and comprehensive plan map can be viewed online.

4.2 Lewis County

Much of the land within Lewis County that is currently zoned for Light Industrial or Heavy Industrial is currently residential, vacant, or open space. As demand for industrial land near I-5 continues to increase, development of these parcels that are already zoned for industrial use are anticipated to accelerate.

Lewis County's current zoning map and comprehensive plan map can be viewed online.

4.3 Port of Centralia

The Port of Centralia updated their Master Plan in February 2021. This Master Plan is largely focused on development standards on the Port's properties. The plan also includes maps of the Port's three industrial parks, two of which are in the NLCIA study area.

Park 1 is located near Galvin Road, east of the Chehalis River. All the parcels in Park 1 are zoned Heavy Industrial. It is close to non-Port-owned parcels zoned Light Industrial. Park 2 is just west of I-5 and accessed via Harrison Avenue to Kuper Road, Robert Thompson Road, and Hoss Road.

The Port-owned property and a map of truck routes associated with each Port-owned industrial park can be viewed in the Master Plan.

5 ACCESS & CIRCULATION

5.1 State and Federal Standards

WSDOT owns and operates I-5, which runs through the study area with the Harrison Avenue interchange providing access. Any changes to existing access points or requests for new access are governed by the WSDOT Design Manual Chapter 530 – Limited Access Control. This chapter provides guidance for WSDOT to establish access control to arterial roadways within their jurisdiction. Types of access control that may be established under Chapter 530 are full, limited, and partial access control. Chapter 530 further describes the necessary documentation needed to establish any one of these types of access control.

Although WSDOT owns and operates I-5, they are required to gain approval from the Federal Highway Administration (FHWA) for changes to existing access points or the construction of new access points. The Interstate System Access Informational Guide has been published by FHWA to provide guidance on how to process requests for changing existing access points or constructing new access points. This document describes the items needed to request a change in access:

- FHWA's policy for changes to the access to the interstate system
- Which facilities this policy applies to
- The eight policy requirements that are addressed in considering either a change to an access point or a new access point
- WSDOT's involvement in requesting these changes
- FHWA's acceptance and final approval of the requested changes.

The technical guidance for creating or changing access to the limited access roadways can be found in National Cooperative Highway Research Program (NCHRP) Report 687 – Guidelines for Ramp and Interchange Spacing. This document identifies the technical criteria for ramps and interchange layouts for both interstate and non-interstate roadways, such as weaving distances for on/off ramps, spacing of interchanges, the establishment of collector-distributor lanes, rest areas, weigh stations, and high occupancy vehicle applications. These guidelines complement the technical principles found in other roadway design guidelines such as the Policy on Geometric Design of Highways and Streets, Highway Capacity Manual, Manual on Uniform Traffic Control Devices and Highway Safety Manual. These manuals have been used as reference material for the creation of the WSDOT Design Manual, Divisions 12 – Geometrics and 13 – Intersections and Interchanges.

5.2 Local Access Management

Both the City of Centralia and Lewis County maintain roadways within the project area. Their policies for access management to these roadways are governed by the City and County codes. The primary focus of these codes is to ensure the safety of vehicles and pedestrians when entering and leaving the roadway. Specified within these codes are the minimum access spacing requirements, corner clearance, sight triangles and when acceleration/deceleration lanes may be needed. These codes refer to the AASHTO Greenbook and WSDOT Design Manual for the technical design requirements and when a Transportation Impact Analysis (TIA) may be required.

Along Harrison Avenue near Belmont Avenue, there are frequent and redundant driveways serving commercial properties. This leads to stop-and-go traffic which aggravates congestion and contributes to high crash rates. Per the City of Centralia, the high crash rate near Belmont Avenue is largely due to the left turn ability onto South Belmont Avenue from westbound traffic and limited visibility for pedestrians and vehicles trying to cross South Belmont Avenue when there are high traffic volumes. Additionally, the Safeway parking lot at the signal has a substandard entrance. These factors lead to to stop-and-go traffic which aggravates congestion and contributes to high crash rates.

6 RAILROAD FACILITIES

The rail system through Centralia is vital to local and statewide freight transportation systems. Currently, there are three freight railroads within the study area, two of which are active. Daily Amtrak passenger rail service is provided at the Centralia station located outside the study area in downtown Centralia.

6.1 Description and Inventory

The two active railroads within the project area are owned by Puget Sound and Pacific Railroad (PSAP), and Tacoma Rail Mountain Division (TRMW). Both railroads access the study area in a north-south direction and closely follow the alignment of I-5. Both railroads merge into one at the I-5 underpass at Blakeslee Junction, then veer to the east. Blakeslee Junction is the only at-grade rail crossing intersecting a high-volume roadway (W. Reynolds Avenue) within the project area. Other at-grade crossings intersect local access roadways which have limited impacts on the flow of traffic.

Figure 6-1: Railroad Facilities Map

PSAP does have intermodal facilities and railyards on its northern alignment, whereas TRMW has none within the study area. Adjacent to these intermodal facilities are both commercial and industrial facilities that utilize the railroad for the shipping and receiving of freight, which in turn is either broken down and distributed or processed at these facilities.

Washington State's Freight and Goods Transportation System (FGTS) was most recently updated in 2021. It classifies freight corridors into distinct categories based on annual freight tonnage moved. It defines tonnage thresholds for truck, rail, and waterway freight corridors and identifies heavily used freight transportation networks within the state.

Rail corridors are classified into 5 tiers based on annual gross freight tonnage:

- R-1: More than 5 million tons per year
- R-2: 1 million to 5 million tons per year
- R-3: 500,000 to 1 million tons per year
- R-4: 100,000 to 500,000 tons per year
- R-5: Less than 100,000 tons per year

Both active railroads in the study are classified as freight corridors. PSAP is classified as an R-1 corridor with TRMW classified as an R-4 corridor. BNSF is classified as an R-1 corridor.

6.2 Freight Rail Assessment

Maintaining the freight rail system ensures that there is capacity on the railroad to meet the demand placed on it. The following issues constrain the current rail network within the study area and should be considered when evaluating improvements.

- At-grade crossings, track curves, surrounding land uses, or speed limits that require trains to travel at slower speeds
- Rail facilities and existing rail-related infrastructure, such as freight terminals or marshaling yards that are too small or require reversing maneuvers
- Insufficient numbers and insufficient capacities for rail cars
- Insufficient numbers of tracks or passing sidings

These constraints also affect the traffic flow within the roadway network, particularly at the at-grade crossing at Blakeslee Junction. During peak hours, rail crossings at this location interrupt traffic flow, not only at the crossing location but at other critical intersections within the roadway network. Increased future volumes of both rail and vehicle traffic will further stress the existing system. Any expansion to the railroads, such as increasing the number of trains or expanding the freight terminal or siding yard at the north end of the study area, will require evaluation of the capacity at the crossing at Blakeslee Junction. The City of Centralia and Lewis County have secured grant funds for adding a secondary storage track and upgrading the switching at Blakeslee Junction.

7 MULTIMODAL FACILITIES

Pedestrian and bicycle facilities were inventoried for functionally classified roadways in the study area and transit services in the study area were reviewed. In general, existing sidewalk facilities are provided along the main roadways within the study area. Bicycle facilities are lacking on most roads in the study corridor. The main transit provider in the study area is Twin Transit, with multiple transit options and locations served. Other transit agencies provide limited services in the area.

In the study area, much of the land is zoned for commercial or light industrial uses, with some areas of residential, institutional, and heavy industrial land. North of Reynolds Avenue and Galvin Road, land uses are mostly industrial and residential with few multimodal facilities. Land around Harrison Avenue, a major thoroughfare in the study area, is zoned for commercial use. Two apartment complexes are located near Harrison Avenue and Ives Road, and another apartment complex is under construction. There are no sidewalks between these apartments and south toward the schools until the Reynolds Avenue and Galvin Road intersection.

Measuring the user experience for people that walk and bike is important to understand how the facilities are used and the perceived safety. It can also help to identify gaps in the system and improvements that could be implemented to achieve a safer and more connected active transportation system. In this technical memo, the multimodal level of stress analysis will be referenced to provide a more complete picture of pedestrian and bicycle conditions in the study area.

Washington State legislation in RCW 47.24 directs WSDOT to incorporate "Complete Streets" on all WSDOT projects with an estimated cost of $500,000 or more that are to be constructed on state highways within incorporated cities and population centers, and where the design phase of the project begins on or after July 1, 2022. Addressing Complete Streets principles in the study area would benefit pedestrians, bicyclists, and transit users in this area, as many gaps and deficiencies were found in this memo.

Complete Streets is an approach to planning, designing, building, operating, and maintaining streets that enables access along and across the street for all people, including pedestrians, bicyclists, motorists, and transit riders of all ages and abilities. Complete Streets prioritizes more comfortable and equitable, context sensitive network connectivity for all roadway users through close coordination with our local partners and stakeholders. This is aligned with WSDOT's policy and commitment to develop and maintain an interconnected and integrated multimodal transportation system that provides all Washington travelers with safe, sustainable, and equitable access.

The Department's existing statutory authority, including RCW 47.01.260, RCW 47.30.030, and RCW 47.01.078, also allows the Department to incorporate the principles of Complete Streets in the design and construction of projects on state limited access highways, on city streets that are not designated as state highway that pass through a state limited access facility, and on state routes within counties.

It is the stated policy of the Department to incorporate the principles of Complete Streets with facilities that provide street access with all users in mind, including pedestrians, bicyclists, and public transportation users, on projects to be constructed on state highways consistent with ESSB 5974 and with existing statutory authority.

7.1 Pedestrian Assessment

7.1.1 Existing Pedestrian Facilities

Pedestrian facilities exist along some of the major roads in the study area. The presence of pedestrian facilities was reviewed along each of the functionally classified roadways in the study area, as shown in Figure 7-1. There are no sidewalks on Scheuber Road and Oakland Avenue. The southern part of Harrison Avenue has full sidewalks on both sides of the roadway, while the northern part only has partial sidewalks. The City of Centralia recently installed a shared-use path with lighting along Borst Avenue from Johnson Road to Eshom Road, connecting Centralia High School and Centralia Middle School. The shared-use path can be used by both pedestrians and bicyclists.

Figure 7-1: Existing and Proposed Pedestrian Facilities

Recreational trails provide connections to natural features for pedestrians and bicyclists. Existing recreational trails in the study area include the Chehalis Discovery Trail, which follows the Chehalis River for approximately 1.5 miles, and the Borst Park trails. Existing and proposed trails are shown in Figure 7-2.

Figure 7-2: Existing and Proposed Trails

7.1.2 Existing Pedestrian Usage

7.1.2.1 Major Pedestrian Volume Generators

The main pedestrian volume generators in the study area include the public schools (Fords Prairie Elementary, Centralia Middle School, and Centralia High School), shopping centers (including the Centralia Factory Outlets and Safeway), and parks (most notably, Fort Borst Park).

7.1.2.2 Pedestrian Network Connectivity Gaps and Needs

Overall, there are significant gaps in the pedestrian network in the study area. Most of the functionally classified roadways in the study corridor have partial sidewalks at best. Connections with the more walkable eastern part of Centralia are limited. This lack of pedestrian facilities discourages non-motorized transportation and may create safety concerns due to conflicting modes using the same space without adequate separation. Gaps in the sidewalk network also create obstacles for travelers accessing transit, particularly for those with disabilities or mobility impairments.

There are no sidewalks on Scheuber Road and Oakland Avenue, and most of Eshom Road lacks sidewalks. Sidewalks are missing along portions of Galvin Road, Reynolds Avenue, and Harrison Avenue.

The intersection of Harrison Ave and the I-5 southbound ramps is the location with the highest number of crashes resulting in injuries in the City of Centralia. Pedestrian crossings are facilitated at three of the four legs of this intersection, but only two of the legs have crosswalk markings. It is a very wide intersection with six lanes on Harrison Ave and four lanes at the off-ramp, which makes it more difficult for pedestrians to cross safely. Implementing pedestrian improvements to address those gaps would improve safety for all road users, while ensuring that the most vulnerable users are less likely to be involved in crashes.

The other notable crash location and gap is at the intersection of Harrison Ave and Reynolds Ave, though it has a lower level of crashes. Pedestrian facilities are present at and between all corners of the intersection, but crosswalks are faded, and the islands and slip lanes make crossing this intersection more complicated and less safe.

In addition, many intersections in the study area are missing ADA ramps, and some of the existing ramps do not meet current standards for ADA ramp design. This significantly limits mobility for some users of pedestrian facilities. Pedestrian-scale lighting, crosswalk markings, pedestrian signals, bulb outs, and other safety measures could be considered throughout the study area to improve conditions for pedestrians, especially in areas of high pedestrian activity.

7.1.3 Proposed Pedestrian Facilities

The City of Centralia seeks to provide appropriate and comprehensive pedestrian connections to link neighborhoods to commercial nodes and services to close modal gaps within the city. Table 7-1 includes proposed pedestrian projects in the study area, which are also reflected in Figure 7-1.

In the Centralia Comprehensive Plan, Harrison Ave was projected to experience worsened conditions in the future due to the closely spaced intersections and driveway approaches. In addition, industrial, employment, and population growth factors are expected to lead to stressed capacity at intersections. The plan suggested expanding transportation options, including expanded bicycle or pedestrian facilities, to maintain the level of service standards.

The City of Centralia plans to expand open and recreational space including the development of an expanded trail along the Chehalis River to connect the Discovery Trail to Schafer County Park in Lewis County. Trails can be used for multiple modes and users, including both pedestrians and bicyclists. Table 7-2 lists proposed trails and Figure 7-2 shows both existing and proposed trails in the study area.

As described in the Lewis County Comprehensive Plan, future pedestrian projects would include sidewalks along Foron/Scheuber/Russell Roads and a separated trail along Eshom Rd.

Table 7-1: Proposed Pedestrian Projects

Title	Location	Description	Status*
Intersection Improvements	Intersections improvements with vehicular capacity deficiencies	Consider adding crosswalks, ADA ramps, and illumination at intersections where reconstruction is warranted.	Unknown
Eshom Rd Sidewalk	On Eshom from Mt Vista to Mayberry	Provide 1,200 feet of sidewalk at schools	Completed on SB side from Mt Vista to Prill Rd
Mt. Vista Road Bike Lane and Sidewalk	On Mt. Vista from Fort Borst Park to Eshom	Provide non-motorized facilities to connect community facilities	Not started
Centralia Middle School Allen Avenue Sidewalk Improvements	Allen Avenue from Mt. Vista Road to Borst Avenue	Add pedestrian facility on eastern edge of school lot to connect with athletic facilities.	Not started
Harrison Avenue Paving Project	Harrison Avenue from the Main Street to Johnson Road	Plane/repave wearing course and replace substandard ADA access ramps. Provide new signage, lane markings, and inductive traffic loops.	High St to Main St is funded. Johnson to Belmont is not currently funded.
Foron Rd, Scheuber Rd, and Russell Rd		Extend Foron Road south to Scheuber Road, and improve Scheuber Road to Russell Road and Russell Road to Harrison Avenue with sidewalks and planter strips	Not started
Galvin Bridge Trail to Borst Park	Trail on Chehalis River from Public Works Facility trail to Fort Borst Park	Designate and develop trail along Chehalis River	Not started
Hayes Lake Trail Project	Bridge Street to Borst Park	Construct path from the Hayes Lake public access at Bridge Street along the Skookumchuck River to the existing path adjacent to Borst Lake.	Not started
Eshom Road		Separated trail along roadway	Not started

*Status is based on observed Nearmap satellite imagery (dated 7/12/2022)

Table 7-2: Proposed Trail Projects

Title	Location	Description	Status*
Galvin Bridge Trail to Borst Park	Trail on Chehalis River from Public Works Facility trail to Fort Borst Park	Designate and develop trail along Chehalis River	Not started
Hayes Lake Trail Project	Bridge Street to Borst Park	Construct path from the Hayes Lake public access at Bridge Street along the Skookumchuck River to the existing path adjacent to Borst Lake.	Not started
Eshom Road		Separated trail along roadway	Not started

*Status is based on observed Nearmap satellite imagery (dated 7/12/2022)

7.2 Bicycle Assessment

7.2.1 Existing Bicycle Facilities

Most of Centralia's existing bicycle network is located east of I-5, in the downtown area. All three of the main public schools in the study area have access to at least one bicycle facility. However, overall bicycle connectivity is lacking, with bicycle facilities absent on most streets connecting schools and parks to neighborhoods and commercial areas.

The presence of bicycle facilities was reviewed along each of the functionally classified roadways in the study area, as shown in Figure 7-3. In the study area, partial bicycle facilities exist along portions of Harrison Ave, Borst Ave, and Reynolds Ave. On Harrison Ave south of Reynolds Ave, there is approximately one mile of bike lanes in total with a quarter mile of gaps between segments. North of Reynolds Ave, there is approximately 1.25 miles of wide shoulders (mostly 6.5 feet wide), which may be suitable for some bicycle riders. On Borst Ave, from Johnson Road to Eshom Road (less than one mile), the City of Centralia recently installed a separated shared-use path. The shared-use path can be used by both bicyclists and pedestrians. On Reynolds Ave, near I-5, there is less than a quarter mile of bicycle lanes.

Figure 7-3: Existing and Proposed Bicycle Facilities

7.2.2 Existing Bicycle Usage

7.2.2.1 Major Bicycle Volume Generators

The main bicycle volume generators in the study area include the three main public schools (Fords Prairie Elementary, Centralia Middle School, and Centralia High School) and parks (including Fort Borst Park).

7.2.2.2 Bicycle Network Connectivity Gaps and Needs

There are significant gaps in the bicycle network in the study area, and the facilities lack connections to locations outside the study area. In addition, many of the signed bicycle routes overlap with common freight routes. This lack of bike lanes discourages transportation by bicycle and may create safety concerns due to conflicting modes using the same space without adequate separation.

Most streets that connect schools and parks to neighborhoods and commercial areas lack bicycle facilities. Reynolds Ave has less than a quarter mile of bicycle lanes. Bicycle facilities are completely absent on Galvin Rd, Oakland Ave, Johnson Rd, and Eshom Rd.

On Harrison Ave, bike lane gaps exist between the I-5 southbound ramps to Belmont Ave, and Johnson Rd to Caveness Dr (approximately a quarter mile total). This segment of Harrison Ave is too narrow for an on-street bicycle lane with the current road configuration. The intersection of Harrison Ave and the I-5 southbound ramps is the location with the highest number of crashes resulting in injuries in the City of Centralia. Although this area does not have on-street bike lanes, the sidewalks have been recently widened to approximately 12 feet in width, which is the width of a standard shared-use path.

The other notable crash location and gap is at the intersection of Harrison Ave and Reynolds Ave, though it has a lower level of crashes. Bicycle facilities are present south of the intersection on Harrison Ave but are not carried through the intersection and are completely lacking on the other three legs of the intersection. Bicycle facilities may be beneficial at this intersection, if appropriate for the local conditions and level of usage. Since there is a school at this intersection, it may be beneficial to carry the Harrison Ave bike lane through the intersection, to support safe crossings for bicyclists and fill the gap in bicycle facilities along Harrison Ave. Lewis County’s upcoming Reynolds Ave and Harrison Ave project has the potential to provide bicycle facility improvements in this area.

7.2.2.3 Proposed Bicycle Facilities

The City of Centralia seeks to address gaps in the non-motorized network through future street improvement and development projects, such as reconstruction, resurfacing, or striping projects. Table 7-3 includes proposed bicycle projects in the study area, which are also reflected in Figure 7-3. According to the City of Centralia Comprehensive Plan, future urban arterial routes will include adequate shoulder widths to allow for the designation of future bike routes. The Lewis County Comprehensive Plan did not include any proposed bicycle-specific projects. Trail projects, which could be used for bicycle users and pedestrians, are included in Table 7-2.

Table 7-3: Proposed Bicycle Facilities from Centralia Comprehensive Plan

Title	Location	Description	Status*
Mt. Vista Road Bike Lane and Sidewalk	On Mt. Vista from Fort Borst Park to Eshom	Provide non-motorized facilities to connect community facilities	Not started
Johnson Bike Lanes	On Johnson from Harrison to Mt. Vista	Provide bike lanes to connect residential to commercial	Not started
Oakland Bike Lanes	On Oakland from Galvin to city limits (Borst Ave)	Provide bike route to connect Oakland	Not started

*Status is based on observed Nearmap satellite imagery (dated 7/12/2022)

7.3 Transit Assessment

7.3.1 Existing Transit Providers and Services

Twin Transit is the main operator for local bus service in the study area. Services include fixed route bus service, dial-a-ride (DARTT), and paratransit (LIFTT). Fixed route services in the study area include the Orange and Yellow lines, described below. Both routes run on weekdays and weekends at hourly intervals.

The Orange line ("West Centralia") provides service between downtown Centralia, Fords Prairie, and Scammon Creek neighborhoods. Functionally classified roads utilized in the study area include Harrison Ave, Reynolds Ave/Galvin Rd, Eshom Rd, Borst Ave, and Johnson Rd. In the study area, notable locations served by this route include the Centralia Outlets retail area, Fort Borst Park, as well as Centralia Middle and High schools. This route has 13 bus stops in the study area.

The Yellow line ("Centralia-Chehalis Express") provides service between downtown Centralia, the Centralia Safeway in Fords Prairie, and Chehalis. In the study area, the bus only operates on Harrison Ave south of Johnson Rd. The only bus stop location served in the study area is the Centralia Safeway, located on Johnson Rd between Harrison Ave and Borst Ave.

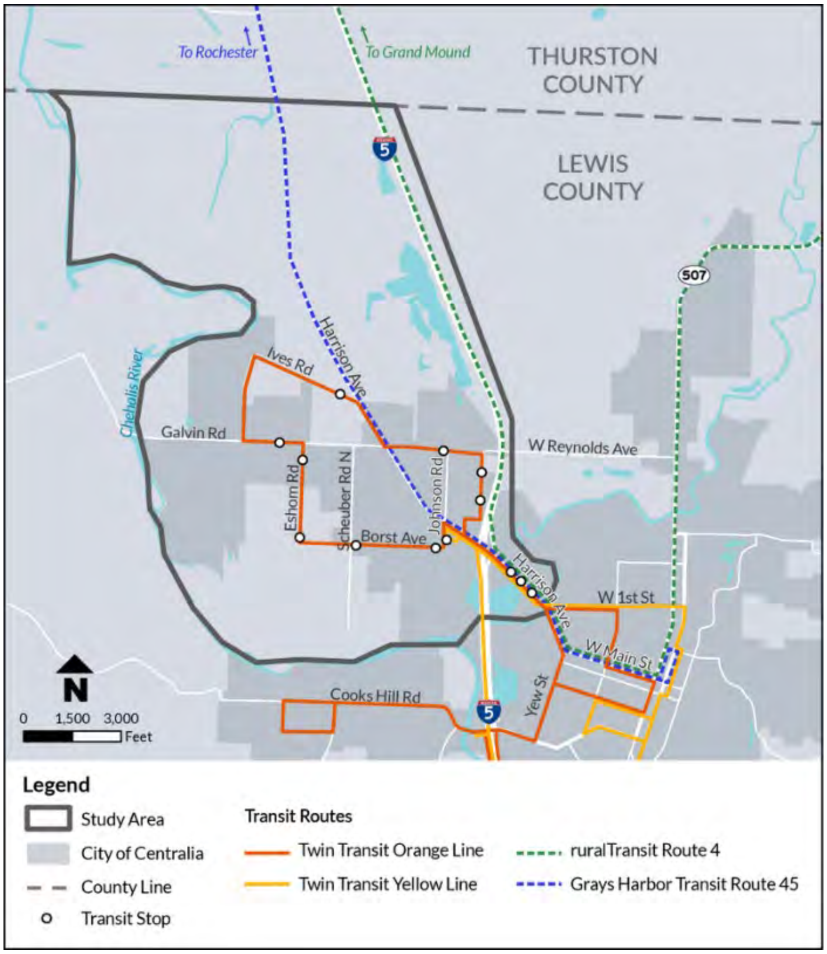
In addition to these services, Twin Transit is establishing a new system of zero-emission public transit along the currently underserved 50-mile section of the I-5 corridor between Thurston, Lewis, and Cowlitz Counties.

Thurston Regional Planning Council (TRPC) provides one ruralTRANSIT (rT) service in the study area. Route 4 travels between the Centralia Amtrak station, Grand Mound Park and Ride, Tenino Library, and Bucoda. From the Amtrak station, the route travels along Main St and Harrison Ave to I-5. There are no timed stops in the study area, but there is one "flag down" stop at Harrison Ave & E High St, which is also a Twin Transit Orange line stop.

Grays Harbor Transit route 45 travels through the study area via Harrison Ave but does not make any stops within the study area.

Existing transit services in the study area are shown in Figure 7-4.

Figure 7-4: Existing Transit Services



7.3.2 Existing Transit Facilities

Twin Transit has 80 signed bus stops/shelters throughout their overall service area and 13 bus stops currently in use within the study area.

7.3.3 Existing Transit Ridership

In 2021, Twin Transit provided an estimated 18,147 hours of fixed route service and 94,337 trips to residents and visitors. In addition, Twin Transit provided 6,864 demand response trips through its dial-a-ride (DARTT) and paratransit (LIFTT) services. Also in 2021, the total ridership for Twin Transit was 101,201, including both fixed route and paratransit passenger trips. In 2020, total ridership was 106,353. These metrics reflect the entire Twin Transit service area, including the study area.

7.3.4 Major Transit Volume Generators

In May 2021, Twin Transit updated and enhanced its fixed route services to support local K-12 school districts, the community college, and local businesses as they made post-pandemic adjustments. Major destinations for transit services in the study area include the Centralia Safeway, Centralia Outlets, Centralia Middle and High schools, community facilities such as Fort Borst Park, and various medical facilities. Transit services also connect users to locations outside of the study area, including downtown Centralia, the City of Chehalis, the Centralia Amtrak station, and Centralia College.

7.3.5 Transit Network Connectivity Gaps and Needs

The Twin Transit Orange line serves most of the major destinations in the study area, although a straighter, line-shaped routing would be more efficient than the current loop-shaped routing. The Yellow line only serves one stop in the study area, therefore people in the area may benefit from an extension to this service. Both services would be improved by increased span and frequency to better serve all current and future riders. Improved bus stop amenities, such as shelters and benches, would make the wait more comfortable for users. Improved pedestrian and bicycle connections to transit stops would support multimodal mobility and increase transit access, especially for people that are reliant on mobility devices.

7.3.6 Proposed Transit Providers, Services and Facilities

Twin Transit recently installed a bus pullout near the intersection of Borst Ave and Scheuber Rd. Twin Transit is targeting installation of shelters at the top 25% of their most active stops, and benches at 50% of the most active stops by 2025. Over the next five years, Twin Transit is planning to expand weekend service hours to increase off-peak access to services and adjust bus schedules to match ridership needs. They also plan to encourage improvements to pedestrian amenities and transit-related development within the community to promote alternative transportation modes. Table 7-4 includes additional future proposed transit projects in the study area.

Table 7-4: Proposed Transit Projects from Centralia Comprehensive Plan

Title	Location	Description	Status
LOS Headway Improvements	All Twin Transit routes	Improve LOS goals by decreasing headway from 60 to 30 minutes on all routes during peak periods	Not started; planned to occur by 2027
Transition flag bus stops to permanent roadside stops	Determined in partnership with Twin Transit	Replace flag bus stops with conventional roadside stops at higher ridership. Where feasible, add bench, shelter, and signage.	In progress

Source: City of Centralia Comprehensive Plan

In addition, Twin Transit plans to expand their I-5 corridor e-Transit initiative with the construction of five additional e-Transit Stations within the next two years, located along a 40-mile section of I-5. Twin Transit plans to transition its fleet to 100% zero-emission by the year 2030.

Twin Transit also plans to expand their on-demand micro-transit system throughout Lewis County over the next five years. This community-based system would decrease operating costs and provide a more user-centric experience.

7.4 Multimodal Assessment

7.4.1 Overview of Major Gaps, Conflicts and Safety Issues for Non-Motorized Modes

Major gaps in pedestrian and bicycle facilities include significant gaps in the overall pedestrian and bicycle networks, especially near schools, and connections outside the study area. Additional pedestrian gaps include lack of ADA ramps and crossings, and a general lack of pedestrian safety features. Increasing bicycle facilities and crossing features would improve safety and connectivity for bicyclists.

Major gaps for transit services include the general lack of transit services in the study area, route efficiency, limited coverage and weekend services, and infrequent service. The lack of bus stop amenities, such as shelters and benches, is another existing gap.

The lack of non-motorized facilities and transit services discourages non-motorized transportation and may create safety concerns due to conflicting modes using the same space without adequate separation. High-crash and high-volume locations should be prioritized for multimodal improvements.

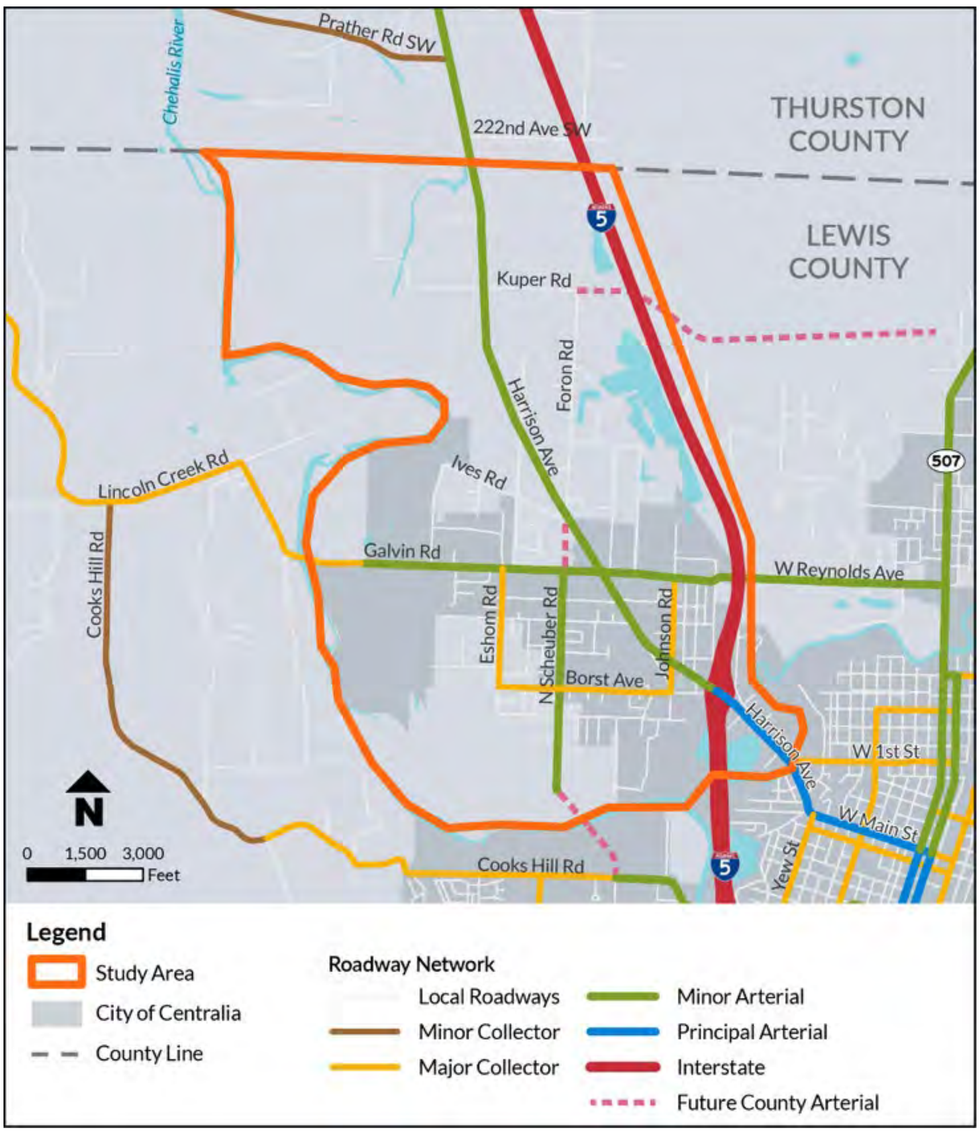
7.4.2 Identification of Major Volume Generators

Major volume generators in the study area include the public schools (Fords Prairie Elementary, Centralia Middle School, and Centralia High School), shopping centers (including the Centralia Factory Outlets and Safeway), community facilities (including Fort Borst Park), and various medical facilities.

8 MAINTENANCE & PRESERVATION NEEDS

WSDOT, the City of Centralia, and Lewis County are responsible for roadways within the project area. The roadway types range from local access to the major collectors. All three agencies continually maintain these roadways using various rehabilitation and maintenance methods. The low-cost maintenance option employed for the low volume roadways has been bituminous surface treatment, also known as chip sealing. The higher volume collectors and arterial roadways within the project area have been maintained primarily with the grind and inlay method. Spot maintenance such as crack sealing and pothole repair is done on an as-needed basis by all three agencies.

Figure 8-1: Existing Roadway Network



8.1 Maintenance and Preservation Projects

WSDOT is responsible for maintaining I-5 along the project area's western edge. This includes all parts of the interchange with Harrison Avenue within WSDOT right of way and for the overpass at Reynolds Road. Recently, this portion of I-5 underwent major improvements with the installation of new travel lanes in both the northbound and southbound directions and collector-distributor lanes starting and stopping on the south side of the Harrison Avenue interchange. These new improvements have not required substantial pavement preservation treatments by WSDOT. The pavement management process that prioritizes pavement projects will ensure this portion of I-5 is included in the annual grind and overlay program at the appropriate time. Based on the WSDOT maintenance records the regional maintenance inspection teams have been to the area to monitor the pavement condition. These inspection teams also perform a periodic structural inspection for the overpasses at Harrison and Reynolds Avenue.

The City of Centralia is responsible for maintaining most of the roadways in the project area. Based on both past and present Six-Year Transportation Improvement Plans, the City maintains its roadways using chip seal for residential and local access roadways with the higher volume roadways maintained with grind and overlay. The maintenance projects within the study area include the grind and overlay for portions of Galvin Road and Harrison Avenue from Belmont to Johnson and the widening of large segments of Harrison and Reynolds Avenue. The cost for these maintenance projects over the next six years is estimated at $1 million per year. This yearly amount is similar to the previous years' spending for roadway maintenance and preservation within the city.

Inside the project area is the recently reconstructed intersection at Harrison Avenue and West Reynolds Avenue, maintained by the City. It is constructed of Portland Cement panels, which have a much longer service life than asphalt roadways. However, the long service life does come with higher maintenance costs due to the rigidity of the material and the lack of inexpensive maintenance options.

Maintenance and preservation of the roadways not maintained by either WSDOT or the City of Centralia are the responsibility of Lewis County. The Countywide 3R Program includes chip sealing, overlay, and cement-treated base as current treatment options. The total cost for all county-wide maintenance projects according to the Six-Year Transportation Plan is $5.6 million with $2.6 million being spent in 2022. These costs are higher than previous TIP projections for maintenance and preservation.

9 SAFETY ANALYSIS

9.1 Existing Safety Analysis

A review of the crash history was conducted to analyze crash patterns and frequency for the North Lewis County Industrial Access Transportation Study (NLCIA). The most recent five-year crash history was obtained from the Washington State Department of Transportation (WSDOT) for the time period of 2017 to 2021 for the following intersections:

1. Old Hwy 99 and Elderberry St (Thurston County)
2. Old Hwy 99 and I-5 SB ramp (Thurston County)
3. Old Hwy 99 and I-5 NB ramp (Thurston County)
4. Old Hwy 99 and Prather Rd (Thurston County)
5. Harrison Ave at the Lewis County Line
6. Harrison Ave and Kuper Rd
7. Harrison Ave and Foron Rd
8. Harrison Ave and Reynolds Ave
9. Reynolds Ave and Industrial Dr
10. Harrison Ave and Belmont Ave
11. Harrison Ave and I-5 SB ramps
12. Harrison Ave and I-5 NB ramps
13. Reynolds Ave and Lum Rd

There were no reported crashes at the intersections of Old Hwy 99 and Prather Rd, Harrison Ave at the Lewis County Line, or at Harrison Ave and Foron Rd. The intersections with the highest number of reported crashes were at Harrison Ave and I-5 SB Ramps with 66 crashes, followed by Harrison and I-5 NB Ramps with 59 crashes.

The total yearly number of crashes at all intersections from 2017 to 2021 ranged from 56 in 2017 to 69 crashes in 2019 and 2021. There was a reduction in crash frequency in 2020 with 59 crashes during the pandemic period, likely due to lower traffic. However, this annual crash total still falls within the 5-year range. Table 9-1 presents the crash total for each intersection for the five-year period. Appendix A.2 provides the full crash data that was obtained from WSDOT.

Table 9-1: Crash Summary by Intersection, 2017-2021

Intersection	2017	2018	2019	2020	2021	Total
Old Hwy 99 and Elderberry St	8	8	9	7	11	43
Old Hwy 99 and I-5 SB ramp	7	4	10	4	10	35
Old Hwy 99 and I-5 NB ramp	4	2	8	3	4	21
Old Hwy 99 and Prather Rd	-	-	-	-	-	-
Harrison Ave at Lewis County line	-	-	-	-	-	-
Harrison Ave and Kuper Rd	3	1	--	3	2	9
Harrison Ave and Foron Rd	-	-	-	-	-	-
Harrison Ave and Reynolds Ave	2	3	7	8	5	25
Reynolds Ave and Industrial Dr	-	-	-	-	1	1
Harrison Ave and Belmont Ave	13	10	10	9	12	54
Harrison Ave and I-5 SB ramps	11	19	10	11	15	66
Harrison Ave and I-5 NB ramps	7	16	15	14	7	59
Reynolds Ave and Lum Rd	1	2	-	-	1	4
Total	56	65	69	59	68	317

Source: WSDOT Public Records (See Appendix A.2)

9.1.1 Crash Severity

Most crashes at the targeted study intersections resulted in Property Damage Only (PDO) or possible injury. As shown in Table 9-2 there was one crash at the intersection of Harrison Ave and I-5 SB ramps that resulted in a fatality – documented as a single vehicle crash due to wrong way travel on the freeway ramp and classified as an Other Objects type crash. The cause for this fatal crash was attributed to Operating Recklessly or Aggressively. Another crash at this same intersection resulted in a serious injury involving a vehicle striking a bicyclist on a right hook type crash. Causal factors included driver inattention. There were no fatal or serious injury crashes reported at the remaining study intersections for the 5-year look back period.

Table 9-2: Crash Summary by Severity, Cumulative 5-Year, 2017-2021

Intersection	Fatality	Serious Injury	Possible or Minor Injury	PDO	Total
Old Hwy 99 and Elderberry St	-	-	13	30	43
Old Hwy 99 and I-5 SB ramp	-	-	6	29	35
Old Hwy 99 and I-5 NB ramp	-	-	5	16	21
Old Hwy 99 and Prather Rd	-	-	-	-	-
Harrison Ave at Lewis County line	-	-	-	-	-
Harrison Ave and Kuper Rd	-	-	1	8	9
Harrison Ave and Foron Rd	-	-	-	-	-
Harrison Ave and Reynolds Ave	-	-	5	20	25
Reynolds Ave and Industrial Dr	-	-	1	-	1
Harrison Ave and Belmont Ave	-	-	16	38	54
Harrison Ave and I-5 SB ramps	1	1	19	45	66
Harrison Ave and I-5 NB ramps	-	-	14	45	59
Reynolds Ave and Lum Rd	-	-	-	4	4
Total	1	1	80	235	317

Source: WSDOT Public Records

9.1.2 Crash Type

The most common crash type involved rear end crashes with 143 incidents, followed by angle type crashes (128), sideswipe type crashes (41), off-road/other objects type crashes (16), bicyclist/pedestrian crashes (5) and other or unclassified type crashes (5). See Table 9-3 for a breakout summary of these crashes. Rear end crashes are the most common type of crash and are expected to occur at a higher frequency at every study intersection. However, the intersection at Harrison Ave and Belmont Ave observed more than double the number of angle crashes in the 5-year period than rear end crashes. The intersections at Harrison Ave and I-5 SB ramps and Harrison Ave and I-5 NB ramps, also showed a significant number of angle type crashes. The intersection of Old Hwy 99 and Elderberry St had the largest number of reported off road/other objects type crashes.

Table 9-3: Crash Summary by Crash Type, Cumulative 5-Year, 2017-2021

Intersection	Rear	Angle	Sideswipe	Offroad / Other Objects	Bike/Ped	Other	Total
Old Hwy 99 and Elderberry St	23	10	3	6	-	1	43
Old Hwy 99 and I-5 SB ramp	18	10	4	2	-	1	35
Old Hwy 99 and I-5 NB ramp	8	8	2	2	-	1	21
Old Hwy 99 and Prather Rd	-	-	-	-	-	-	-
Harrison Ave at Lewis County line	-	-	-	-	-	-	-
Harrison Ave and Kuper Rd	-	6	2	-	-	1	9
Harrison Ave and Foron Rd	-	-	-	-	-	-	-
Harrison Ave and Reynolds Ave	18	5	2	-	-	-	25
Reynolds Ave and Industrial Dr	1	-	-	-	-	-	1
Harrison Ave and Belmont Ave	10	29	13	-	2		54
Harrison Ave and I-5 SB ramps	27	27	5	3	3	1	66
Harrison Ave and I-5 NB ramps	27	24	7	1	-	-	59
Reynolds Ave and Lum Rd	1	1		2	-	-	4
Total	133	120	38	16	5	5	317

Source: WSDOT Public Records

9.1.3 Crashes by Vehicle Type

Table 9-4 shows crashes by vehicle type for the 5-year study period; these only reports vehicle one (primary vehicle), which is the vehicle to have been determined causing the crash. Most crashes involved pickup panel trucks under 10,000 lb. and passenger cars at 157 and 149 incidents, respectively. There were 19 crashes involving heavy vehicles such as truck tractors and semi-trailers, three crashes involving motorcycles and 10 crashes involving vehicles that do not fall under these classifications or were not stated in the data. The intersection of Old Hwy 99 and Elderberry St showed the highest incidence of Heavy Vehicle crashes (5) and motorcycle crashes (2).

Table 9-4: Crash Summary by Vehicle Type, Cumulative 5-Year, 2017-2021

Intersection	Passenger Car	Pickup, Panel Truck Under 10,000 lbs.	Median Vehicle	Heavy Vehicle	Motorcycle	Not Stated	Total
Old Hwy 99 and Elderberry St	18	17	-	5	2	1	43
Old Hwy 99 and I-5 SB ramp	18	15	-	2	-	-	35
Old Hwy 99 and I-5 NB ramp	10	8	1	2	-	-	21
Old Hwy 99 and Prather Rd	-	-	-	-	-	-	-
Harrison Ave at Lewis County line	-	-	-	-	-	-	-
Harrison Ave and Kuper Rd	1	5	1	2	-	-	9
Harrison Ave and Foron Rd					-	-	0
Harrison Ave and Reynolds Ave	14	8	1	2	-	-	25
Reynolds Ave and Industrial Dr	-	1	-		-	-	1
Harrison Ave and Belmont Ave	24	25	1	2	1	1	54
Harrison Ave and I-5 SB ramps	28	33	-	2	-	3	66
Harrison Ave and I-5 NB ramps	24	32	-	2	-	1	59
Reynolds Ave and Lum Rd	4	-	-	-	-	-	4
Total	141	144	4	19	3	6	317

Source: WSDOT Public Records

9.1.4 Pedestrian Crashes

There were two reported crashes involving pedestrians at the intersections of Harrison Ave and Belmont Ave, and Harrison Ave and I-5 SB ramps, both pedestrians were struck by a vehicle making a right turn. The cause was inconclusive at Harrison Ave and Belmont Ave, and at Harrison Ave/I-5 SB ramps the cause was classified as other distractions. The pedestrian crash at Harrison Ave and Belmont Ave resulted in an injury, and the crash at Harrison Ave and I-5 SB ramps resulted in a suspected minor injury.

9.1.5 Bicycle Crashes

There were three reported crashes involving bicyclists, one at the intersection of Harrison Ave and Belmont Ave and two at the intersection of Harrison Ave and I-5 SB ramps. The bicyclist crash at Harrison Ave and Belmont Ave resulted in an injury, and the crashes at Harrison Ave and I-5 SB ramps resulted in a suspected minor injury. All bicyclist crashes were right hook type crashes. At the intersection of Harrison Ave and I-5 SB ramps, both crashes occurred from vehicles making a right turn from the north leg of the intersection. The cause was attributed to inattention and unknown distraction at the intersection of Harrison Ave and I-5 SB ramps, and inconclusive at the intersection of Harrison Ave and Belmont Ave.

9.2 Highway Safety Manual (HSM) Predictive Analysis

Safety analysis for 2022 and 2045 conditions included calculating predicted and expected crash frequencies (number of crashes) for the study intersections using the Highway Safety Manual (HSM) Part C methodology (AASHTO 2010), which was further updated by WSDOT. The number of predicted crashes is the number of crashes a similar intersection is anticipated to experience on average. The number of expected crashes is the number of crashes the study intersection is anticipated to have based on physical variables, volumes, and crash history. The number of predicted/expected crashes are reported in decimal form since it represents a calculation over time—for example, a 0.2 crash could be defined as on average, one crash occurring in a 5-year period. This methodology estimates predicted and expected crash frequency as a function of traffic volume and roadway characteristics (e.g., number of lanes, median type, intersection control, number of approach legs) and crash history at each intersection.

The analysis was conducted for Existing Conditions (2022) and Future Baseline Conditions (2045). The safety analysis was conducted using projected turn movement volumes for the study facilities, adjusted to daily volume based on 24-hr counts collected throughout the project area. The following shows the HSM results for Existing Conditions (2022) and Future Baseline Conditions (2045).

9.2.1 HSM Analysis Existing Conditions Year (2022)

Table 9-5 shows the predicted number of crashes versus the expected number of crashes for each intersection, by severity for Existing Conditions Year (2022). The intersections with the most potential for improvement include Harrison Avenue and I-5 SB ramps, Harrison Avenue and I-5 NB ramps, and Harrison Avenue and Belmont Avenue. The project has the potential to reduce the number of fatal and injury crashes on average per year by 10.7 and PDO by 19.9 throughout all the study intersection in this analysis. Additional HSM analysis can be found in Appendix A.3.

Table 9-5: HSM Analysis Existing Conditions Year (2022)

Intersection	Fatal and Injury Crashes			Property Damage Only Crashes		
	Predicted average crash frequency	Expected average crash frequency	Potential for improvement	Predicted average crash frequency	Expected average crash frequency	Potential for improvement
Old Hwy 99 and Elderberry St	1.3	2.7	1.4	2.3	4.8	2.5
Old Hwy 99 and I-5 SB ramp	1.6	2.3	0.8	2.9	4.4	1.4
Old Hwy 99 and I-5 NB ramp	1.1	1.3	0.2	2.3	2.7	0.4
Old Hwy 99 and Prather Rd	0.4	0.2	0.0	0.6	0.3	0.0
Harrison Ave at Lewis County line	0.1	0.0	0.0	0.0	0.0	0.0
Harrison Ave and Kuper Rd	0.3	0.5	0.2	0.5	0.9	0.4
Harrison Ave and Foron Rd	0.3	0.1	0.0	0.4	0.1	0.0
Harrison Ave and Reynolds Ave	0.5	1.3	0.9	0.9	2.7	1.8
Reynolds Ave and Industrial Dr	0.1	0.1	0.0	0.0	0.1	0.0
Harrison Ave and Belmont Ave	1.0	3.4	2.4	1.8	6.0	4.2
Harrison Ave and I-5 SB ramps	1.2	4.0	2.8	2.3	7.3	5.1
Harrison Ave and I-5 NB ramps	1.4	3.7	2.4	2.6	7.2	4.6
Reynolds Ave and Lum Rd	0.1	0.2	0.1	0.1	0.2	0.1
Total	9.2	19.9	10.7	16.9	36.8	19.9

Source: WSDOT Public Records

9.2.2 HSM Analysis Future Baseline Conditions (2045)

Table 9-6 shows Baseline Conditions Year (2045) predicted number of crashes compared to the predictive number of crashes for Existing conditions Year (2022) for each intersection, by severity. The intersections with the most potential for improvement between existing and future are Old Hwy 99 and I-5 SB ramps, Old Hwy 99 and I-5 NB ramps, and Old Hwy 99 and Elderberry St. As shown, the project has the potential to reduce the expected number of fatal and injury crashes by 5.5 per year on average and PDO by 10.5 throughout all study intersections, from Existing Conditions Year (2022) to Future Baseline Conditions Year (2045). Additional future baseline analysis can be found in Appendix A.3.

Table 9-6: HSM Analysis Predicted Future Baseline Conditions (2045) vs Existing (2022)

Intersection	2022	2045	Difference 2045 minus 2022	2022	2045	Difference 2045 minus 2022
	Predicted Fatal and Injury Crashes	Predicted Fatal and Injury Crashes		Predicted Property Damage Only Crashes	Predicted Property Damage Only Crashes	
Old Hwy 99 and Elderberry St	1.3	2.1	0.8	2.3	3.8	1.5
Old Hwy 99 and I-5 SB ramp	1.6	3.1	1.5	2.9	5.6	2.7
Old Hwy 99 and I-5 NB ramp	1.1	2.2	1.1	2.3	4.9	2.6
Old Hwy 99 and Prather Rd	0.4	0.7	0.3	0.6	1.1	0.5
Harrison Ave at Lewis County line	0.1	0.1	0	0.0	0.0	0
Harrison Ave and Kuper Rd	0.3	0.5	0.2	0.5	0.7	0.2
Harrison Ave and Foron Rd	0.3	0.5	0.2	0.4	0.6	0.2
Harrison Ave and Reynolds Ave	0.5	0.7	0.2	0.9	1.4	0.5
Reynolds Ave and Industrial Dr	0.1	0.1	0	0.0	0.1	0.1
Harrison Ave and Belmont Ave	1.0	1.4	0.4	1.8	2.5	0.7
Harrison Ave and I-5 SB ramps	1.2	1.7	0.5	2.3	3.0	0.7
Harrison Ave and I-5 NB ramps	1.4	1.7	0.3	2.6	3.3	0.7
Reynolds Ave and Lum Rd	0.1	0.1	0	0.1	0.2	0.1
Total	9.4	14.9	5.5	16.7	27.2	10.5

Source: WSDOT Public Records

10 ORIGIN-DESTINATION STUDY

10.1 Methodology

10.1.1 StreetLight Analysis Parameters and Data Sources

The origin-destination (OD) study uses data extracted from StreetLight Data's InSight online platform. StreetLight is a web-based, on-demand mobility data analytics platform. This service leverages anonymized personal cellular-device location data (location-based services data), connected vehicle data, and commercial vehicle GPS data that are processed into origin/destination matrices, travel time, and routing information.

This OD study relied mainly on location-based services data for all vehicles trips and commercial vehicle GPS data for freight trips. For location-based services (LBS) data, the raw sample data were processed into probable trips with adjustments to trip data made based on sampled devices compared to the population at the level of the census block and then classified to travel modes. For GPS data, the same process was used to derive probable freight trips, and vehicle classes are identified from information about data providers and trip characteristics. All-vehicles trips include all vehicle modes, including trucks, since the trips were derived from individual smart mobile devices regardless of the vehicles.

The Streetlight tool provides access to a larger scale of transportation data to support better understanding of transportation patterns and travel behavior in the study area than would be available through more traditional, count-based data collection techniques.

10.1.2 Analysis Limitations

Despite the benefits and insights gathered through the StreetLight platform, the methods by which StreetLight compiles, transforms, analyzes, and models data do have some limitations that should be noted when interpreting analysis results. While StreetLight bases its data on actual, historical information collected from travelers, it 1) provides only a sample of the total trips being made, and 2) requires algorithms to normalize and expand location-based data. As such, its accuracy can be affected by sample size, which varies by mode, location, year, date, and time of day. It is important to consider these limitations when deriving travel patterns and trip characteristics from StreetLight's data.

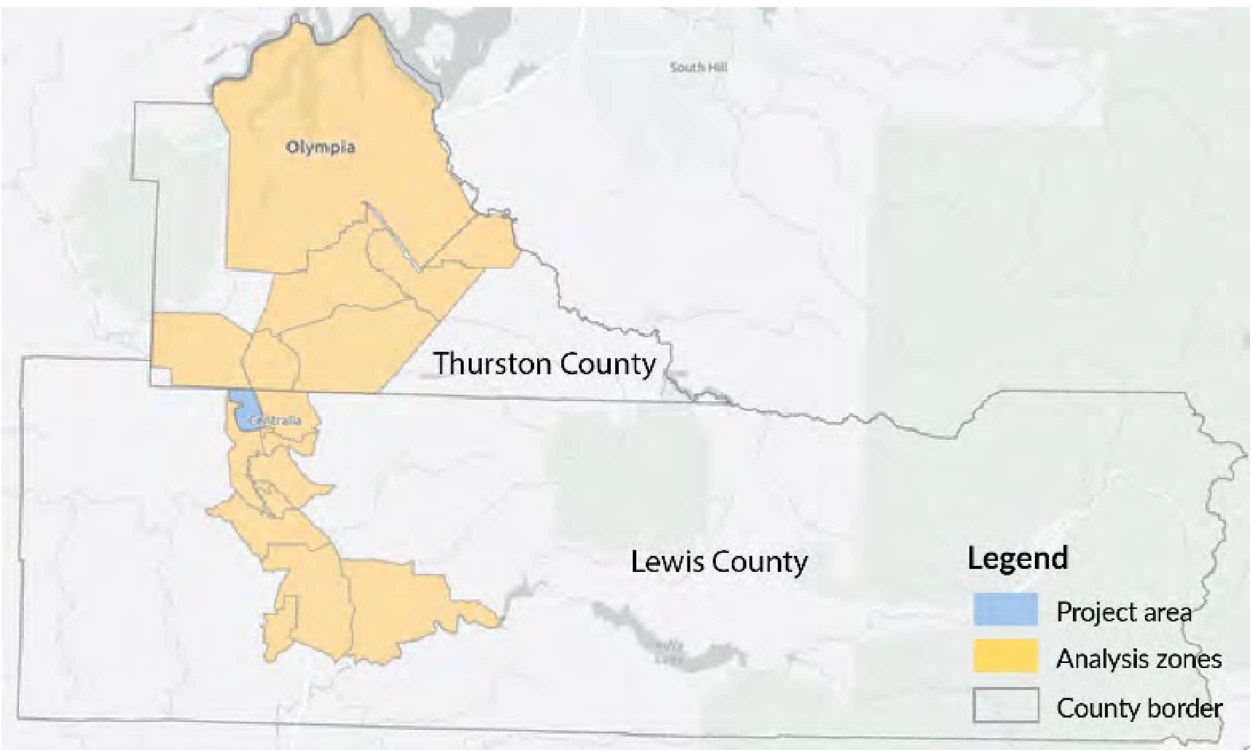
Additionally, because StreetLight's data depends on smart device and GPS tracking, some inherent biases in the sample base could occur because a proportion of members within certain demographic groups may not use smart devices; therefore, these groups could be underrepresented in StreetLight data. The Project team does not know the identity of individual drivers or smart devices, as the data is anonymized. In addition, individual smart device data is not tracked for trucks.

10.2 Origin-Destination Analysis

The origin-destination (OD) analysis from/to the study area was conducted using zones shown in Figure 10-1. The zones cover areas that the travel shed analyses (discussed in Section 4) indicate trips are from or going to. The zones mostly comprise of 2020 census tracts where available in StreetLight's Insight platform. Zones that are farther away from the study area are combined into bigger zones since granular OD data are not as relevant to this study.

One thing to note is that the StreetLight analysis boundary is Lewis and Thurston Counties. There are trip origins and destinations outside of this boundary that cannot be included due to this limitation. Therefore, the OD analysis only examined travel patterns within the two-county area.

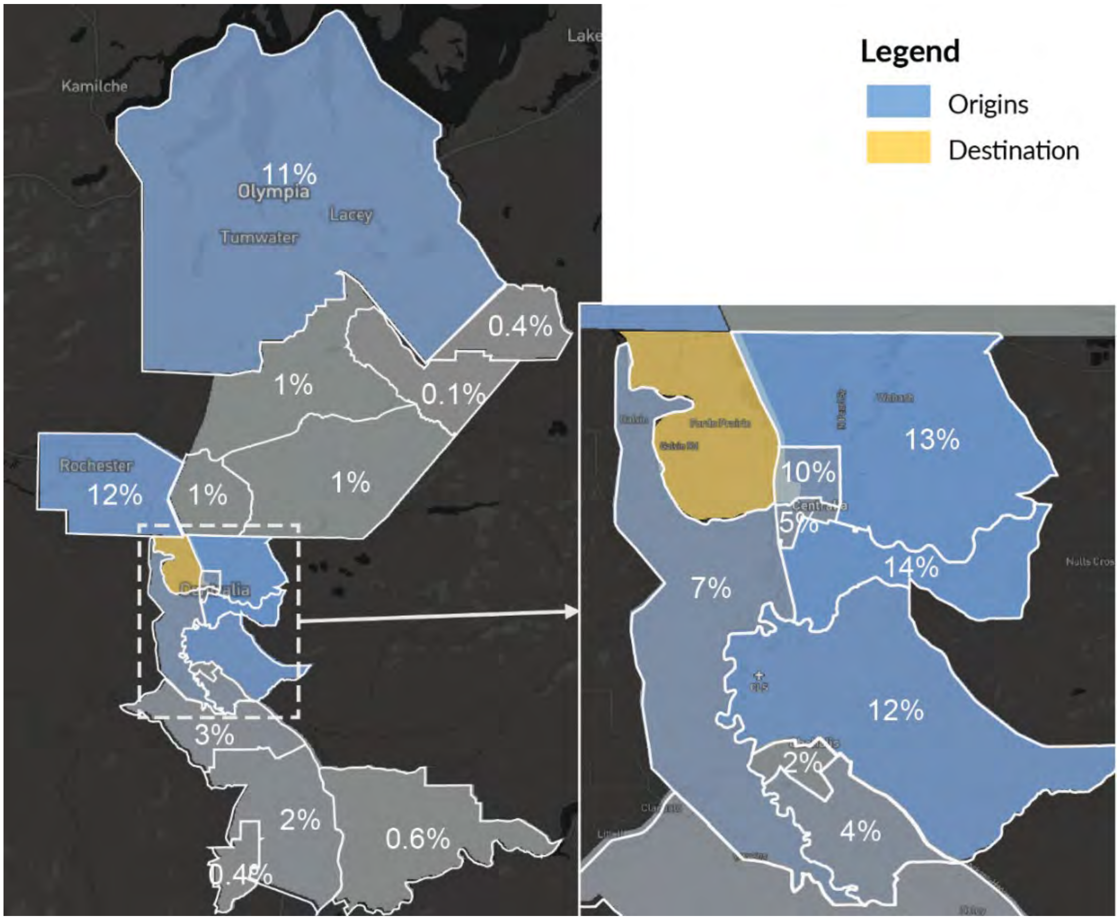
Figure 10-1: Origin-Destination Analysis Zones



10.2.1 Origins and Destinations – All Vehicles

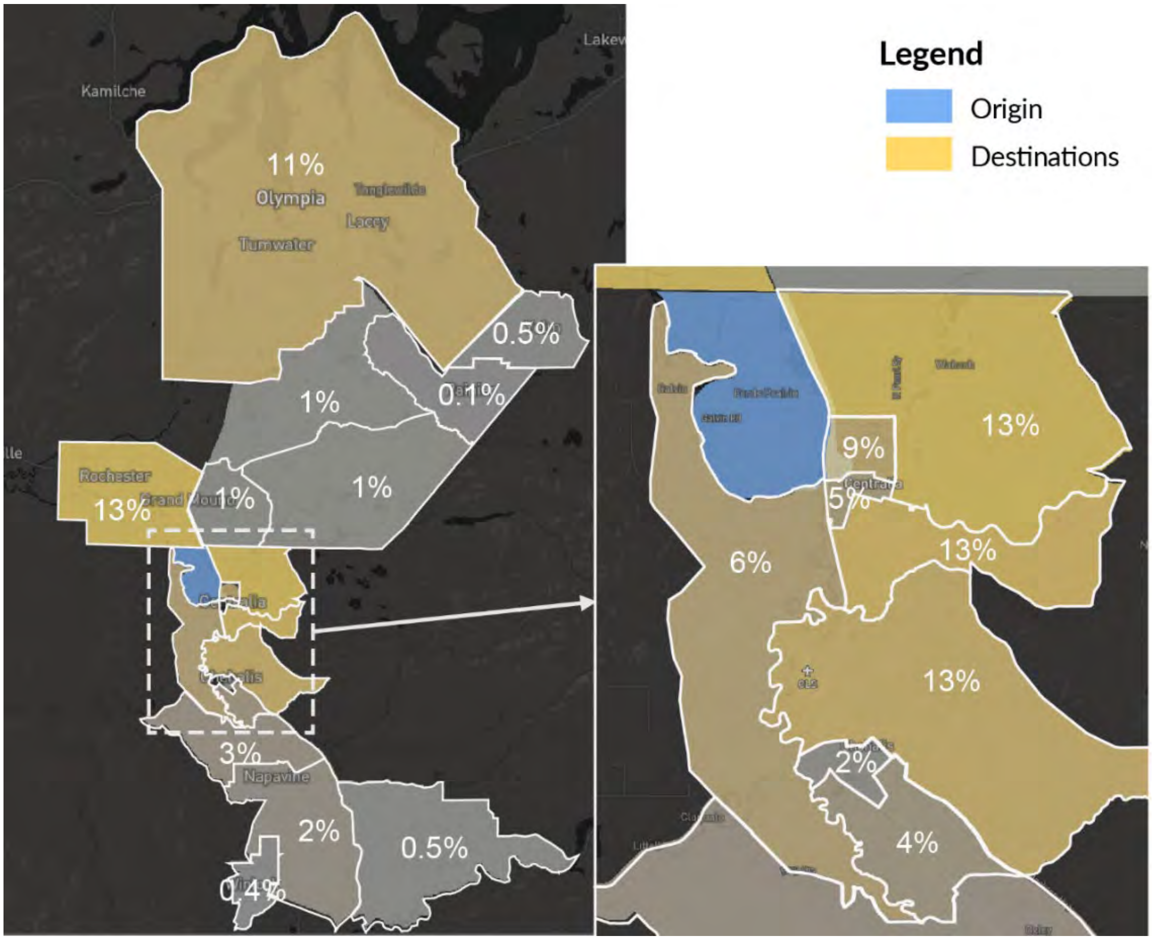
- Within the areas examined, more than 50 percent of trips going to the study area are local and come from urbanized areas and adjacent areas in Lewis County.
- Approximately 12 percent of trips also come from Grand Mound and the Rochester areas.
- Similarly, around 11 percent of trips come from the Olympia-Lacey-Tumwater areas.
- The destination map shows a similar distribution of trips as the origin map, as highlighted in Figure 10-2 and Figure 10-3.

Figure 10-2: Share of All-Vehicle Trip Origins to Study Area



March & April 2019 and March & April 2022, Tuesday – Thursday, All Day
Sample Size: Trip count – 101,000; Device count – 17,000

Figure 10-3: Share of All-Vehicle Trip Destinations from Study Area

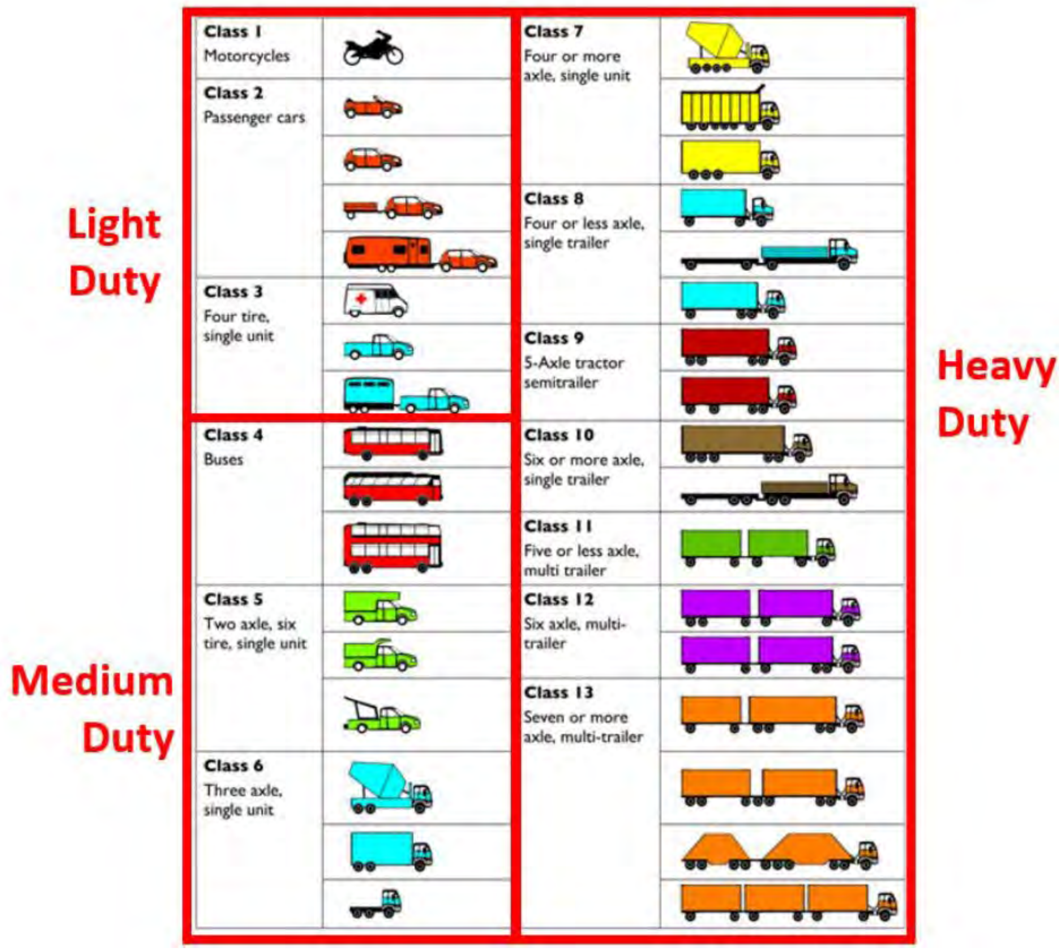


March & April 2019 and March & April 2022, Tuesday – Thursday, All Day
Sample Size: Trip count – 100,000; Device count – 18,000

10.2.2 Origins and Destinations – Freight Vehicles

StreetLight truck classifications are based on the Federal Highway Administration (FHWA) vehicle classifications and grouped in medium-duty and heavy-duty categories. In StreetLight's data, Class 4 to 6 defined by FHWA are grouped together as medium-duty trucks, which include buses and trucks of up to three axles. Class 7 to 13 are grouped together as heavy-duty trucks, which include trucks with four or more axles.

Figure 10-4: StreetLight Data Vehicle Classifications

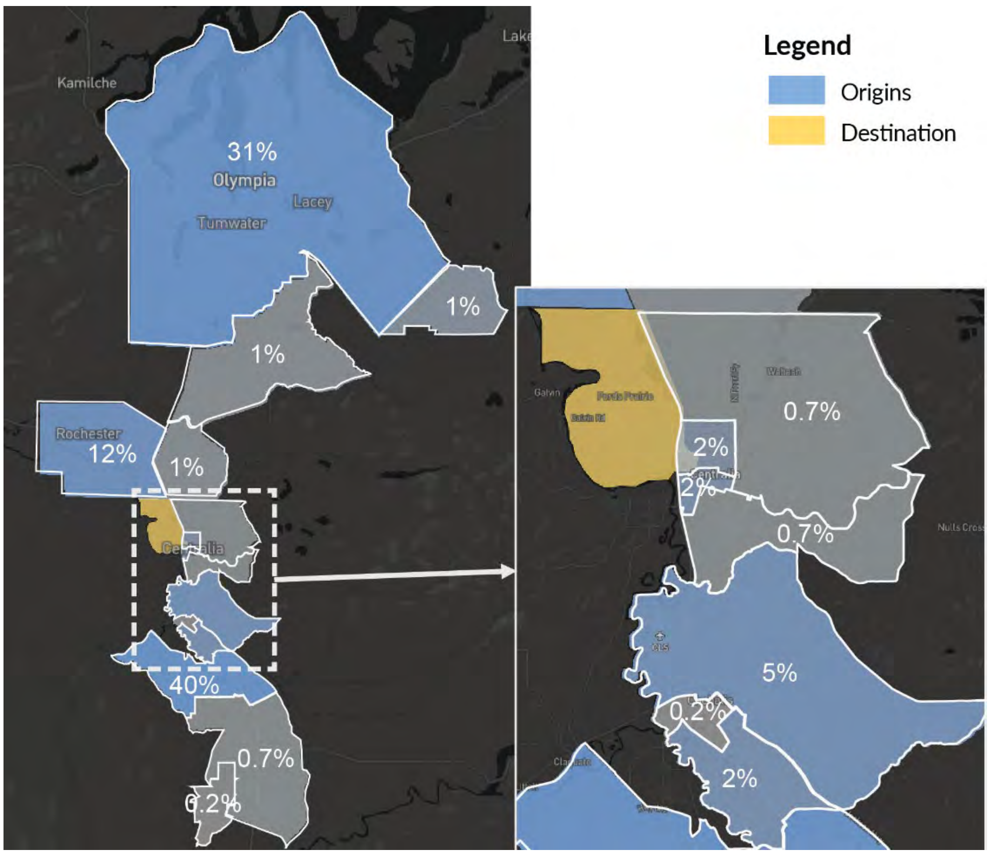


Source: Truck Volume Methodology and Validation White Paper (updated September 2022), StreetLight Data

10.2.2.1 Freight Trip Origins

- As shown in Figure 10-5, origins of heavy truck trips to the study area are farther from the study area and more concentrated compared to those of all-vehicle trips.
- Within the areas examined, heavy truck trip origins are concentrated around the Port of Chehalis and Olympia-Lacey-Tumwater area, which make up 40 percent and 31 percent of all trips, respectively.
- About 12 percent of the trips enter the study area from the Grand Mound and Rochester areas west of I-5.

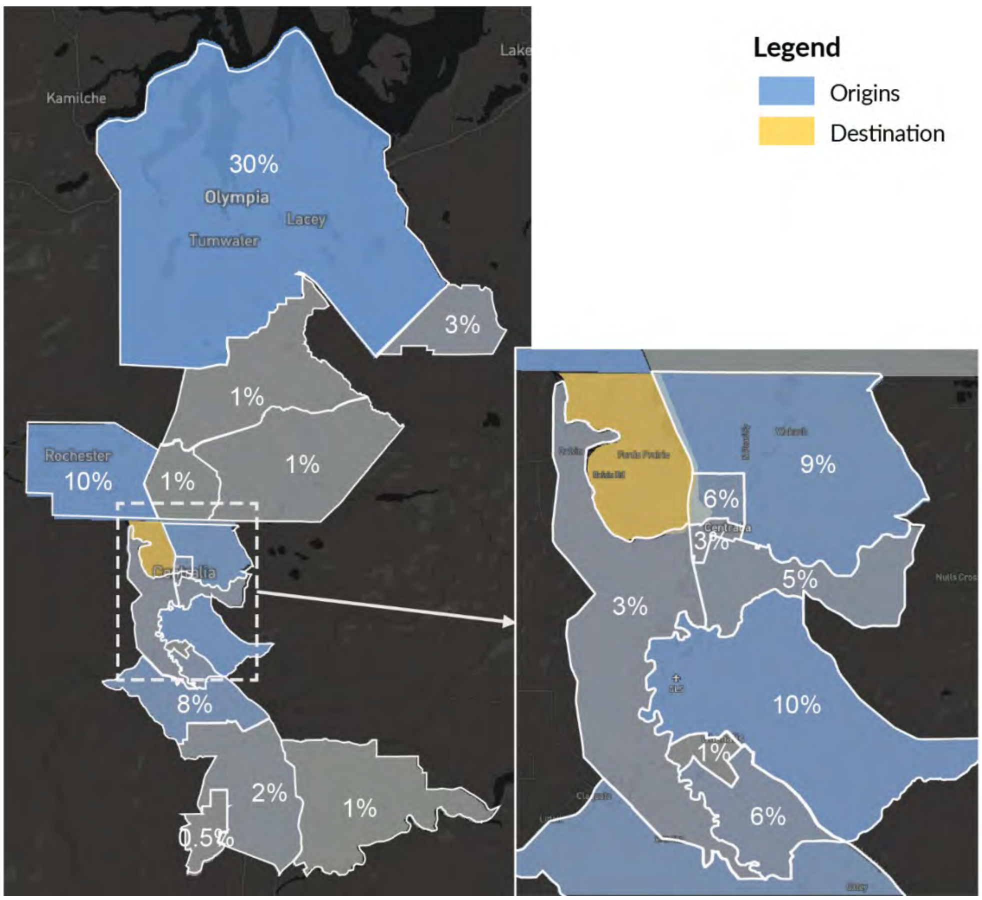
Figure 10-5: Share of Heavy Truck Trip Origins to Study Area



March & April 2019 and March & April 2022, Tuesday – Thursday, All Day
Sample Size: Heavy Truck Trip Count – 1,000

- As shown in Figure 10-6, medium truck trips entering the study area are regional in nature. Trips are longer in distance north-south, with about 30 percent of trips originating from the Olympia-Lacey-Tumwater area.
- About 10 percent of medium truck trips originate from Grand Mound and Rochester area.
- Trip origins are more evenly distributed in areas east of the study area, including Centralia and Chehalis. These trips account for about 40 percent of all medium truck trips.
- About 8 percent of trips come from the Port of Chehalis area and another 3 – 4 percent from areas farther south along I-5 around Napavine.

Figure 10-6: Share of Medium Truck Trip Origins to Study Area

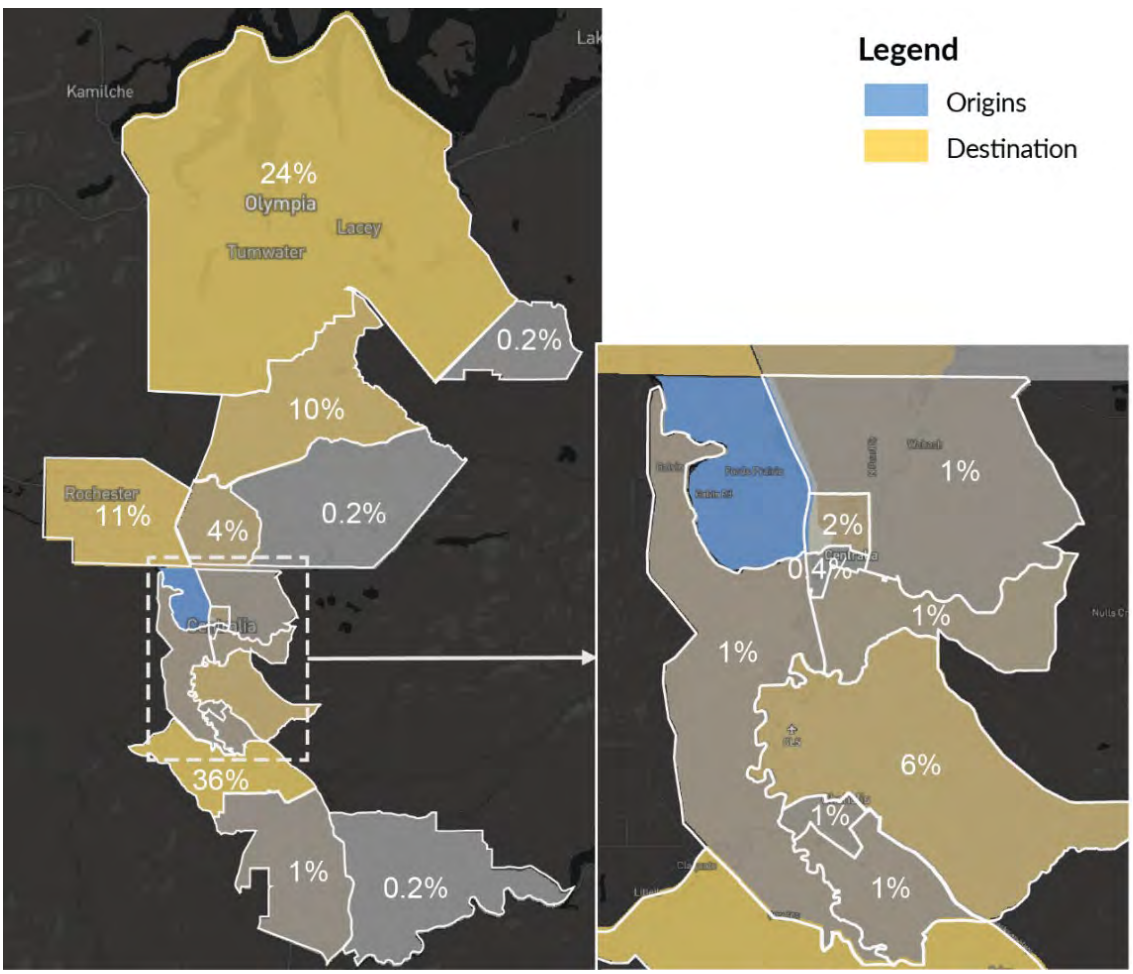


March & April 2019 and March & April 2022, Tuesday – Thursday, All Day
Sample Size: Medium Truck Trip Count – 2,000

10.2.2.2 Freight Trip Destinations

- As shown in Figure 10-7, destinations of heavy truck trips from the study area are more dispersed compared to the origins.
- The Port of Chehalis area has the largest share of trips among all destination zones, with about 36 percent of all freight trips.
- About 24 percent of all freight trips terminate in the Olympia-Lacey-Tumwater area.
- About 25 percent of all trips end just north of the study area, including 11 percent to the northwest in the Grand Mound and Rochester areas and 10 percent just south of the Olympia-Lacey-Tumwater area.

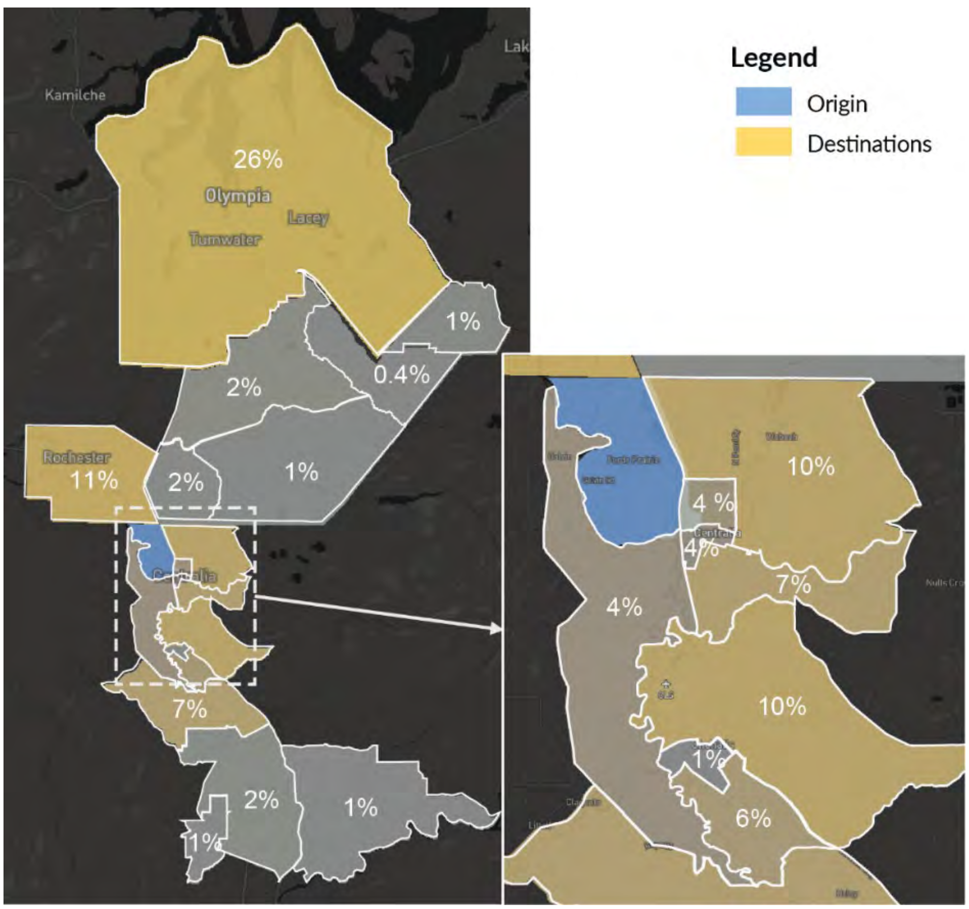
Figure 10-7: Share of Heavy Truck Trip Destinations from Study Area



March & April 2019 and March & April 2022, Tuesday – Thursday, All Day
Sample Size: Heavy Vehicle Trip Count – 1,000

- As shown in Figure 10-8, medium truck trips are longer distance in north-south direction. Trips to destinations east or west of the study area are more local and shorter in general.
- About 26 percent of trips terminate in Olympia-Lacey-Tumwater area, which is the largest destination zone.
- Trip destinations are more evenly distributed near the study area near Centralia, Chehalis, and Grand Mound areas. About 40 percent of medium truck trips end east of I-5 in Centralia or Chehalis areas. About 11 percent of trips end in the Grand Mound and Rochester area.

Figure 10-8: Share of Medium Truck Trip Destinations from Study Area



March & April 2019 and March & April 2022, Tuesday – Thursday, All Day
Sample Size: Medium Truck Trip Count – 2,000

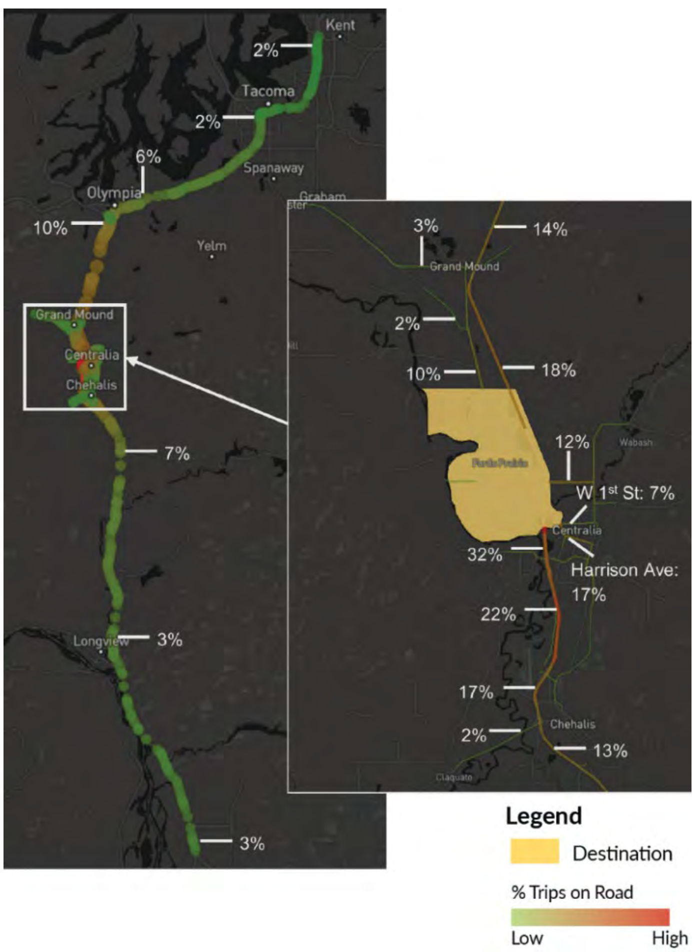
10.3 Travel Shed Analysis

10.3.1 Travel Shed Analysis – All Vehicles

- Trips entering the study area most commonly use the I-5 spine represented by 32 percent of all trips on I-5 south of the study area and 18 percent of all trips on I-5 north of the area.
- A significant percentage of trips also use local arterials in Centralia to access the study area, including 17 percent on Harrison Avenue, 12 percent on Reynolds Avenue and 7 percent on W 1st Street.

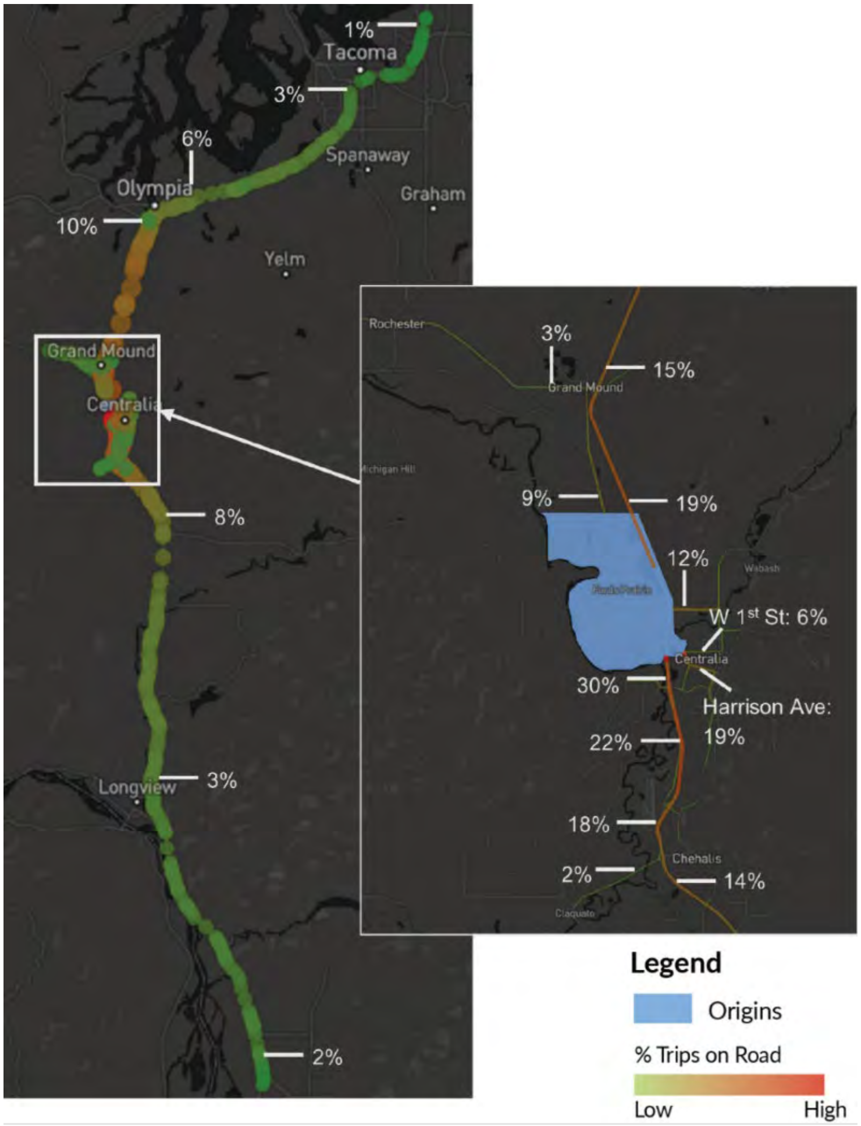
- The north-south extent of the travel shed is large, spanning from Kent in the north of Vancouver area in the south. Longer distance trips are shown to travel on I-5.
- The east-west extent of the travel shed is more limited and extends only to Grand Mound/Rochester area to the west and Centralia to the east.
- Old Hwy 99/Harrison Avenue is another major roadway for trips coming from the north, accounting for about 10 percent of all trips.
- Compared to the large north-south extent, most trips do not travel as far. Only 6 percent of trips travel past Olympia and 7 percent continue past Napavine to the south, indicating about 85 to 90 percent of trips end in between.
- The route patterns of trips leaving the study area are like that of routes entering the study area, as shown in Figure 10-9 and Figure 10-10.

Figure 10-9: Travel Shed of Trips to Study Area – All Vehicles



March & April 2019 and March & April 2022, Tuesday – Thursday, All Day
Sample Size: Trip count – 246,000; Device count – 31,000

Figure 10-10: Travel Shed of Trips from Study Area – All Vehicles



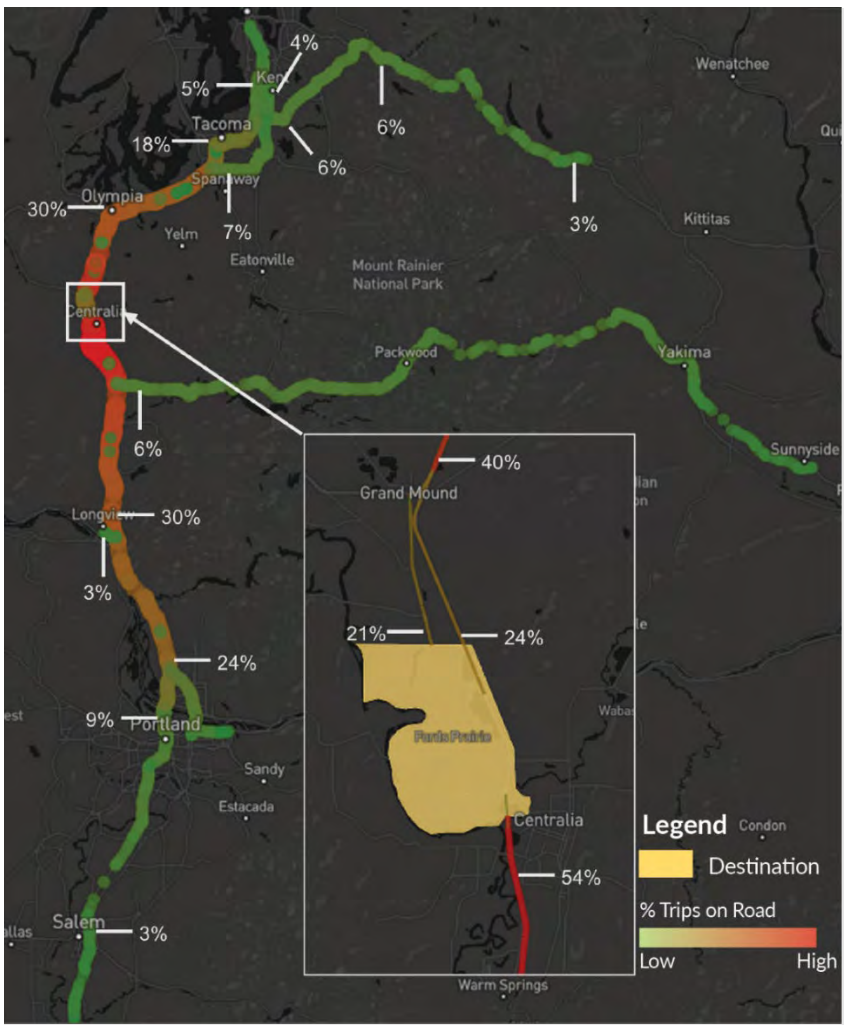
March & April 2019 and March & April 2022, Tuesday – Thursday, All Day
Sample Size: Trip count – 121,000; Device count – 19,000

10.3.2 Travel Shed Analysis – Freight Vehicles

10.3.2.1 Freight Trips to Study Area

- The travel shed of heavy truck trips to the study area is larger compared to that of all vehicles (Figure 10-11). The extent spans from south of Salem to Seattle in the north-south direction; trips come from as far east as Sunnyvale and Cle Elum.
- Trips entering the study area use I-5 north and south of it and Old Highway 99.
- Heavy truck trips to the study area are more regional in nature, with about 30 percent traveling from Olympia and 18 percent from Tacoma. To the south, about 30 percent travel from at least as far as Longview and 24 percent from the Vancouver area.
- About 6 percent of all heavy truck trips travel from the east on US 12 near Napavine.
- Another 6 percent of all heavy truck trips travel from the east on SR 512 near Lakewood.

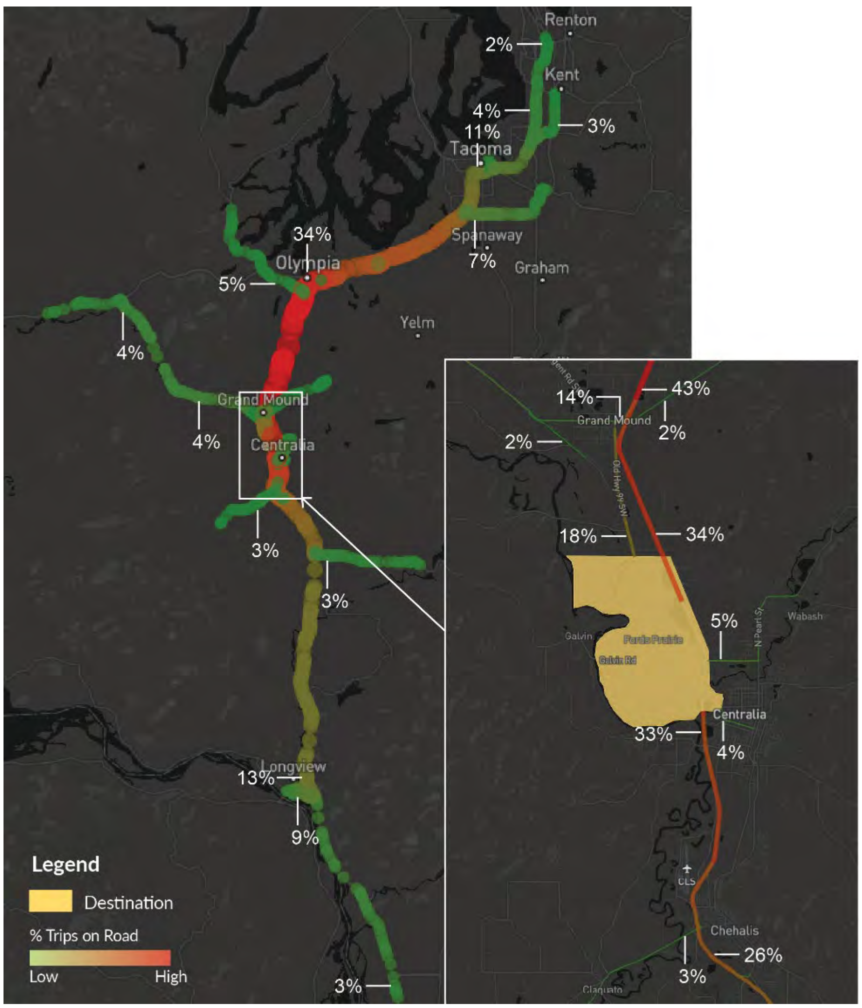
Figure 10-11: Heavy Truck Trips to Study Area



March & April 2019 and March & April 2022, Tuesday – Thursday, All Day
Sample Size: Trip count – 6,000

- Origins of medium truck trips to the study area extend from Renton in the north to Vancouver in the south (Figure 10-12)
- About 43 percent of trips come from I-5 north of Grand Mound. 34 percent of trips continue on I-5 to access the study area while 18 percent enter the area via Old Hwy 99/Harrison Avenue.
- About 9 percent of trips enter the study area from east of I-5. 5 percent of trips travel on Reynolds Avenue and 4 percent on Harrison Avenue to the study area.
- About 3 percent of trips come from the Vancouver area and 9 percent from the Longview area.

Figure 10-12: Medium Truck Trips to Study Area

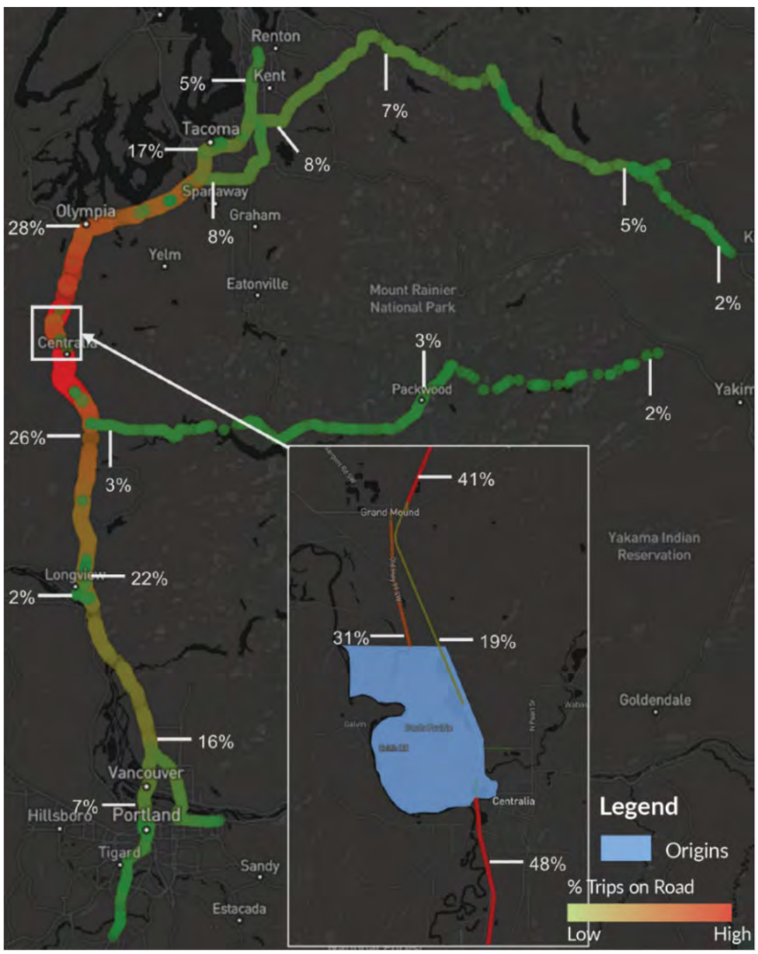


March & April 2019 and March & April 2022, Tuesday – Thursday, All Day
Sample Size: Trip count – 7,000

10.3.2.2 Freight Routes from Study Area

- The travel shed for heavy truck trips leaving the study area is like that of the trips entering, spanning from Seattle to Portland and from Yakima to Ellensburg (Figure 10-13).
- Similarly, the trips are more regional than those of all-vehicles trips.
- About 28 percent of heavy truck trips reach Olympia and about 5 percent continue to Kent and Renton.
- About 16 percent of heavy truck trips travel to Vancouver and about 7 percent continue to Portland.
- 3 percent of heavy truck trips head east on US 12 near Napavine.
- About 8 percent of heavy truck trips exit to the east on SR 512 near Lakewood.

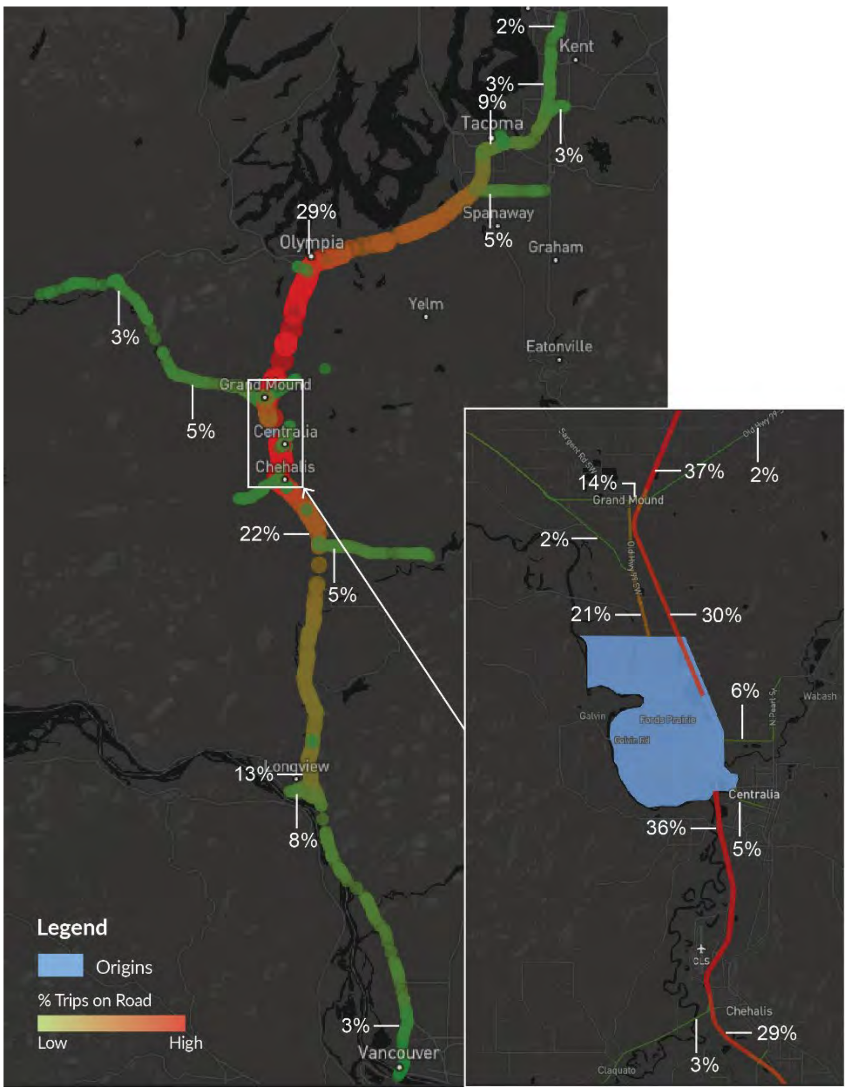
Figure 10-13: Heavy Truck Trips from Study Area



March & April 2019 and March & April 2022, Tuesday – Thursday, All Day
Sample Size: Trip count – 6,000

- Like the medium truck trip pattern to the study area, trips from the study area travel farther in the north-south direction (Figure 10-14).
- About 36 percent of trips travel south on I-5 and about 37 percent end up on I-5 north of Grand Mound.
- 30 percent of trips leave the study area on northbound I-5 and 21 percent use Old Hwy 99/Harrison Avenue.
- About 5 percent of medium truck trips travel west on US 12 via Grand Mound and Rochester.
- About 11 percent of trips head east of I-5 on Reynolds (6 percent) and Harrison Avenue (5 percent).

Figure 10-14: Medium Truck Trips from Study Area



March & April 2019 and March & April 2022, Tuesday – Thursday, All Day
Sample Size: Trip count – 7,000

10.4 Port of Centralia Travel Patterns

The Port of Centralia owns three industrial parks, two of which are in the study area. This analysis only examines trips to and from Port Industrial Parks 1 and 2. Travel sheds are examined and compared from both 2019 and 2022.

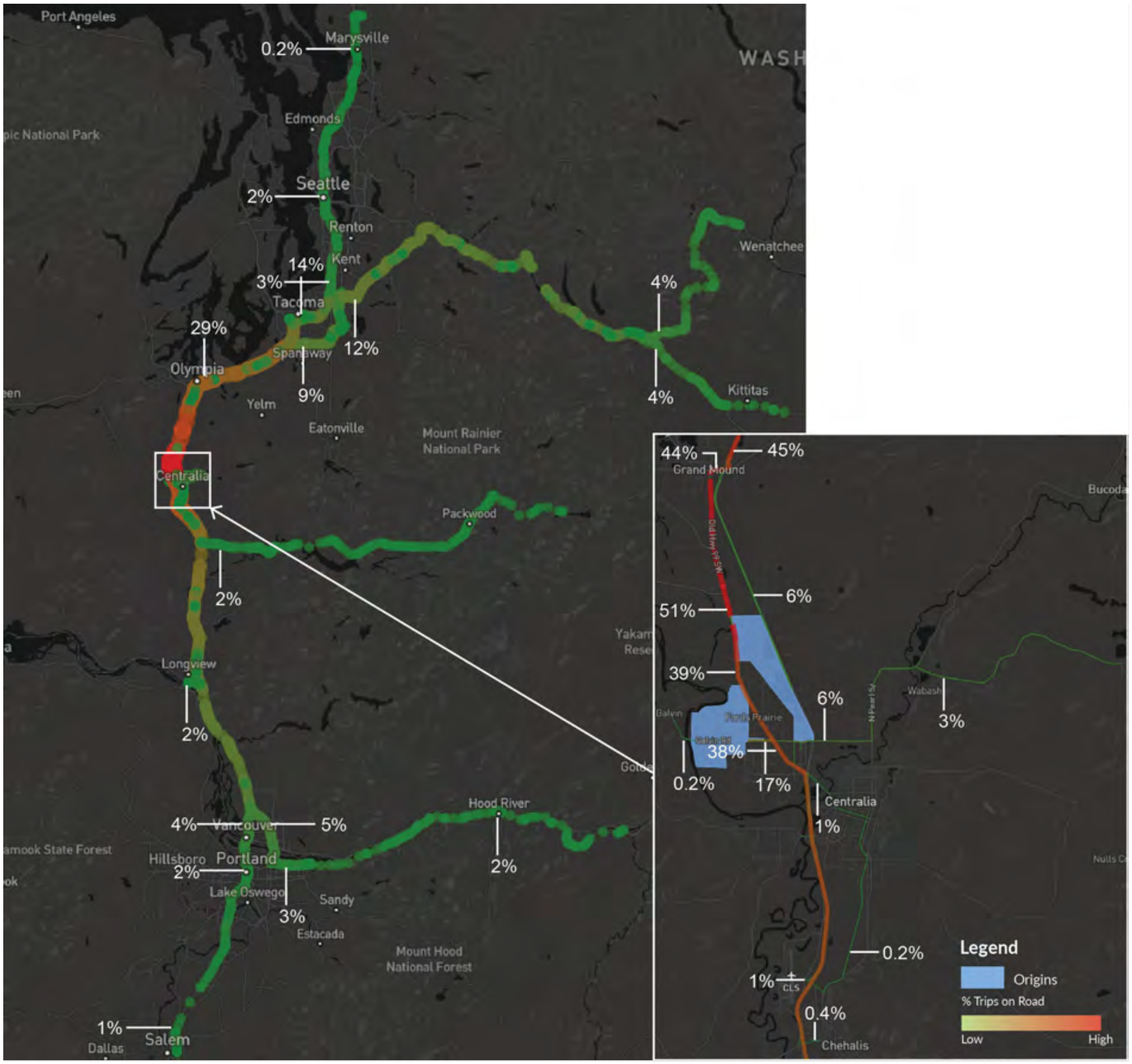
10.4.1 Heavy Truck Trips

Overall, heavy trucks with origins or destinations at the Port of Centralia industrial parks have the largest travel sheds of all vehicle types examined in this study.

10.4.1.1 Heavy Truck Trips Leaving the Port of Centralia

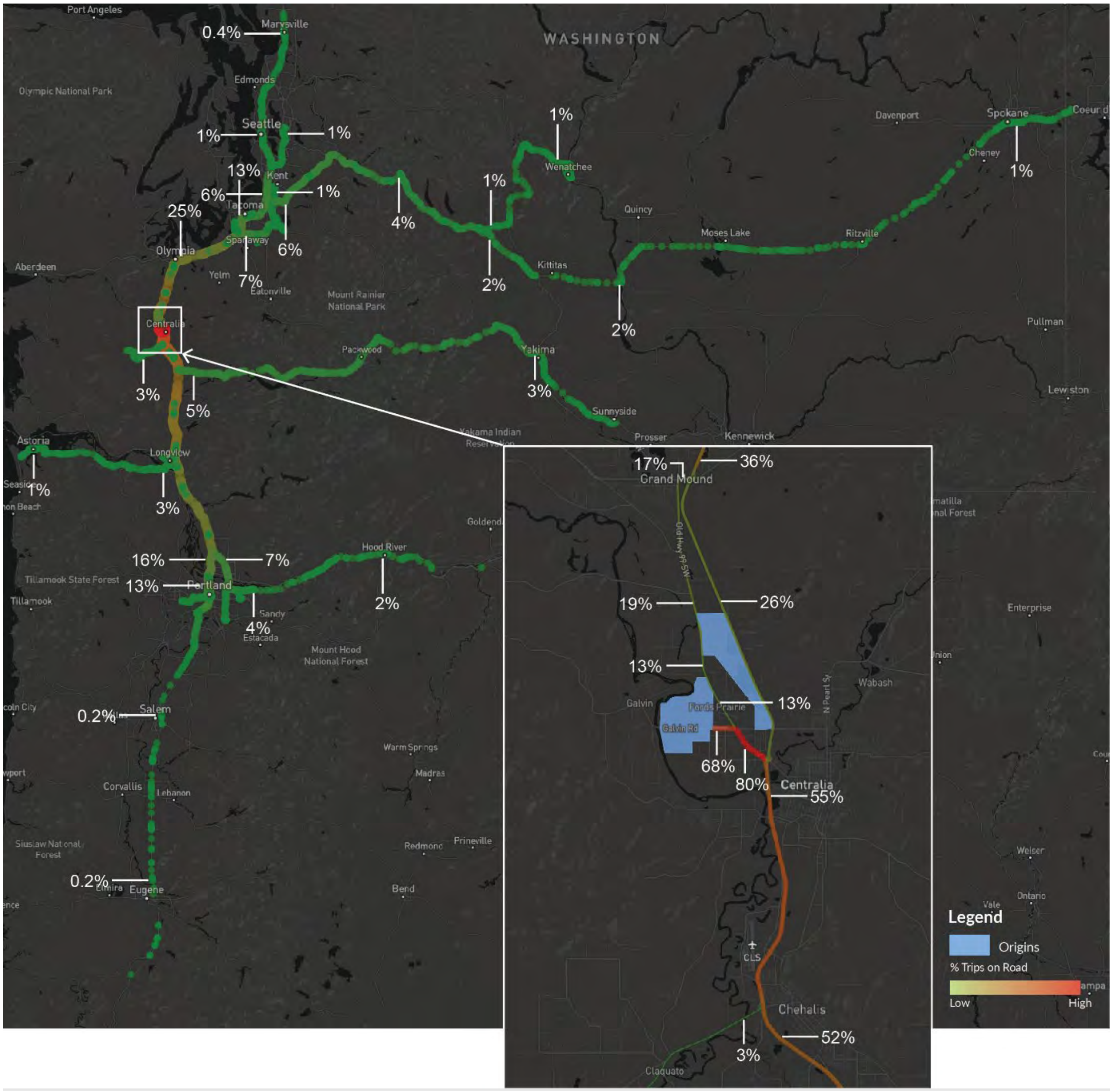
- In 2019 (Figure 10-15), 44% of heavy trucks leaving the Port reached Grand Mound via Old Highway 99. In 2022 (Figure 10-16), 36% of heavy trucks reached Grand Mound, with trips evenly split between Old Highway 99 and I-5.
- In 2019, 29% of heavy trucks leaving the Port reached Olympia, with 14% reaching Tacoma and 2% continuing to Seattle. 2022 routes contracted slightly, with 25% of heavy trucks reaching Olympia, 13% reaching Tacoma and 1% continuing to Seattle.
- The eastern extent of heavy truck destinations significantly expanded between 2019 and 2022, from Central Washington in 2019 to the Idaho state line in 2022.
- The southern extent also expanded, from Salem in 2019 to Eugene in 2022.
- A greater share of trips reached the Portland metro area in 2022 compared to 2019. Approximately 2% of trips reached Portland in 2019, which increased to 13% in 2022.

Figure 10-15: Heavy Truck Trips Leaving the Port of Centralia, 2019



March and April 2019, Tuesday – Thursday, All Day
Trip count: 2,000

Figure 10-16: Heavy Truck Trips Leaving the Port of Centralia, 2022



March and April 2022, Tuesday – Thursday, All Day
Trip count: 2,000

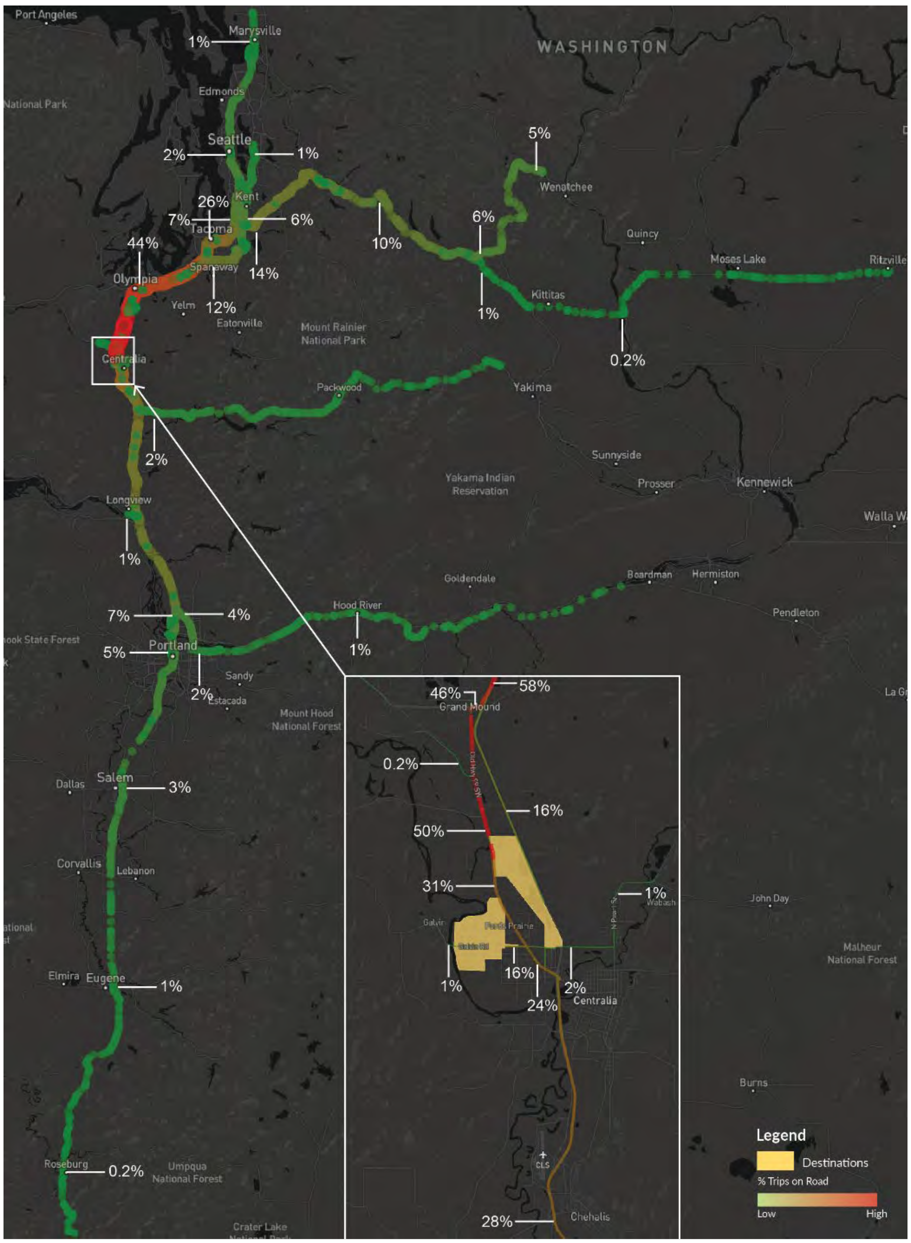
10.4.1.2 Heavy Truck Trips to the Port of Centralia

- The eastern extent of heavy truck origins expanded, from Ritzville in 2019 (Figure 10-17) to the Idaho state line in 2022 (Figure 10-18).
- The southern extent contracted, from south of Roseburg, Oregon in 2019 to north of Eugene, Oregon in 2022. Despite this contraction, heavy truck origins overall shifted from north to south.

- In 2019, 44% of heavy truck trips came from Olympia or points north. In 2022, this decreased to 17%.
- In 2019, 5% of heavy truck trips came from Vancouver, Washington, or points south. In 2022, this increased to 30%.

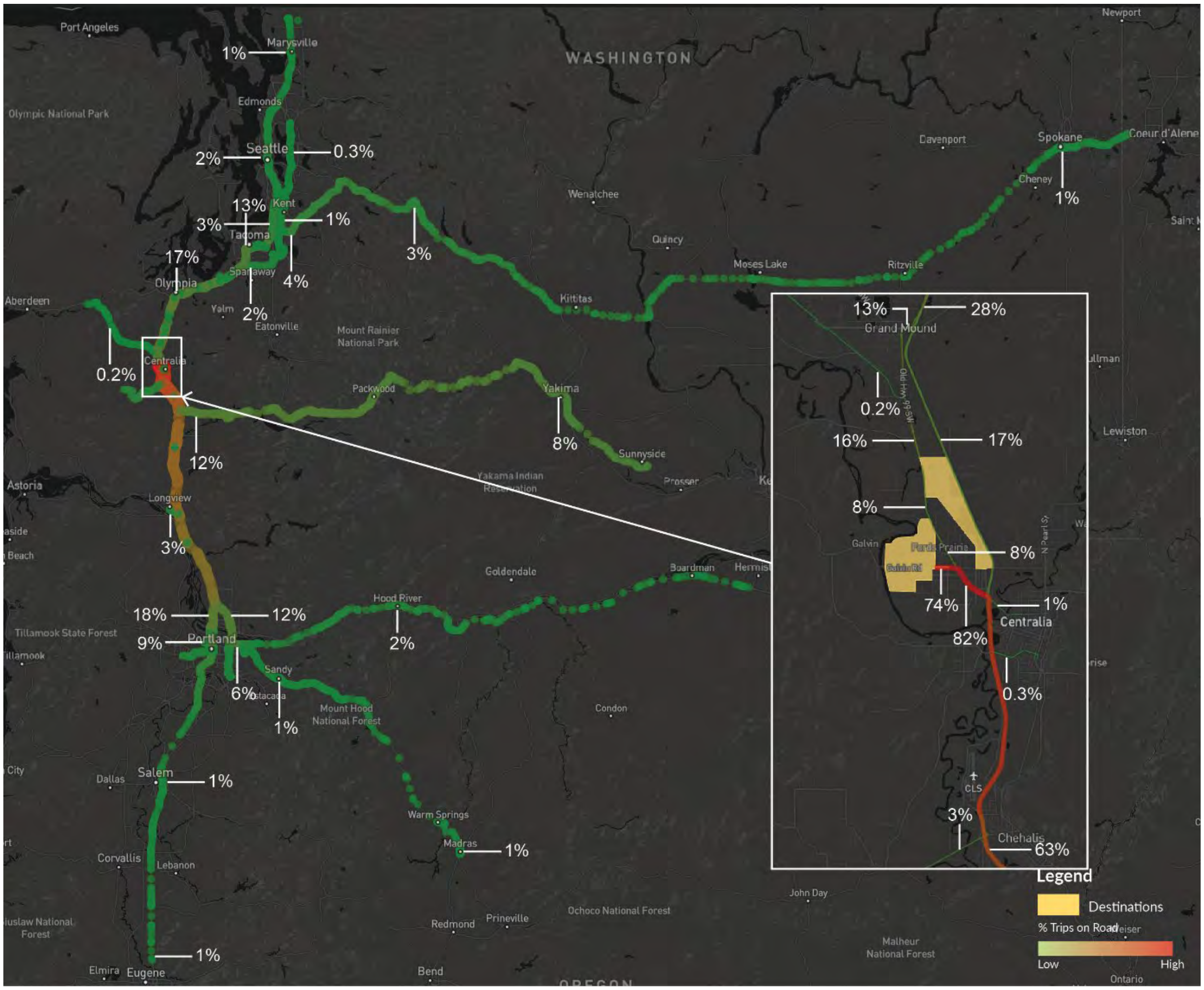
- In 2019, only 2% of heavy truck trips came from east of I-5 via Reynolds Avenue. 50% of trips came from the north via Old Highway 99, and 16% of trips came from the north via I-5. 28% of trips came from Chehalis or points south via I-5.

Figure 10-17: Heavy Truck Trips to the Port of Centralia, 2019



March and April 2019, Tuesday – Thursday, All Day
Trip count: 2,000

Figure 10-18: Heavy Truck Trips to the Port of Centralia, 2022



March and April 2022, Tuesday – Thursday, All Day
Trip count: 2,000

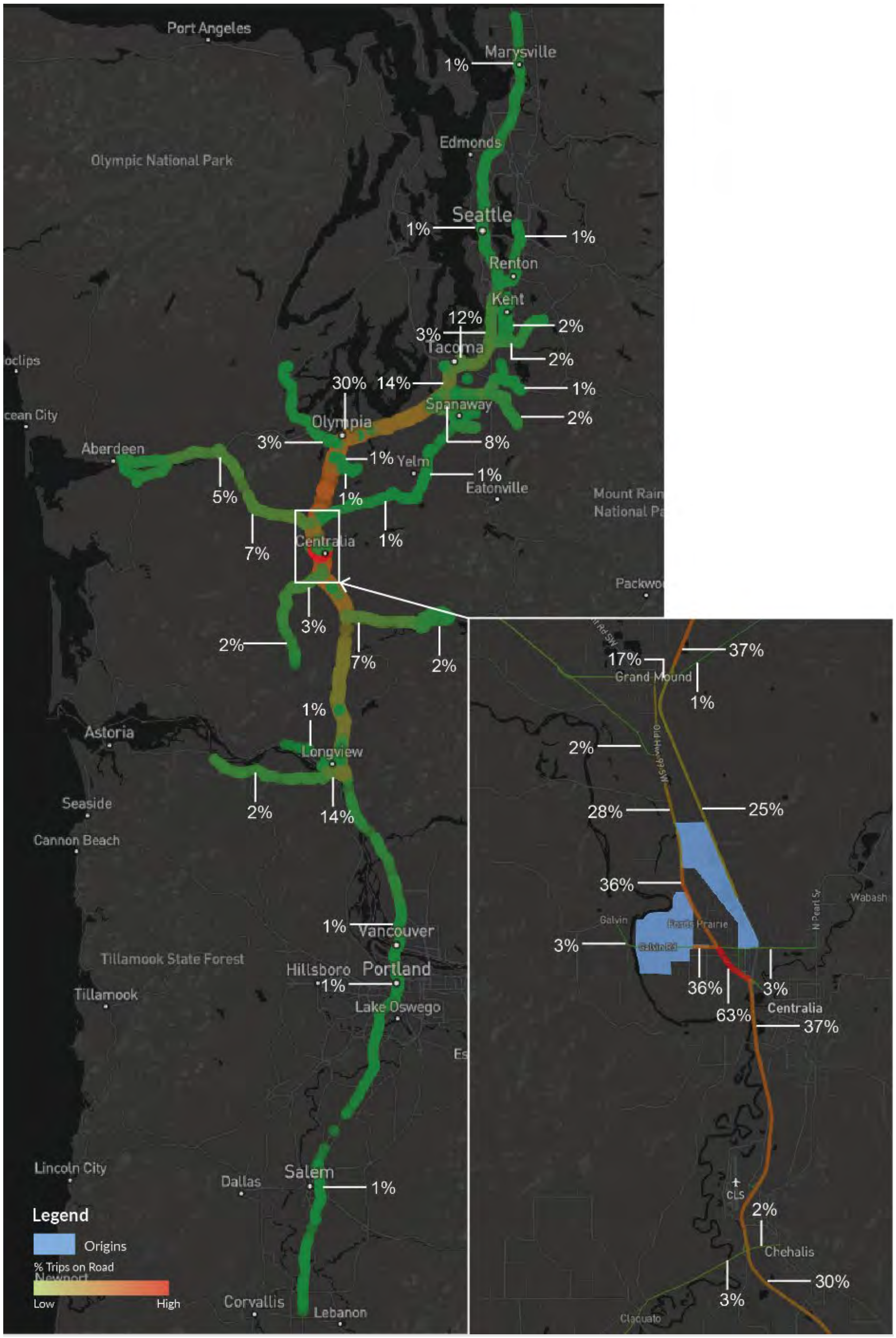
10.4.2 Medium Truck Trips

Compared to heavy trucks, medium trucks leaving from or traveling to the Port of Centralia have a smaller travel shed. Medium trucks are defined as two- or three-axle freight vehicles that do not fall under the semi-trailer combination category.

10.4.2.1 Medium Truck Trips Leaving the Port of Centralia, 2019 and 2022

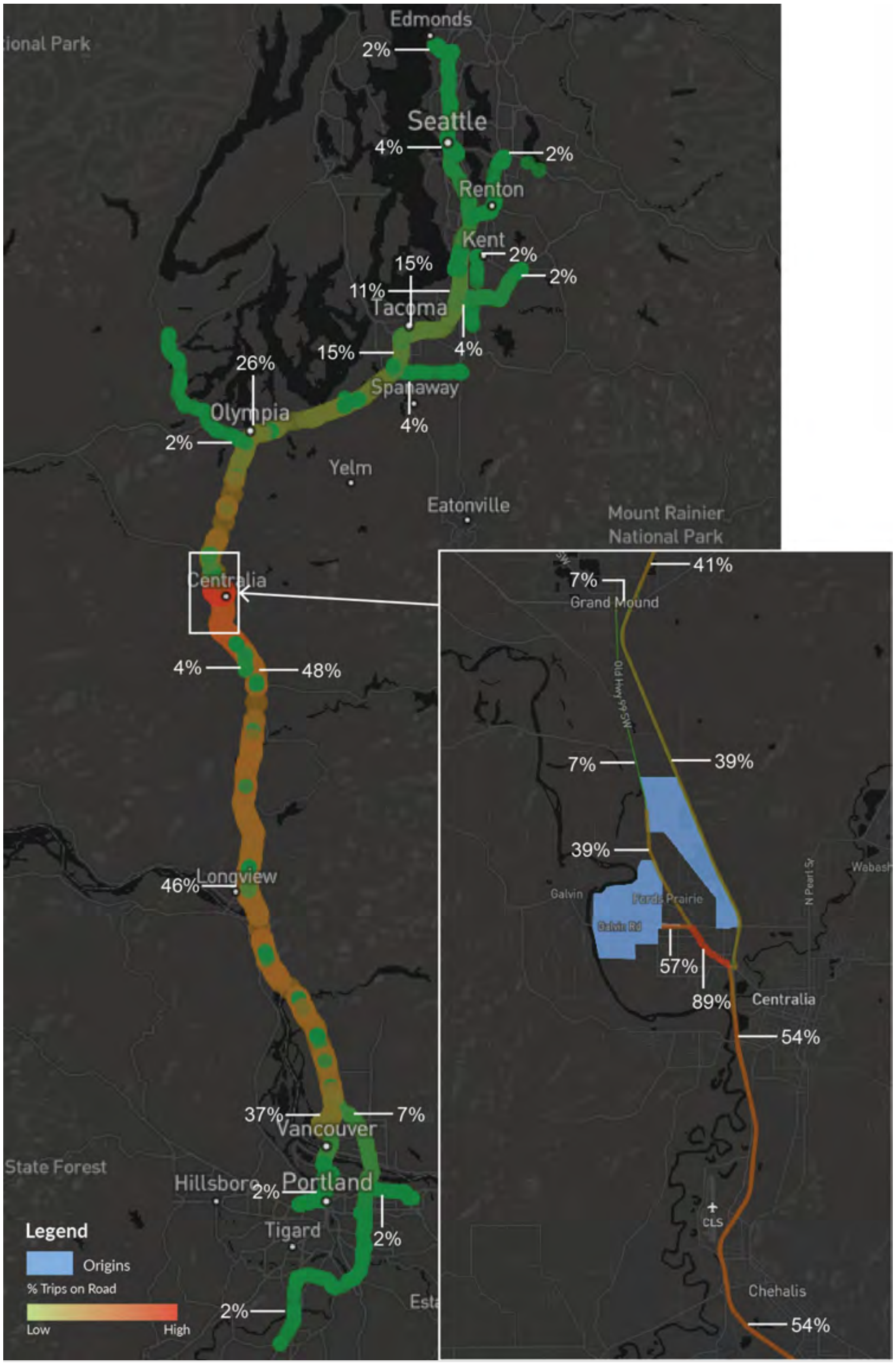
- In 2019 (Figure 10-19), 30% of medium trucks reached Olympia, with 12% continuing to Tacoma. In 2022 (Figure 10-20), 26% reached Olympia, with 15% continuing to Tacoma.
- The share of medium trucks headed southbound increased significantly. In 2019, 37% of trips traveled south of Centralia, with 14% reaching Kelso-Longview and 1% continuing to Vancouver. In 2022, 54% of trips traveled south of Centralia, with 46% reaching Kelso-Longview and 44% continuing to Vancouver.
- In 2019, 28% of medium trucks leaving the Port headed north via Old Highway 99, and 25% of trips headed north via I-5. 63% of trips accessed I-5 via Harrison Avenue. Only 3% of 2019 trips headed east of I-5 via Reynolds Avenue.
- In 2022, only 7% of medium trucks leaving the Port headed north via Old Highway 99, with 39% of trips heading north via I-5. 89% of trips accessed I-5 via Harrison Avenue. Less than 1% of trips headed east of I-5.

Figure 10-19: Medium Truck Trips Leaving the Port of Centralia, 2019



March and April 2019, Tuesday – Thursday, All Day
Trip count: 4,000

Figure 10-20: Medium Truck Trips Leaving the Port of Centralia, 2022

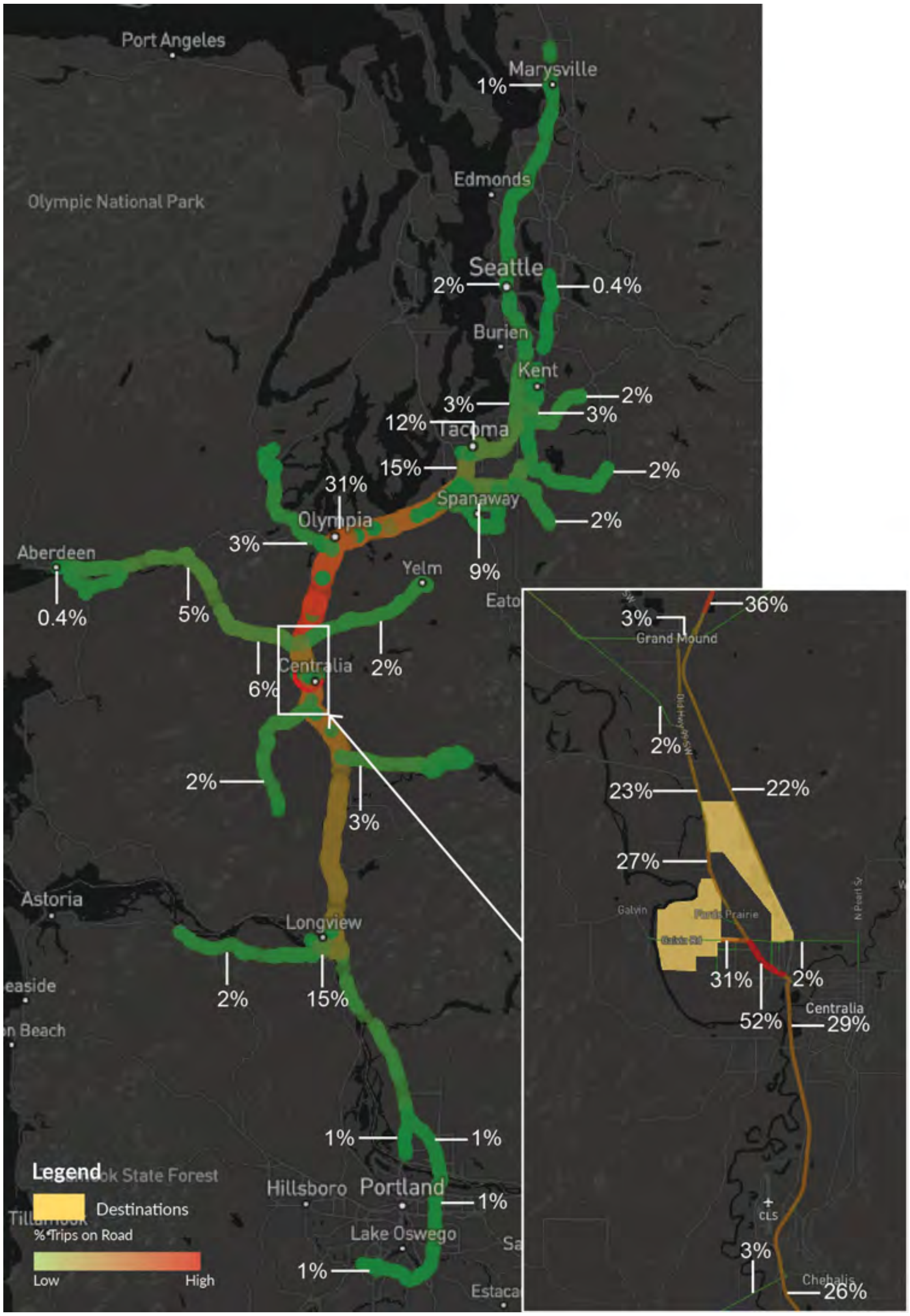


March and April 2022, Tuesday – Thursday, All Day
Trip count: <1,000

10.4.2.2 Medium Truck Trips to the Port of Centralia, 2019 and 2022

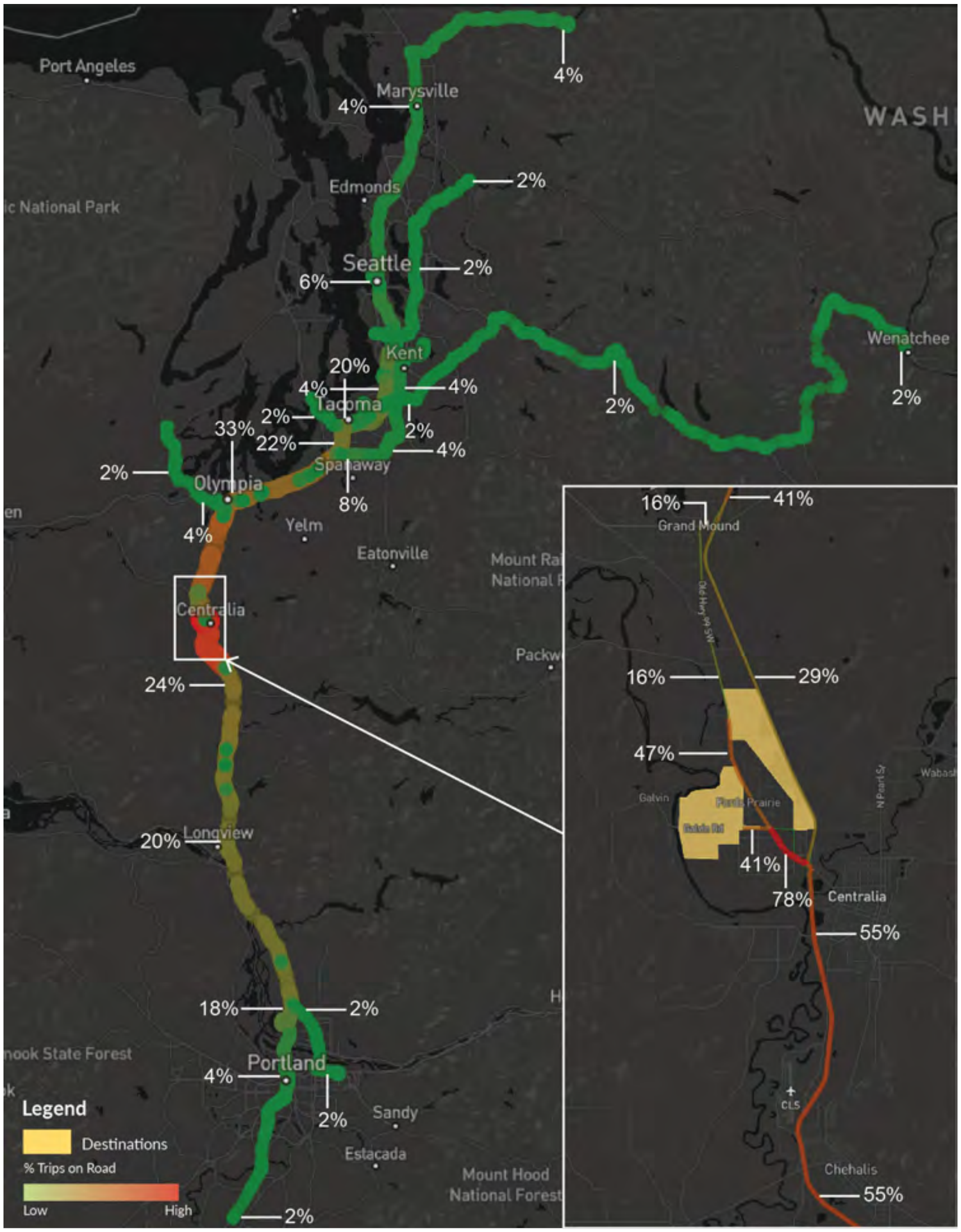
- Compared to medium trucks leaving the Port, the travel shed for medium trucks headed to the Port expanded to the north, south and east between 2019 and 2022.
- The western extent of the travel shed contracted, from Aberdeen in 2019 to Shelton in 2022.
- In 2019 (Figure 10-21), 12% of medium trucks came from Tacoma or points north. In 2022 (Figure 10-22), this increased to 20%.
- The share of medium trucks originating from the south increased significantly. In 2019, 29% of trips came from south of Centralia, with 15% from Kelso-Longview and 4% from the Portland metro area. In 2022, 55% of trips came from south of Centralia, with 20% from Vancouver.
- In 2019, 23% of medium trucks accessed the Port via Old Highway 99 southbound, and 25% of trips came from I-5 southbound. 52% of trips accessed the Port via Harrison Avenue south of Reynolds Avenue. Only 2% of 2019 trips came from east of I-5 via Reynolds Avenue.
- In 2022, 16% of medium trucks accessed the Port via Old Highway 99 southbound, and 29% of trips came from I-5 southbound. 78% of trips accessed the Port via Harrison Avenue south of Reynolds Avenue. Less than 1% of 2022 trips came from east of I-5 via Reynolds Avenue.

Figure 10-21: Medium Truck Trips to the Port of Centralia, 2019



March and April 2019, Tuesday – Thursday, All Day
Trip count: 4,000

Figure 10-22: Medium Truck Trips to the Port of Centralia, 2022



March and April 2022, Tuesday – Thursday, All Day
Trip count: <1,000

10.4.3 Average Travel Times and Speeds to Access I-5

- In general, heavy trucks take the longest to access I-5 ramps and travel at the slowest average speed as shown in Figure 10-23 and Table 10-1.
- Outbound trips for all modes to access I-5 interchanges take longer compared to inbound trips from I-5 to the industrial parks

- Heavy truck travel times are relatively consistent between O-D pairs compared with all vehicles and medium trucks. Traveling to I-5 ramps at Harrison Avenue take about 13 to 15 minutes, whereas traveling to Grand Mound takes about 19 to 22 minutes

Figure 10-23: Travel Times and Speed to I-5 Ramps

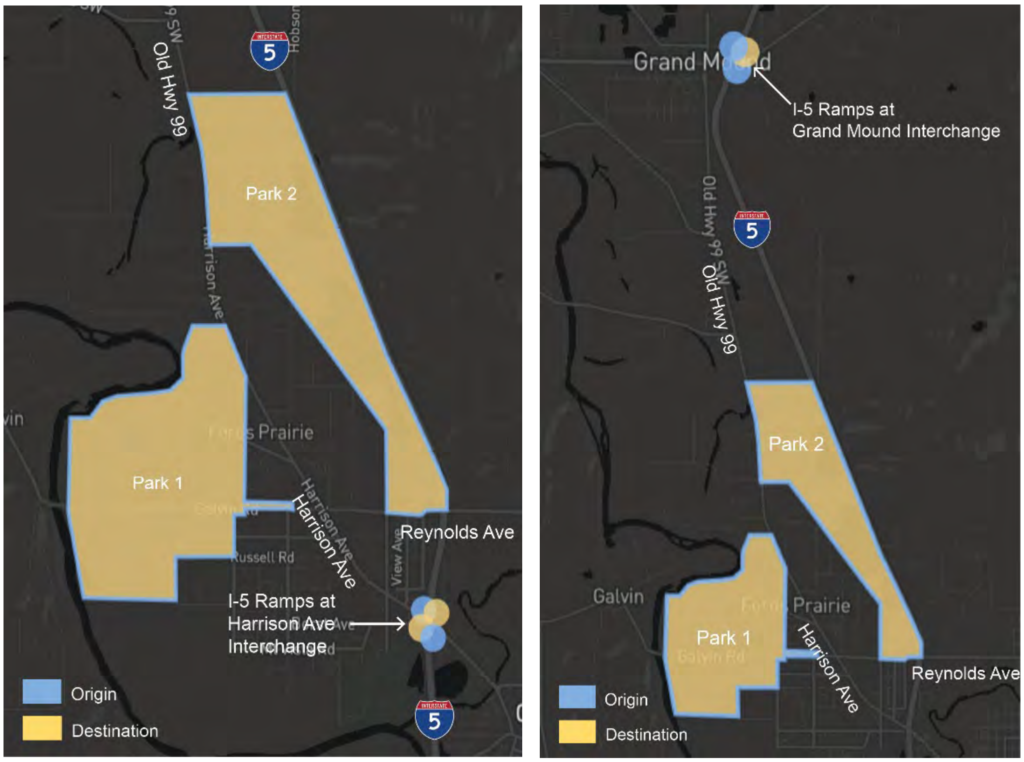


Table 10-1: Average Travel Times and Speed between Port of Centralia Industrial Parks and I-5 Ramps

Origin	Destination	Vehicle Type	Avg Travel Time (min)	Avg Speed (mph)	Sample Size - Trip Counts*
Park 1	Harrison I/C NB On	All vehicles	15.1	11	45,000
		Trucks - Medium	9.4	14	3,000
		Trucks - Heavy	15.9	10	4,000
	Harrison I/C SB On	All vehicles	12.7	10	45,000
		Trucks - Medium	7.0	18	3,000
		Trucks - Heavy	15.7	9	4,000
	Grand Mound I/C NB On	All vehicles	17.1	22	7,000
		Trucks - Medium	14.9	26	1,000
		Trucks - Heavy	19.8	20	2,000

Origin	Destination	Vehicle Type	Avg Travel Time (min)	Avg Speed (mph)	Sample Size - Trip Counts*
Park 2	Harrison I/C NB On	All vehicles	12.1	12	45,000
		Trucks - Medium	N/A	N/A	3,000
		Trucks - Heavy	N/A	N/A	4,000
	Harrison I/C SB On	All vehicles	13.4	15	45,000
		Trucks - Medium	10.3	19	3,000
		Trucks - Heavy	15.1	14	4,000
	Grand Mound I/C NB On	All vehicles	15.1	17	7,000
		Trucks - Medium	12.5	22	1,000
		Trucks - Heavy	14.2	18	2,000
Harrison I/C NB Off	Park 1	All vehicles	7.7	16	45,000
		Trucks - Medium	8.7	15	3,000
		Trucks - Heavy	13.8	11	4,000
	Park 2	All vehicles	9.3	21	45,000
		Trucks - Medium	13.2	14	3,000
		Trucks - Heavy	13.1	15	4,000
Harrison I/C SB Off	Park 1	All vehicles	7.9	16	45,000
		Trucks - Medium	6.5	18	3,000
		Trucks - Heavy	14.0	10	4,000
	Park 2	All vehicles	7.2	16	45,000
		Trucks - Medium	N/A	N/A	3,000
		Trucks - Heavy	N/A	N/A	4,000
Grand Mound I/C NB Off	Park 1	All vehicles	N/A	N/A	7,000
		Trucks - Medium	N/A	N/A	1,000
		Trucks - Heavy	N/A	N/A	2,000
	Park 2	All vehicles	9.2	27	7,000
		Trucks - Medium	N/A	N/A	1,000
		Trucks - Heavy	N/A	N/A	2,000
Grand Mound I/C SB Off	Park 1	All vehicles	11.7	30	7,000
		Trucks - Medium	12.1	28	1,000
		Trucks - Heavy	22.1	18	2,000
	Park 2	All vehicles	10.4	24	7,000
		Trucks - Medium	14.4	19	1,000
		Trucks - Heavy	15.1	18	2,000

Source: StreetLight Data
Date range: March & April 2019 and March & April 2022
Data collection times: Tuesdays-Thursdays, all day
Data is not available when sample size is too small.
*Truck (medium and heavy) trips are from vehicle GPS data, and therefore only have trip sample size and not a separate device sample size.

10.4.4 Average Travel Times and Speeds to Access Other Major Arterials

- In general, outbounds trips to state highways take slightly longer than inbound trips to industrial parks as shown in Figure 10-24 and Table 10-2
- Due to small sample sizes (less than 1,000 trips), heavy truck travel times and speed to US 12 and US 507 are not available. Many of the medium truck travel times and speed are also not available due to the same reason

Figure 10-24: Travel Times and Speed to Major Arterials

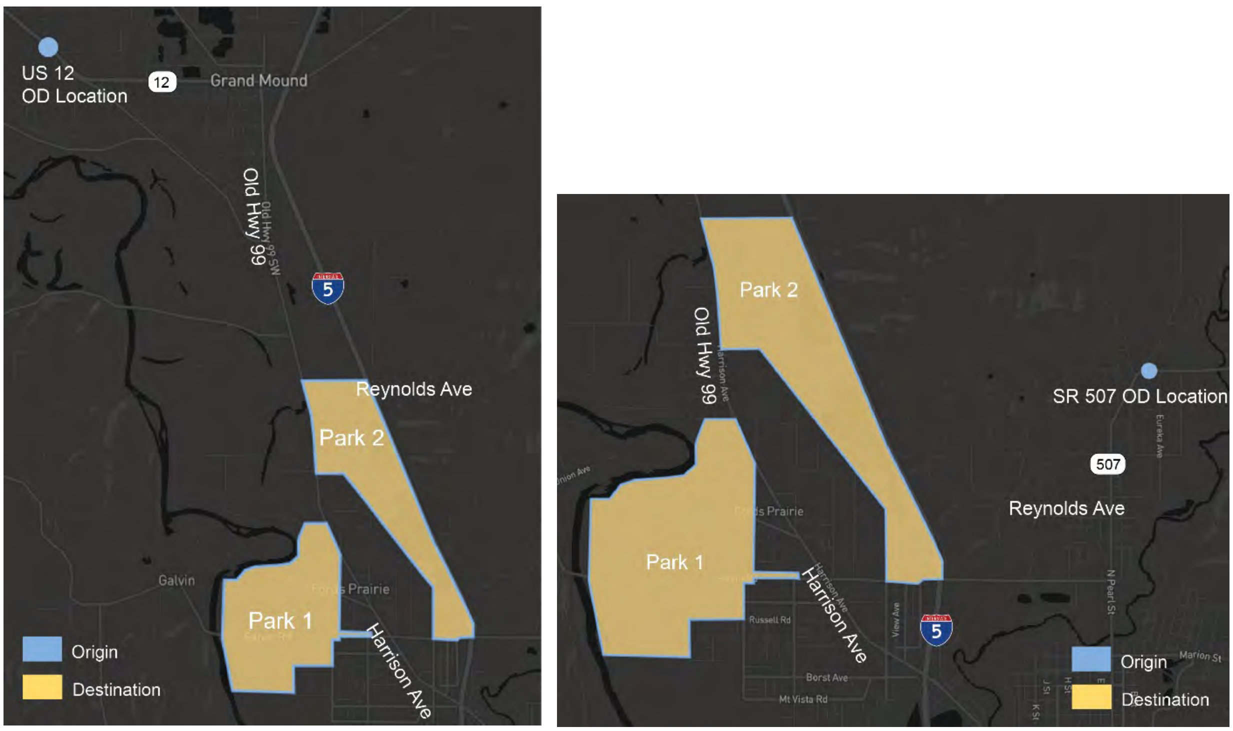


Table 10-2: Average Travel Times and Speed between Port of Centralia Industrial Parks and Major Arterials

Origin	Destination	Vehicle Type	Avg Travel Time (min)	Avg Speed (mph)	Sample Size - Trip Counts*
Park 1	US 12 NB	All vehicles	21.7	23	5000
		Trucks - Medium	13.1	32	<1,000
		Trucks - Heavy	N/A	N/A	<1,000
	SR 507 NB	All vehicles	17.7	18	3000
		Trucks - Medium	N/A	N/A	<1,000
		Trucks - Heavy	N/A	N/A	<1,000
Park 2	US 12 NB	All vehicles	16.4	23	5000
		Trucks - Medium	14.4	25	<1,000
		Trucks - Heavy	N/A	N/A	<1,000
	SR 507 NB	All vehicles	N/A	N/A	3000
		Trucks - Medium	N/A	N/A	<1,000
		Trucks - Heavy	N/A	N/A	<1,000
US 12 SB	Park 1	All vehicles	13.6	33	5000
		Trucks - Medium	N/A	N/A	<1,000
		Trucks - Heavy	N/A	N/A	<1,000
	Park 2	All vehicles	12.0	28	5000
		Trucks - Medium	17.3	24	<1,000
		Trucks - Heavy	N/A	N/A	<1,000
SR 507 SB	Park 1	All vehicles	11.8	22	3000
		Trucks - Medium	N/A	N/A	<1,000
		Trucks - Heavy	N/A	N/A	<1,000
	Park 2	All vehicles	N/A	N/A	3000
		Trucks - Medium	N/A	N/A	<1,000
		Trucks - Heavy	N/A	N/A	<1,000

Source: StreetLight Data
Date range: March & April 2019 and March & April 2022
Data collection times: Tuesdays – Thursdays, all day
Data is not available when sample size is too small.
*Truck (medium and heavy) trips are from vehicle GPS data, and therefore only have trip sample size and not a separate device sample size.

10.5 Bicycle and Pedestrian Travel Patterns

This section focuses on key destinations that generate bicycle and pedestrian traffic, including three schools and two commercial areas within the study area. Due to limited availability of active transportation (bike/ped) data, only an origin and destination analysis was possible rather than a travel shed analysis showing specific road segment usage. The following analyses are divided into pedestrian and bicycle traffic and by destination. The analysis zones used are 2020 Census block groups.

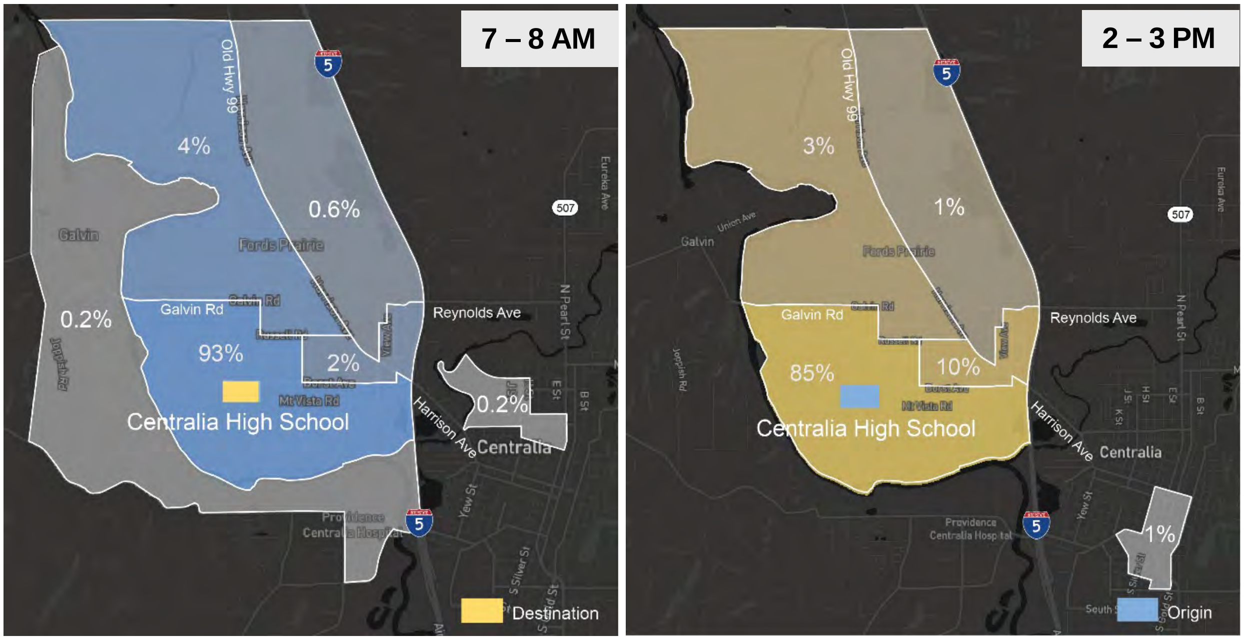
Due to the small sample size, the total volume estimates for some of the analyses are low, especially the bicycle origin-destination analyses. The pedestrian origin-destination analyses for three schools have a combined sample size of 1,000 devices tracked and 5,000 trips recorded during March and April 2019, and March and April 2022. The bicycle origin-destination analyses for three schools have a combined sample size of less than 1,000 devices tracked and 1,000 trips recorded. The pedestrian and bicycle sample sizes for the two commercial areas are 7,000 devices tracked / 12,000 trips recorded and 2,000 devices tracked / 3,000 trips recorded, respectively.

10.5.1 Bicycle and Pedestrian Travel Patterns to and from Schools

For origin-destination patterns to and from schools, the analyses are conducted for AM and PM school peaks based on current school schedules as well as peak hour identification from StreetLight's data. This analysis assumes most trips during school peak hours are to/from the schools. Based on known start and end times for nearby schools, Centralia High School, and Centralia Middle School both begin between 7 and 8 AM and end between 3 and 4 PM. Fords Prairie Elementary begins between 8 and 9 AM and ends between 2 and 3 PM.

- Most pedestrian origins and destinations are located west of Harrison Avenue and south of Reynolds Avenue (Figure 10-25).
- During both the AM and PM peak, pedestrian origins and destinations are concentrated in the census block group that Centralia High School is in; the area is mostly single family residential and includes Port of Centralia properties.
- The PM peak travel pattern is more dispersed than that of AM peak. About 10 percent of trips head to the area around the Harrison Avenue commercial areas and dense residential neighborhoods.

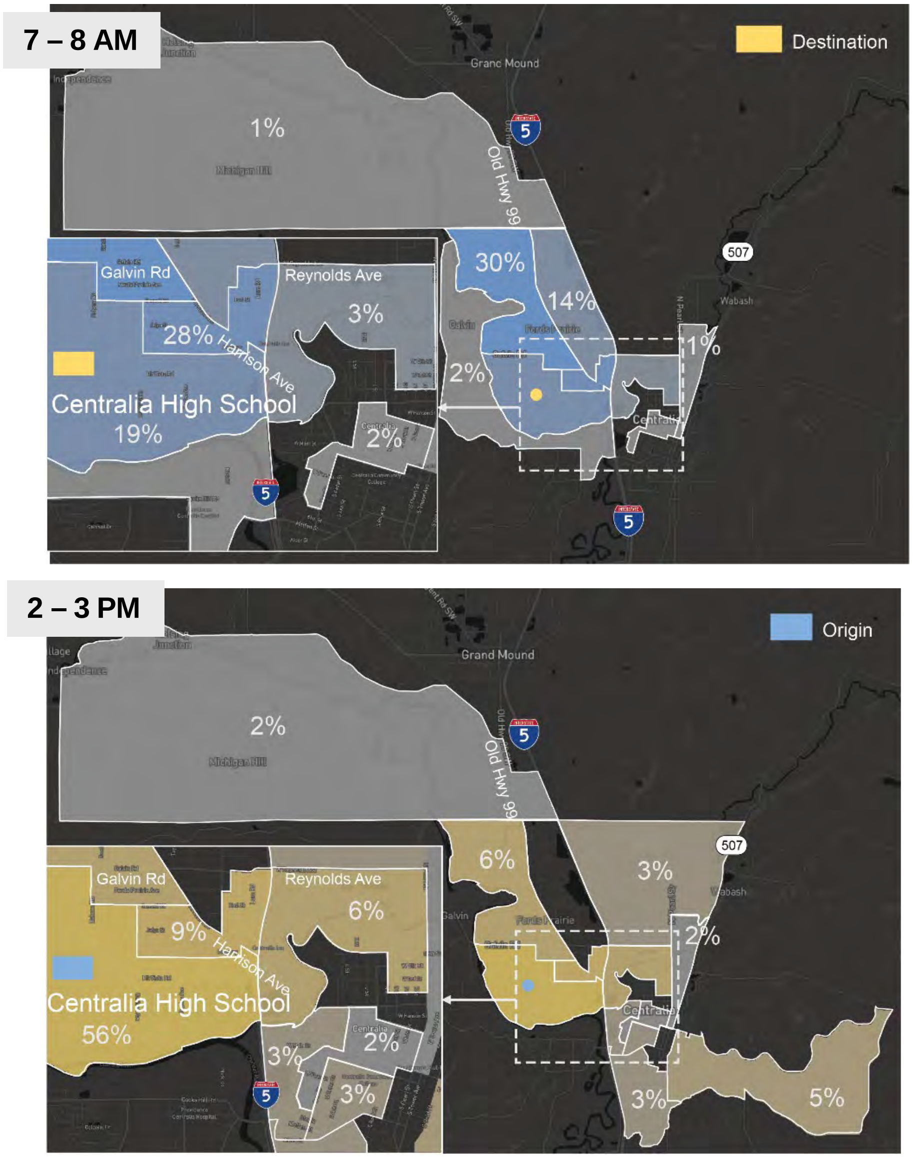
Figure 10-25: Pedestrian Origins and Destinations – Centralia High School



March & April 2019 and March & April 2022, Tuesday – Thursday, AM and PM Peak
Sample Size: Trip count – 5,000; Device count – 1,000

- Bicycle trips are in general longer in distance, so the travel shed to/from Centralia High School covers a larger area than that of pedestrian trips (Figure 10-26).
- Origin patterns and destination patterns are different. AM peak trips are more evenly distributed in all directions of the school, whereas PM peak trips are more concentrated to the southwest of the study area.
- During AM peak, bicycle trips to Centralia High School are concentrated to the west of I-5. Two census block groups with the most origin trips are directly north of the school.
- During PM peak, more than half of all bicycle trips from the school stay within the census block group where the school is located. About 24 percent of all trips cross to the east side of I-5 – much higher compared to the origin trips from east of I-5 during AM peak, which consist of about 6 percent of all trips.

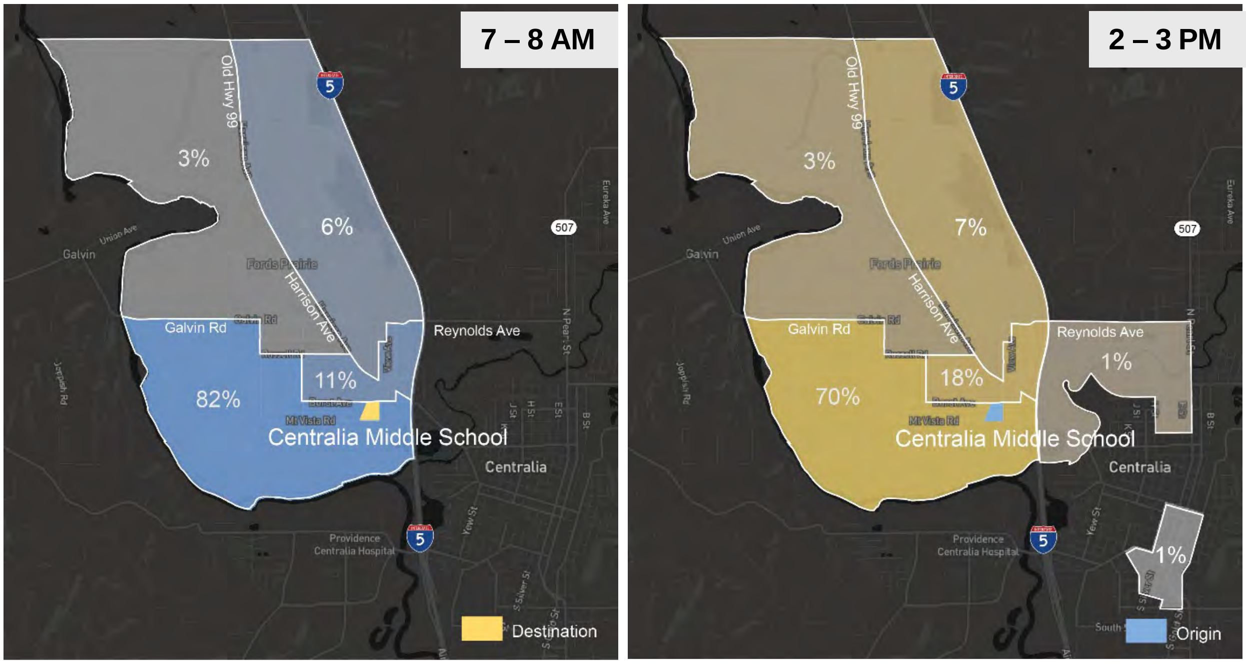
Figure 10-26: Bicycle Origins and Destinations – Centralia High School



March & April 2019 and March & April 2022, Tuesday – Thursday, AM and PM Peak
Sample Size: Trip count – 1,000; Device count – <1,000

- Most of the pedestrian trips to/from Centralia Middle School originate and terminate west of Harrison Avenue (Figure 10-27).
- For both AM and PM peak, most pedestrians come from/head to the census block group southwest of the study area, which consists of mostly single-family homes and the Port of Centralia properties.
- About 6 to 7 percent of pedestrian trips come from/head to the census block group between I-5 and Harrison Avenue north of the school. The block group has single-family homes in the south and green space and Port of Centralia properties in the north.

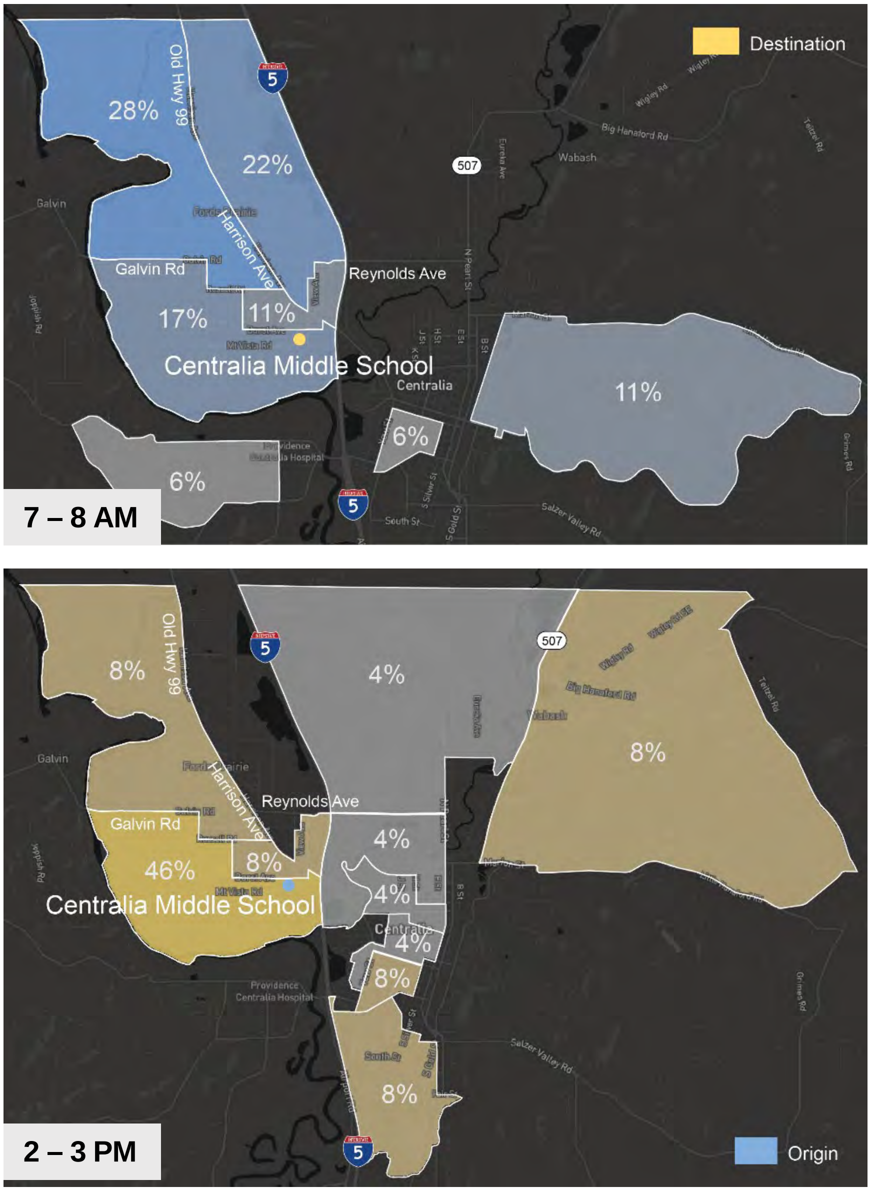
Figure 10-27: Pedestrian Origins and Destinations – Centralia Middle School



March & April 2019 and March & April 2022, Tuesday – Thursday, AM and PM Peak
Sample Size: Trip count – 5,000; Device count – 1,000

- Most origins and destinations of Centralia Middle School are located west of I-5, but some modest level of trip activity is from/to areas east of I-5, especially during PM peak (Figure 10-28).
- During AM peak, about 50 percent of the bicycle trips originate from two core census block groups north of Reynolds Avenue.
- Notably, some trips travel longer distances and cross physical barriers to the school during AM peak. 11 percent of the trips come from a large census block group east of the railroad through the east side of Centralia. 6 percent of the bicycle trips originate from a census block south of Chehalis River.
- During PM peak, the destinations are more concentrated in the census block group where the school is located, which accounts for about 46 percent of all bicycle trips.
- About 40 percent of the PM peak bicycle trips terminate east of I-5. The destinations are more dispersed on the eastside of I-5 and farther away from the school compared to trip origins during AM peak.

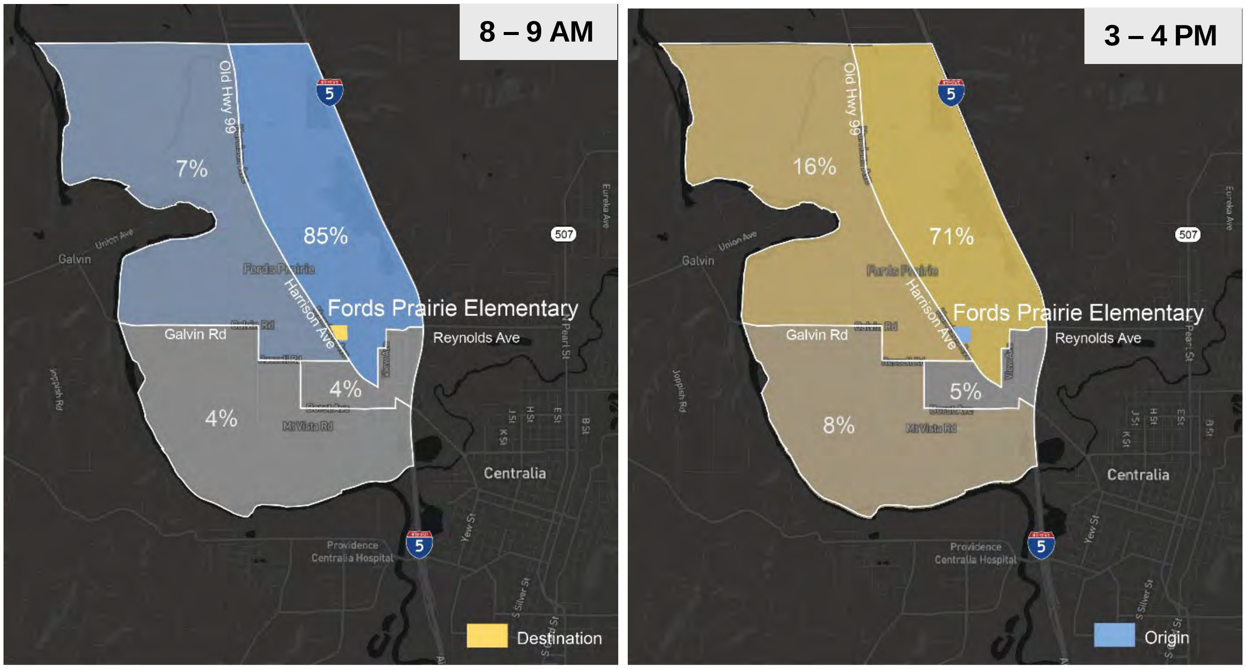
Figure 10-28: Bicycle Origins and Destinations – Centralia Middle School



March & April 2019 and March & April 2022, Tuesday – Thursday, AM and PM Peak
Sample Size: Trip count – 1,000; Device count – <1,000

- Fords Prairie Elementary is at the heavily travelled intersection of Reynolds Avenue and Harrison Avenue, which are major arterials with heavy freight traffic. Most of the pedestrian trips to/from the school are from the census block group between I-5 and Harrison Avenue north of Reynolds Avenue (Figure 10-29).
- The block group northwest to the school also generates approximately 7 percent of pedestrian trips during AM peak and 16 percent during PM peak. This specific area shows most of the residential density concentrated in the southwest sub-area near the elementary school.

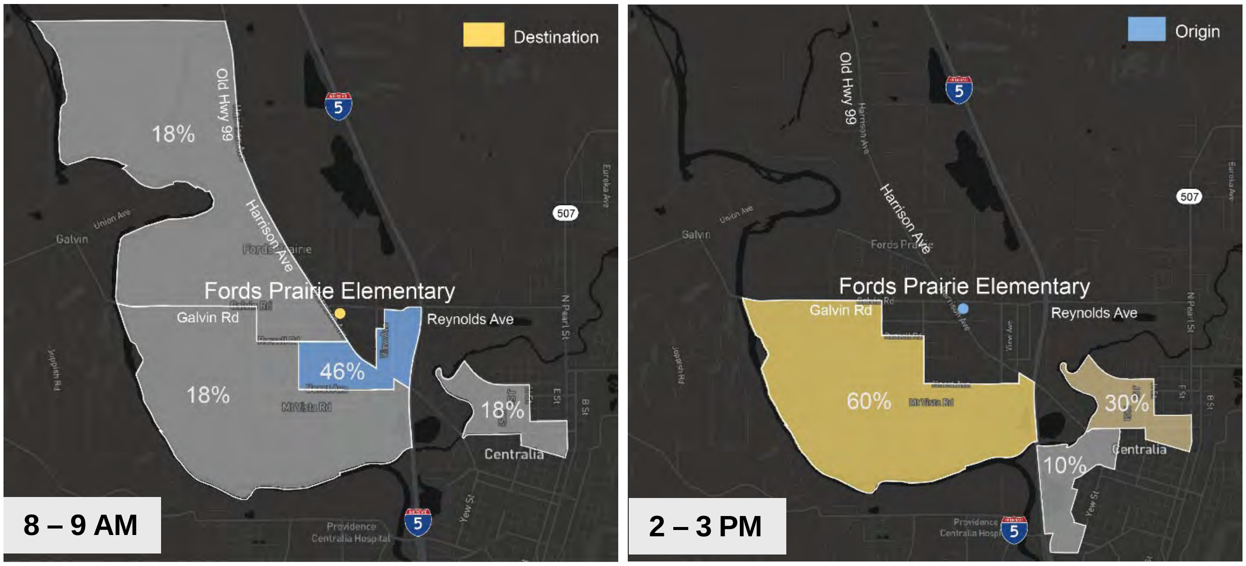
Figure 10-29: Pedestrian Origins and Destinations – Fords Prairie Elementary



March & April 2019 and March & April 2022, Tuesday – Thursday, AM and PM Peak
Sample Size: Trip count – 5,000; Device count – 1,000

- Bicycle trip patterns to/from Fords Prairie Elementary are different between AM and PM peak (Figure 10-30).
- During AM peak, about 46 percent bicycle trips come from the census block group south of the school, which includes a dense residential area. The rest of the trips are split evenly between areas northwest and southwest of the school and a residential area east of I-5.
- During PM peak, 60 percent bicycle trips terminate farther southwest in the area including many single-family homes and Port of Centralia properties. 40 percent of trips end east of I-5 just to the east of downtown Centralia.
- Notably, the estimated bicycle volume is particularly low for Fords Prairie Elementary, with only 11 origin trips between 8 and 9 AM and 10 destination trips between 2 and 3 PM. The sample size for bicycle trips is 1,000 from less than 1,000 devices, so the accuracy of the patterns may be affected.

Figure 10-30: Bicycle Origins and Destinations – Fords Prairie Elementary

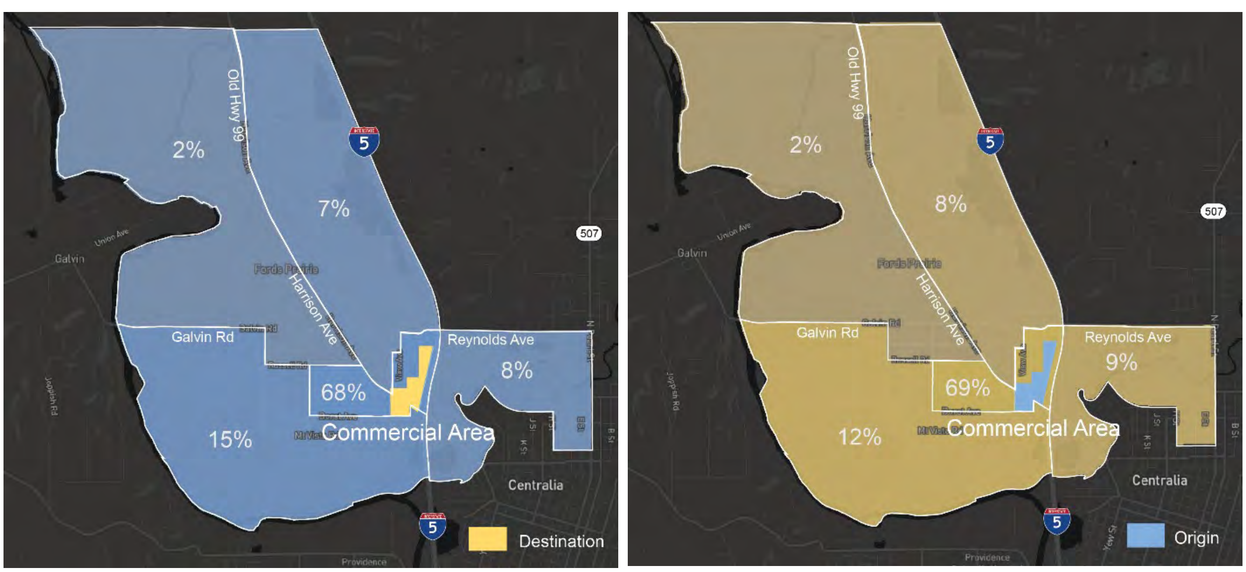


March & April 2019 and March & April 2022, Tuesday – Thursday, AM and PM Peak
Sample Size: Trip count – 1,000; Device count – <1,000

10.5.1 Bicycle and Pedestrian Travel Patterns to and from Commercial Areas

- The commercial area west of the Harrison Avenue interchange includes businesses such as outlet stores, grocery stores and restaurants. Most of the pedestrian trips are from/to the small census block group where the businesses are located (Figure 10-31).
- About 8 to 9 percent of trips are from an area directly east of I-5, which are mostly single-family homes.

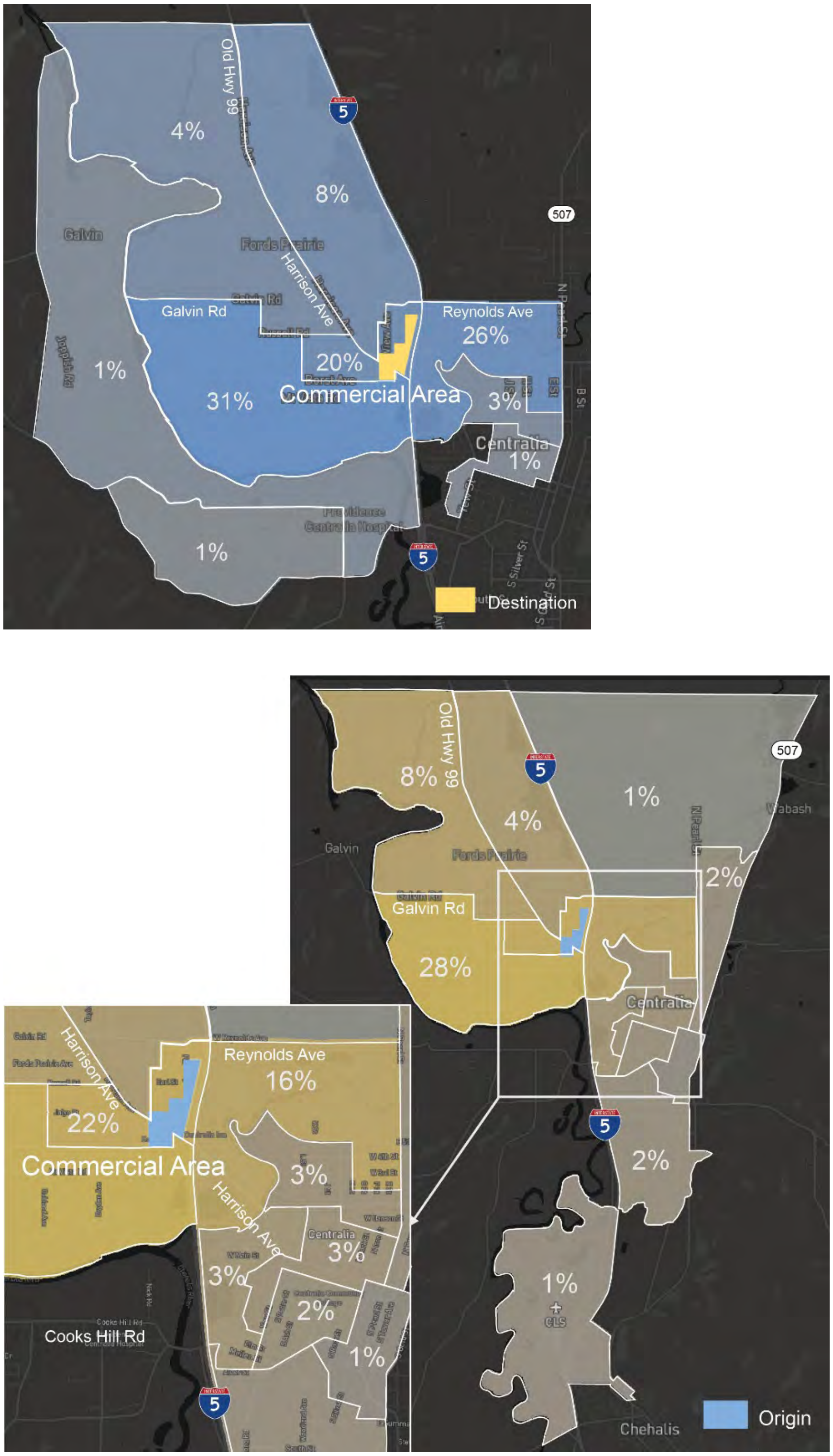
Figure 10-31: Pedestrian Origins and Destinations – Commercial Area West of I-5



March & April 2019 and March & April 2022, Tuesday – Thursday, All Day
Sample Size: Trip count – 12,000; Device count – 7,000

- Like pedestrian trip origins and destinations, most bicycle trips originate and end west of I-5. However, a higher percentage of bicycle trips cross I-5 to/from the east compared to pedestrian trips (Figure 10-32).
- About 20 percent of bicycle trips originate from the same block group where the commercial area is located. About 31 percent of trips are from the area more to the west, which includes single-family homes and the Port of Centralia properties. About 30 percent of trips are from east of I-5, most of which are from the area just south of Reynolds Avenue.
- For bicycle destinations, the trip distribution is similar near the commercial area. Trips to east of I-5 account for about 34 percent of all trips, and the destinations are more dispersed throughout Centralia compared to trip origins. A small portion of trips ends farther north and south.

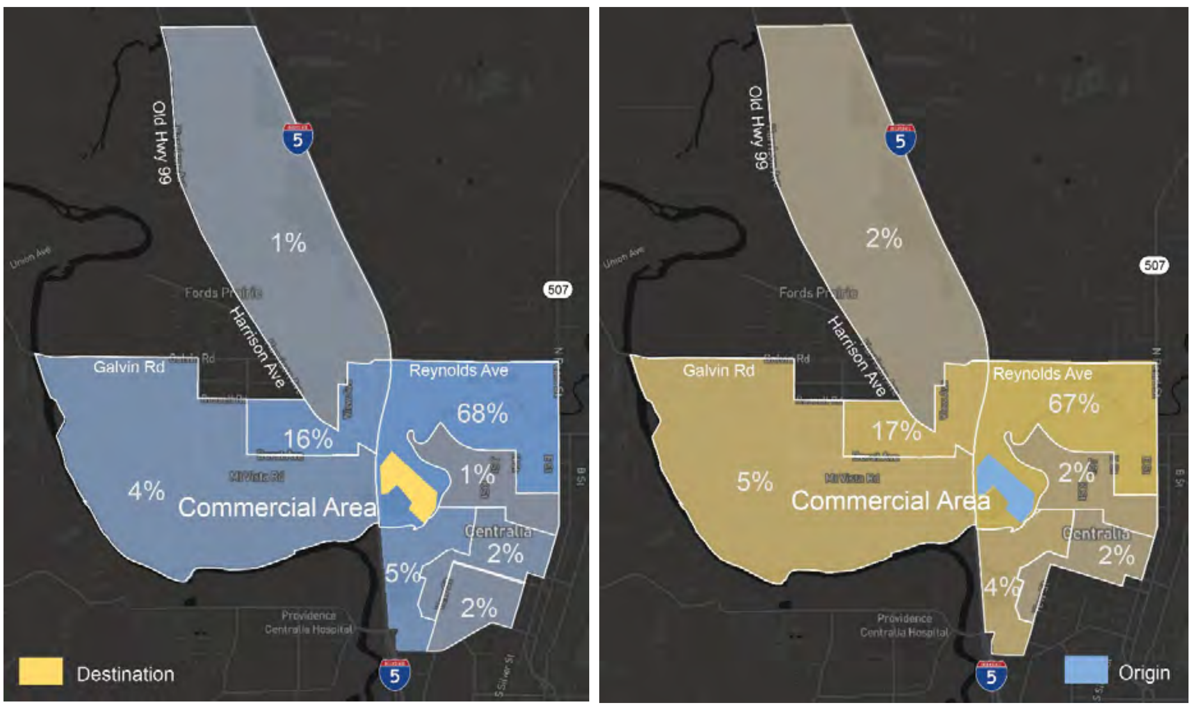
Figure 10-32: Bicycle Origins and Destinations – Commercial Area West of I-5



March & April 2019 and March & April 2022, Tuesday – Thursday, All Day
Sample Size: Trip count – 3,000; Device count – 2,000

- The commercial area east of the Harrison Avenue interchange includes businesses such as the Nike Clearance Store, Centralia Goodwill, and restaurants (Figure 10-33).
- The origin and destination patterns of the pedestrian trips are very similar.
- 67 to 68 percent of the pedestrian trips are from/to the census block group north of the commercial area.
- About 16 to 17 percent of trips are from the area west of I-5, most of which are single-family homes and big-box stores.

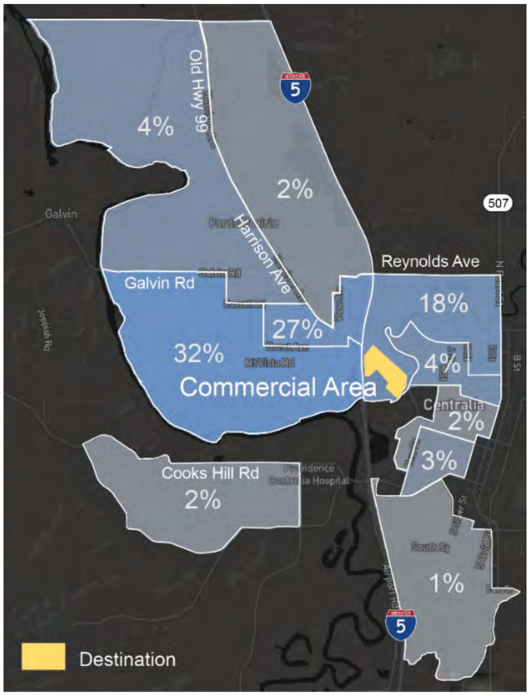
Figure 10-33: Pedestrian Origins and Destinations – Commercial Area East of I-5

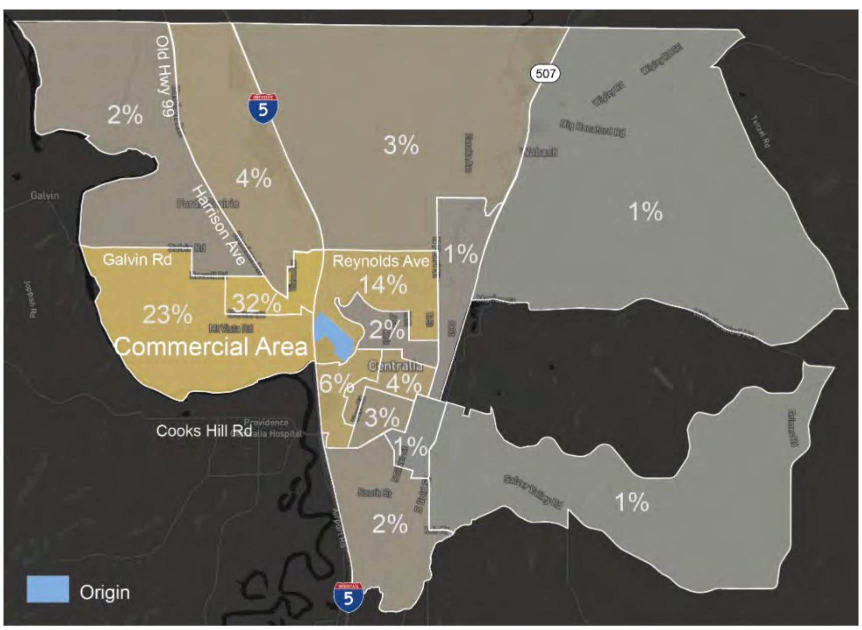


March & April 2019 and March & April 2022, Tuesday – Thursday, All Day
Sample Size: Trip count – 12,000; Device count – 7,000

- Bicycle trips to/from the commercial area are concentrated in the census block groups nearby on both sides of I-5, south of Reynolds Avenue (Figure 10-34).
- Trip destinations extend to two census block groups east of SR 507, although the percentages are only around 1 percent.

Figure 10-34: Bicycle Origins and Destinations – Commercial Area East of I-5





March & April 2019 and March & April 2022, Tuesday – Thursday, All Day
Sample Size: Trip count – 3,000; Device count – 2,000

11 EXISTING INTERSECTION OPERATIONS

11.1 Transportation Inventory and Geometrics

For traffic analysis purposes, the study area within the North Lewis County Industrial Area is bound by Old Highway 99/US 12 to the north and Harrison Avenue/I-5 to the south with key industrial access points captured along Old Highway 99, Harrison Avenue and Reynolds Avenue. Critical roadways represented in the study area are listed and defined in Table 11-1 below.

Table 11-1: Study Area Key Roadway Characteristics

Roadway	Jurisdiction	Federal Functional Classification	Freight and Goods Transportation System	Speed Limit (mph)
I-5	WSDOT	Interstate	T-1	60/70
US 12/Old Highway 99 (I-5 to Elderberry Street)	WSDOT	Freeway/Expressway	T-2	40
Elderberry Street	Grand Mound	Major Collector	T-3	35
Old Highway 99 (US 12 to south city limit)	Thurston County	Major Collector	T-2	40
Harrison Avenue (I-5 to Yew St)	Centralia	Principal Arterial	T-2	30
Harrison Avenue (I-5 to north city limit)	Centralia	Minor Arterial	T-2	30
Reynolds Avenue	Centralia	Minor Arterial	T-3	35
Johnson Road	Centralia	Major Collector	T-3	25
Belmont Avenue	Centralia	Local Roadways	NA	20

Notes:
1. FGTS T-1 stands for over 10 million gross tons annually; T-2 stands for 4 to 10 million gross tons annually; T-3 stands for 300,000 to 4 million gross tons annually.
2. Source: Lewis County Comprehensive Plan; City of Centralia Comprehensive Plan Transportation Element Update; Thurston County Comprehensive Plan; Washington State Freight and Goods Transportation System.

To assess traffic impacts associated with background growth and potential future alternatives, 16 intersections within the study area were identified and evaluated. These intersections include most of the study locations evaluated for the Safety Analysis, in addition to several others. The analysis study intersections are shown in Table 11-2.

Table 11-2: Traffic Analysis Study Intersections

ID	Intersection	Intersection Control	Jurisdiction	Mobility Standard (LOS)
1	Elderberry St SW & Old Hwy 99 SW/US 12	Signal	WSDOT/Thurston County	D
2	I-5 SB Ramps & Old Hwy 99	Signal	WSDOT	D
3	I-5 NB Ramps & Old Hwy 99	Signal	WSDOT	D
4	Old Hwy 99 SW & 216th Ave SW	TWSC	Thurston County	C
5	Old Hwy 99 SW & Prather Rd SW	TWSC	Thurston County	C
6	Harrison Ave & Goodrich Rd/Kuper Rd	TWSC	Lewis County	D
7	Harrison Ave & Foron Rd	TWSC	Lewis County	D
8	Harrison Ave & Galvin Rd/W Reynolds Ave	Signal	Centralia	D
9	Johnson Rd & W Reynolds Ave	TWSC	Centralia	D
10	Lum Rd & W Reynolds Ave	TWSC	Centralia	D
11	Industrial Dr & W Reynolds Ave	TWSC	Centralia	D
12	N Pearl St (SR 507) & W Reynolds Ave	Signal	Lewis County/Centralia	D
13	Johnson Rd & Harrison Ave	Signal	Centralia	D
14	Belmont Ave & Harrison Ave	Signal	Centralia	D
15	I-5 SB Ramps & Harrison Ave	Signal	WSDOT/Centralia	D
16	I-5 NB Ramps & Harrison Ave	Signal	WSDOT/Centralia	D

1. TWSC: Two-way stop control intersection
2. Old Hwy 99 SW & 216th Ave SW and Old Hwy 99 SW & Prather Rd SW intersections are within Rural Strategy Corridor. The intersections may exceed adopted LOS standard per Thurston County Comprehensive Plan 2019 Update.

11.2 Traffic Operations Analysis

Synchro 11 traffic analysis software was used to analyze all study intersections for both the AM and PM peak hours. A morning peak hour of 7:15-8:15 AM and an afternoon peak of 4:00-5:00 PM were identified from the existing traffic count data as the peak periods to be analyzed in Synchro.

The existing inputs for the Synchro model were created using traffic count data collected at the intersections in May and July 2022. A full summary of volumes and intersection geometry (channelization) can be found in Appendix A.4. Due to the timing of data collection activities, in 2022 when schools were not in session, comparisons of the collected count data to previous volumes compiled from 2017 and 2019 were made to adjust volumes slightly upward and account for school-related demand (mainly inbound in the morning). The key corridors targeted for these volume adjustments were Harrison Avenue and Galvin Road. Signal timing and phasing data were provided by WSDOT and Lewis County, except for the Harrison Avenue & Galvin Road / West Reynolds Avenue intersection, which used optimized signal cycle and phase split times due to lack of signal timing availability.

Key measures of effectiveness (MOE) collected from the Synchro analysis include average intersection delay, level of service (LOS), volume to capacity (v/c) ratio and 95th percentile queue length.

11.2.1 Intersection Capacity Results

Under 2022 existing conditions, all study intersections in either the AM or PM peak hours meet jurisdictional mobility standards (LOS D as described previously). Table 11-3 and Table 11-4 summarize the intersection operations for existing conditions. A full version of intersection delay and LOS by lane group can be found in Appendix A.5.

Table 11-3: Intersection Operations Summary: 2022 Existing Conditions – AM Peak

ID	Intersection	Intersection Control	Mobility Standard	Average Vehicle Delay (sec/veh)	LOS	V/C Ratio/Worst Movement
1	Elderberry St SW & Old Hwy 99 SW/US 12	Signal	D	38.2	D	0.67
2	I-5 SB Ramps & Old Hwy 99	Signal	D	15.4	B	0.43
3	I-5 NB Ramps & Old Hwy 99	Signal	D	31.7	C	0.68
4	Old Hwy 99 SW & 216th Ave SW	TWSC	D	11.2	B	0.02 (WB)
5	Old Hwy 99 SW & Prather Rd SW	TWSC	D	12.4	B	0.06 (EB)
6	Harrison Ave & Goodrich Rd/Kuper Rd	TWSC	D	15.0	B	0.04 (WBL)
7	Harrison Ave & Foron Rd	TWSC	D	12.1	B	0.04 (WB)
8	Harrison Ave & Galvin Rd/W Reynolds Ave	Signal	D	20.7	C	0.52
9	Johnson Rd & W Reynolds Ave	TWSC	D	15.9	C	0.09 (SB)
10	Lum Rd & W Reynolds Ave	TWSC	D	15.8	C	0.05 (NBL)
11	Industrial Dr & W Reynolds Ave	TWSC	D	10.7	B	0.01 (SB)
12	N Pearl St (SR 507) & W Reynolds Ave	Signal	D	13.6	B	0.51
13	Johnson Rd & Harrison Ave	Signal	D	23.0	C	0.54
14	Belmont Ave & Harrison Ave	Signal	D	17.4	B	0.55
15	I-5 SB Ramps & Harrison Ave	Signal	D	15.3	B	0.59
16	I-5 NB Ramps & Harrison Ave	Signal	D	20.6	C	0.43

Notes:
1. Delay, level-of-service and intersection v/c measures were obtained from Highway Capacity Manual (HCM) 2000.
2. For two-way stop control (TWSC) intersections, the worst movements were reported and the delay and v/c for the worst movements was used to report the intersection delay and LOS.

Table 11-4: Intersection Operations Summary: 2022 Existing Conditions – PM Peak

ID	Intersection	Intersection Control	Mobility Standard	Average Vehicle Delay (sec/veh)	LOS	V/C Ratio/Worst Movement
1	Elderberry St SW & Old Hwy 99 SW/US 12	Signal	D	50.3	D	0.68
2	I-5 SB Ramps & Old Hwy 99	Signal	D	30.7	C	0.44
3	I-5 NB Ramps & Old Hwy 99	Signal	D	27.5	C	0.63
4	Old Hwy 99 SW & 216th Ave SW	TWSC	D	11.0	B	0.01 (WB)
5	Old Hwy 99 SW & Prather Rd SW	TWSC	D	13.8	B	0.07 (EB)
6	Harrison Ave & Goodrich Rd/Kuper Rd	TWSC	D	20.6	C	0.07 (WBL)
7	Harrison Ave & Foron Rd	TWSC	D	20.5	C	0.23 (WB)
8	Harrison Ave & Galvin Rd/W Reynolds Ave	Signal	D	21.9	C	0.60
9	Johnson Rd & W Reynolds Ave	TWSC	D	15.8	C	0.15 (SB)
10	Lum Rd & W Reynolds Ave	TWSC	D	19.8	C	0.06 (NBL)
11	Industrial Dr & W Reynolds Ave	TWSC	D	12.1	B	0.05 (SB)
12	N Pearl St (SR 507) & W Reynolds Ave	Signal	D	21.8	C	0.71
13	Johnson Rd & Harrison Ave	Signal	D	24.5	C	0.67
14	Belmont Ave & Harrison Ave	Signal	D	29.1	C	0.77
15	I-5 SB Ramps & Harrison Ave	Signal	D	26.2	C	0.86
16	I-5 NB Ramps & Harrison Ave	Signal	D	26.1	C	0.60

Notes:
1. Delay, level-of-service and intersection v/c measures were obtained from Highway Capacity Manual (HCM) 2000.
2. For two-way stop control (TWSC) intersections, the worst movements were reported and the delay and v/c for the worst movements was used to report the intersection delay and LOS.

11.2.1 Summary of Intersection Queueing Results

Queue lengths by intersection lane groups were determined based on Synchro 11 analysis output for the study intersections. The 95th percentile queue lengths were compared against the available upstream storage in turn pockets or between intersections for each lane group as applicable.

Table 11-5 provides a summary of key intersection movements where queueing impacts are expected. A full version of key intersection queueing by lane group can be found in Appendix A.6.

Under 2022 existing conditions, queueing impacts are shown to occur at four approaches in the AM peak hour, including the southbound approach at the Elderberry St SW & Old Highway 99 SW / US 12 intersection, the eastbound approach at the I-5 northbound ramps & Old Hwy 99 intersection, the northbound approach at the Harrison Ave & Galvin Rd / W Reynolds Ave intersection and the westbound approach at the Johnson Rd & Harrison Ave intersection.

Table 11-5: Key Intersection Movement Queueing Summary: Existing Conditions

ID	Intersection	Lane Group	Storage Length (feet)	AM Peak		PM Peak	
				95th Percentile Queue (feet)	% of Distance in 95th Percentile Queue	95th Percentile Queue (feet)	% of Distance in 95th Percentile Queue
1	Elderberry St SW & Old Hwy 99 SW/US 12	SBL	280	300	107%	375	134%
2	I-5 SB Ramps & Old Hwy 99	WBL	200	125	63%	225	113%
3	I-5 NB Ramps & Old Hwy 99	EBL	300	450	150%	375	125%
		NBL	240	175	73%	275	115%
8	Harrison Ave & Galvin Rd/W Reynolds Ave	NBL	135	150	111%	125	93%
		SBL	150	50	33%	150	100%
13	Johnson Rd & Harrison Ave	WBL	150	275	183%	275	183%
		SBLTR	320	175	55%	250	78%
14	Belmont Ave & Harrison Ave	WBTR	520	200	38%	650	125%
		SBL	185	125	68%	300	162%
		SBLTR	290	125	43%	300	103%
15	I-5 SB Ramps & Harrison Ave	EBR	275	200	73%	925	336%
16	I-5 NB Ramps & Harrison Ave	EBL	180	75	42%	150	83%

Notes:
1. Storage length rounded to nearest 10, if storage length beyond 2,500 feet, 2,500 feet used in this case.
2. 95th Percentile Queue rounded to nearest 25 feet.
3. % of Distance in 95th Percentile Queue stands for percentage of storage space utilized by vehicles in queue.
4. Orange shading represents lanes with greater than 75% queue storage utilized, and red shading represents lanes with >100% queue storage utilized.

During the PM peak hour, queueing impacts occur at both the Grand Mound interchange area and Harrison Ave interchange area. Queue spillbacks occur on the eastbound and westbound Old Highway 99 and eastbound Harrison Ave due to heavy traffic activity crossing and accessing I-5.

12 FORECASTING, FUTURE INTERSECTION OPERATIONS & SAFETY

12.1 Traffic Forecasting Results

Traffic demand forecasts for this study were provided by the Thurston Regional Planning Council (TRPC) and based on the TRPC current EMME travel demand model which applied current and projected land use. All raw traffic forecast plot volumes were post-processed along with 2022 existing turning movement volumes using National Cooperative Highway Research Program (NCHRP) 765 post-processing techniques to develop the 2045 baseline intersection turning movement volumes.

Table 12-1 provides a summary of the AM and PM peak hour traffic volumes for study intersections under existing 2022 and future 2045 forecast years. A full summary of the future year turning movement volumes and channelization are shown in Appendix A.5.

Table 12-1: Intersection Volumes: Existing vs 2045 Baseline Conditions – AM Peak & PM Peak

ID	Intersection	AM Peak			PM Peak		
		2022 Existing	2045 Baseline	Growth%	2022 Existing	2045 Baseline	Growth%
1	Elderberry St SW & Old Hwy 99 SW/US 12	1,960	2,810	43%	2,545	3,215	26%
2	I-5 SB Ramps & Old Hwy 99	1,755	2,940	68%	2,245	2,930	31%
3	I-5 NB Ramps & Old Hwy 99	1,280	2,170	70%	1,550	2,215	43%
4	Old Hwy 99 SW & 216th Ave SW	450	715	59%	810	1,045	29%
5	Old Hwy 99 SW & Prather Rd SW	465	745	60%	765	1,070	40%
6	Harrison Ave & Goodrich Rd/Kuper Rd	480	710	48%	825	1,100	33%
7	Harrison Ave & Foron Rd	520	710	37%	935	1,165	25%
8	Harrison Ave & Galvin Rd/W Reynolds Ave	990	1,330	34%	1,485	1,935	30%
9	Johnson Rd & W Reynolds Ave	470	660	40%	685	855	25%
10	Lum Rd & W Reynolds Ave	625	875	40%	930	1,130	22%
11	Industrial Dr & W Reynolds Ave	600	835	39%	890	1,085	22%
12	N Pearl St (SR 507) & W Reynolds Ave	720	1,110	54%	1,280	1,835	43%
13	Johnson Rd & Harrison Ave	1,330	1,785	34%	2,015	2,425	20%
14	Belmont Ave & Harrison Ave	1,830	2,410	32%	2,915	3,660	26%
15	I-5 SB Ramps & Harrison Ave	2,200	2,800	27%	3,595	4,445	24%
16	I-5 NB Ramps & Harrison Ave	1,885	2,315	23%	3,135	3,975	27%

12.2 Traffic Operations Analysis

The transportation network for the 2045 baseline scenarios were updated to include all proposed background projects. The following background projects were identified from Lewis County's Six-Year Transportation Improvement Program (2022-2027) and Thurston County's Six-Year Transportation Improvement Program (2023-2028) and were incorporated into the future year Synchro models.

- <u>US12/Old Highway 99/Elderberry Street SW Intersection Improvements:</u> Improve pedestrian right-of-way to decrease crossing times; implement a right-turn overlap phase for the northbound approach.
- <u>US 12 (West UGA boundary to Old Hwy 99 SW):</u> New US 12 intersection at west UGA, US 12 / Old Highway 99 / Elderberry St SW intersection improvements, additional eastbound lane, and eastbound turn lane.

All future traffic demands used for the analysis were based on the traffic forecast post-processing performed for this study. Signalized intersection signal phasing splits were optimized based on the future demand.

12.2.1 Intersection Capacity Results

Intersection operational analysis was completed using Synchro software as previously described in the discussion of existing conditions. Under 2045 baseline conditions, 14 of 16 study intersections in either the AM or PM peak hour are expected to meet jurisdictional mobility standards. The intersections that do not meet mobility standards under 2045 baseline conditions are listed below.

- #1 – Elderberry St SW & Old Highway 99 / US 12: **LOS F, PM Peak**
- #3 – I-5 northbound ramps & Old Highway 99: **LOS E, AM Peak**

Table 12-2 and Table 12-3 summarize the intersection operations for 2045 baseline conditions. A more detailed table with intersection delay and LOS by lane group can be found in Appendix A.5.

Table 12-2: Intersection Operations Summary: Existing vs 2045 Baseline Conditions – AM Peak

ID	Intersection	Intersection Control	Mobility Standard	2022 Existing AM Peak			2045 Baseline AM Peak		
				Average Vehicle Delay (sec/veh)	LOS	V/C Ratio/ Worst Movement	Average Vehicle Delay (sec/veh)	LOS	V/C Ratio/ Worst Movement
1	Elderberry St SW & Old Hwy 99 SW/US 12	Signal	D	38.2	D	0.67	52.9	D	0.91
2	I-5 SB Ramps & Old Hwy 99	Signal	D	15.4	B	0.43	28	C	0.73
3	I-5 NB Ramps & Old Hwy 99	Signal	D	31.7	C	0.68	61.8	E	0.93
4	Old Hwy 99 SW & 216th Ave SW	TWSC	D	11.2	B	0.02 (WB)	12.9	B	0.07 (WB)
5	Old Hwy 99 SW & Prather Rd SW	TWSC	D	12.4	B	0.06 (EB)	15.9	C	0.21 (EB)
6	Harrison Ave & Goodrich Rd/Kuper Rd	TWSC	D	15.0	B	0.04 (WBL)	18.3	C	0.08 (WBL)
7	Harrison Ave & Foron Rd	TWSC	D	12.1	B	0.04 (WB)	13.9	B	0.07 (WB)
8	Harrison Ave & Galvin Rd/W Reynolds Ave	Signal	D	20.7	C	0.52	29.3	C	0.64
9	Johnson Rd & W Reynolds Ave	TWSC	D	15.9	C	0.09 (SB)	19.2	C	0.12 (SB)
10	Lum Rd & W Reynolds Ave	TWSC	D	15.8	C	0.05 (NBL)	19.1	C	0.09 (NBL)
11	Industrial Dr & W Reynolds Ave	TWSC	D	10.7	B	0.01 (SB)	11.1	B	0.02 (SB)
12	N Pearl St (SR 507) & W Reynolds Ave	Signal	D	13.6	B	0.51	16.3	B	0.63
13	Johnson Rd & Harrison Ave	Signal	D	23.0	C	0.54	28.1	C	0.62
14	Belmont Ave & Harrison Ave	Signal	D	17.4	B	0.55	17.1	B	0.63
15	I-5 SB Ramps & Harrison Ave	Signal	D	15.3	B	0.59	15.9	B	0.63
16	I-5 NB Ramps & Harrison Ave	Signal	D	20.6	C	0.43	20.9	C	0.50

Notes:
1. Delay, level-of-service and intersection v/c measures were obtained from Highway Capacity Manual (HCM) 2000.
2. For two-way stop control (TWSC) intersections, the worst movements were reported and the delay and v/c for the worst movements was used to report the intersection delay and LOS.
3. Intersections do not meet mobility standard are marked in red.

Table 12-3: Intersection Operations Summary: Existing vs 2045 Baseline Conditions – PM Peak

ID	Intersection	Intersection Control	Mobility Standard	2022 Existing AM Peak			2045 Baseline AM Peak		
				Average Vehicle Delay (sec/veh)	LOS	V/C Ratio/Worst Movement	Average Vehicle Delay (sec/veh)	LOS	V/C Ratio/ Worst Movement
1	Elderberry St SW & Old Hwy 99 SW/US 12	Signal	D	50.3	D	0.68	158.9	F	0.91
2	I-5 SB Ramps & Old Hwy 99	Signal	D	30.7	C	0.44	30.9	C	0.55
3	I-5 NB Ramps & Old Hwy 99	Signal	D	27.5	C	0.63	39.9	D	0.78
4	Old Hwy 99 SW & 216th Ave SW	TWSC	D	11.0	B	0.01 (WB)	11.4	B	0.03 (WB)
5	Old Hwy 99 SW & Prather Rd SW	TWSC	D	13.8	B	0.07 (EB)	19.3	C	0.23 (EB)
6	Harrison Ave & Goodrich Rd/Kuper Rd	TWSC	D	20.6	C	0.07 (WBL)	25.9	D	0.10 (WBL)
7	Harrison Ave & Foron Rd	TWSC	D	20.5	C	0.23 (WB)	25.1	D	0.36 (WB)
8	Harrison Ave & Galvin Rd/W Reynolds Ave	Signal	D	21.9	C	0.60	38.3	D	0.70
9	Johnson Rd & W Reynolds Ave	TWSC	D	15.8	C	0.15 (SB)	17.6	C	0.17 (SB)
10	Lum Rd & W Reynolds Ave	TWSC	D	19.8	C	0.06 (NBL)	23.4	C	0.09 (NBL)
11	Industrial Dr & W Reynolds Ave	TWSC	D	12.1	B	0.05 (SB)	14.1	B	0.08 (SB)
12	N Pearl St (SR 507) & W Reynolds Ave	Signal	D	21.8	C	0.71	27.3	C	0.82
13	Johnson Rd & Harrison Ave	Signal	D	24.5	C	0.67	26.2	C	0.73
14	Belmont Ave & Harrison Ave	Signal	D	29.1	C	0.77	34.0	C	0.87
15	I-5 SB Ramps & Harrison Ave	Signal	D	26.2	C	0.86	33.8	C	0.97
16	I-5 NB Ramps & Harrison Ave	Signal	D	26.1	C	0.60	29.7	C	0.74

Notes:
1. Delay, level-of-service and intersection v/c measures were obtained from Highway Capacity Manual (HCM) 2000.
2. For two-way stop control (TWSC) intersections, the worst movements were reported and the delay and v/c for the worst movements was used to report the intersection delay and LOS.
3. Intersections do not meet mobility standard are marked in red.

12.2.2 Summary of Intersection Queuing Results

Under 2045 Baseline conditions, queue lengths are expected to be longer than 2022 existing conditions. Based on the traffic analysis results, queueing exceeds storage length at the following locations under the 2045 baseline conditions.

- 1 - Elderberry St SW & Old Hwy 99 SW/US 12: NBR (AM/PM) and SBL (AM/PM)
- 2 - I-5 SB Ramps & Old Hwy 99: WBL (AM/PM)
- 3 - I-5 NB Ramps & Old Hwy 99: EBL (AM/PM), WBTR (AM), and NBL (PM)
- 8 - Harrison Ave & Galvin Rd/W Reynolds Ave: NBL (AM/PM), SBL (PM)
- 13 - Johnson Rd & Harrison Ave: WBL (AM/PM)
- 14 - Belmont Ave & Harrison Ave: WBTR (PM), SBL (PM), SBLTR (PM)
- 15 - I-5 SB Ramps & Harrison Ave: EBR (PM)
- 16 - I-5 NB Ramps & Harrison Ave: EBL (PM)

Based on the results, it is anticipated the queueing would affect traffic flow at the Grand Mound Interchange during both the AM and PM peak hour. Extensive queueing is also expected to occur at the Harrison Ave interchange during the PM peak hour, with significant queue spillback from I-5 ramp terminal to Harrison Ave that affects traffic flow and operational access.

Table 12-4 and Table 12-5 provide a summary of key intersection movement queueing results whose queues near or exceed storage length. A full version of key intersection queueing by lane group can be found in Appendix A.6.

Additionally, a SimTraffic model was developed for future baseline conditions as a validation tool for Synchro models. Overall, SimTraffic validated Synchro's findings with SimTraffic providing slightly higher queueing results and spill-back effects. During AM peak hour, overall queue lengths are anticipated to be about the same or slightly worse (longer) compared with Synchro queueing results. During PM peak hour, overall queue lengths are estimated to be worse (longer) compared with Synchro queueing results, especially for the Harrison Avenue interchange area. SimTraffic simulations show queues backing up from the I-5 ramp terminal to Johnson Road and beyond. A full version of SimTraffic key intersection queueing by lane group can be found in Appendix A.6.

Although most intersections are anticipated to meet the LOS D mobility standard, both the Synchro queueing and SimTraffic queueing results indicate potential congestion at the Grand Mound Interchange and Harrison Avenue Interchange areas.

Table 12-4: Key Intersection Movement Queuing Summary: Existing vs 2045 Baseline Conditions – AM Peak

ID	Intersection	Lane Group	Storage Length (feet)	2022 Existing		2045 Baseline	
				95th Percentile Queue (feet)	% of Distance in 95th Percentile Queue	95th Percentile Queue (feet)	% of Distance in 95th Percentile Queue
1	Elderberry St SW & Old Hwy 99 SW/US 12	NBR	390	100	26%	550	141%
		SBL	280	300	107%	375	134%
2	I-5 SB Ramps & Old Hwy 99	WBL	200	125	63%	400	200%
3	I-5 NB Ramps & Old Hwy 99	EBL	300	450	150%	875	292%
		WBTR	310	225	73%	550	177%
		NBL	240	175	73%	225	94%
8	Harrison Ave & Galvin Rd/W Reynolds Ave	EBL	100	50	50%	50	50%
		NBL	135	150	111%	200	148%
		SBL	150	50	33%	75	50%
		SBTR	290	125	43%	150	52%
12	N Pearl St (SR 507) & W Reynolds Ave	NBL	120	25	21%	50	42%
13	Johnson Rd & Harrison Ave	EBTR	460	225	49%	350	76%
		WBL	150	275	183%	375	250%
		SBLTR	320	175	55%	300	94%
14	Belmont Ave & Harrison Ave	WBTR	520	200	38%	125	24%
		NBR	150	0	0%	0	0%
		SBL	185	125	68%	150	81%
		SBLTR	290	125	43%	150	52%
15	I-5 SB Ramps & Harrison Ave	EBR	275	200	73%	125	45%
		WBL	160	25	16%	50	31%
16	I-5 NB Ramps & Harrison Ave	EBL	180	75	42%	100	56%
		WBT	460	100	22%	125	27%
		WBR	240	50	21%	50	21%

Notes:
1. Storage length rounded to nearest 10, if storage length beyond 2,500 feet, 2,500 feet used in this case.
2. 95th Percentile Queue rounded to nearest 25 feet.
3. % of Distance in 95th Percentile Queue stands for percentage of storage space utilized by vehicles in queue.
4. Orange shading represents lanes with >75% queue storage utilized. Red shading represents lanes with >100% queue storage utilized.

Table 12-5: Key Intersection Movement Queuing Summary: Existing vs 2045 Baseline Conditions – PM Peak

ID	Intersection	Lane Group	Storage Length (feet)	2022 Existing		2045 Baseline	
				95th Percentile Queue	% of Distance in 95th Percentile Queue	95th Percentile Queue	% of Distance in 95th Percentile Queue
1	Elderberry St SW & Old Hwy 99 SW/US 12	NBR	390	100	26%	675	173%
		SBL	280	375	134%	500	179%
2	I-5 SB Ramps & Old Hwy 99	WBL	200	225	113%	325	163%
3	I-5 NB Ramps & Old Hwy 99	EBL	300	375	125%	550	183%
		WBTR	310	200	65%	300	97%
		NBL	240	275	115%	400	167%
8	Harrison Ave & Galvin Rd/W Reynolds Ave	EBL	100	50	50%	100	100%
		NBL	135	125	93%	225	167%
		SBL	150	150	100%	200	133%
		SBTR	290	200	69%	250	86%
12	N Pearl St (SR 507) & W Reynolds Ave	NBL	120	75	63%	100	83%
13	Johnson Rd & Harrison Ave	EBTR	460	275	60%	400	87%
		WBL	150	275	183%	300	200%
		SBLTR	320	250	78%	225	70%
14	Belmont Ave & Harrison Ave	WBTR	520	650	125%	650	125%
		NBR	150	75	50%	150	100%
		SBL	185	300	162%	375	203%
		SBLTR	290	300	103%	375	129%
15	I-5 SB Ramps & Harrison Ave	EBR	275	925	336%	1000	364%
		WBL	160	100	63%	150	94%
16	I-5 NB Ramps & Harrison Ave	EBL	180	150	83%	225	125%
		WBT	460	275	60%	350	76%
		WBR	240	75	31%	225	94%

Notes:
1. Storage length rounded to nearest 10, if storage length beyond 2500 feet, 2500 feet used in this case.
2. 95th Percentile Queue rounded to nearest 25 feet.
3. % of Distance in 95th Percentile Queue stands for percentage of storage space utilized by vehicles in queue.
4. Orange shading represents lanes with >75% queue storage utilized. Red shading represents lanes with >100% queue storage utilized.

12.3 Future Safety Summary

Based on the safety analysis conducted for Existing Conditions Year (2022) and Future Baseline Conditions Year (2045), the estimated predicted crash frequency has a potential safety improvement of 5.5 fatal and severe crashes and 10.5 property damage only across all the 13 intersections. Intersections with the greatest potential for improvement in predicted crash frequency between 2022 and 2045 include Old Hwy 99 and I-5 SB ramp, and Old Hwy 99 and I-5 NB ramp with an estimated 4.2 and 3.7 total crash reduction opportunity, respectively. Additionally, the intersection at Harrison Ave and Belmont Ave had a significant proportion of angle type crashes in the 5-year period that may indicate a distinct type of intersection deficiency. Further analysis of the crash data is recommended to discern crash patterns at these intersections in more detail and identify crash reduction strategies that could lower the number of observed and predicted crashes.

13 LEVEL OF TRAFFIC STRESS ASSESSMENT

The WSDOT Active Transportation Plan sets agency goals and performance metrics that apply to how facilities for bicyclists and pedestrians on state highways are designed in population centers. A new data-driven method was recently adopted by WSDOT for evaluating state right of way for active transportation use; Level of Traffic Stress (LTS).

LTS provides an objective, quantitative assessment of roadway characteristics that affect safety, mobility and access for active transportation use. LTS can be used to determine essential design characteristics of active transportation facilities, including design elements, target speed, features, dimensions and configuration of highway facilities. Bicycle Level of Traffic Stress (BLTS) provides an indication of the performance and relative comfort with respect to bicycle riders, while Pedestrian Level of Traffic Stress (PLTS) applies to people who are neither on a bicycle nor in a motor vehicle.

Basic LTS is calculated based on the posted speed of a facility, the average traffic volumes, and the cross-section characteristics. It's expressed as an integer from 1 to 4, where a lower number indicates a greater willingness for active travelers to use the facility. Basic LTS is determined by referring to tables from WSDOT Development Division Multimodal Development and Delivery Designing for Level of Traffic Stress Bulletin #2022-01.

The design goals according to WSDOT guidelines call for a Level of Traffic Stress value for both bicycles (BLTS) and pedestrian (PLTS) of 1 or 2.

Table 13-1 and Table 13-2 provide a summary of Bicycle Level of Traffic Stress and Pedestrian Level of Traffic Stress for key roadways under existing conditions.

Under existing conditions, most roadway segments have BLTS scores of 3 or 4 except Belmont Avenue from Harrison Ave to Haviland St. Highway 99 in the Grand Mound interchange area and Harrison Avenue in the Harrison Avenue interchange area scored as significant gaps in the bicycle network.

As for the pedestrian network, overall LTS conditions are generally more favorable than the bicycle network. However, the following roadway segments have PLTS scores of 3 or 4 under existing conditions.

- <u>Old Highway 99:</u> I-5 NB Ramps to Elderberry St, Ivan St SW to I-5 NB Ramps, 216th Ave SW to Prather Rd SW
- <u>Elderberry Street</u>: Old Hwy 99 to 196th Ave SW
- <u>Harrison Avenue</u>: Reynolds Ave to Johnson Rd, Foron Rd to Reynolds Ave
- <u>Reynolds Avenue</u>: Johnson Rd to Lum Rd

Table 13-1: Existing and Future Baseline Conditions BLTS Summary

Roadway	Scenario	Speed Limit (mph)	AADT[1] (veh/day)	Lanes	Bike Lane	BLTS
US 12/Old Highway 99: I-5 NB Ramps to Elderberry St	Existing	40	12,950	2 thru lanes per direction	Marked, less than 7 feet	4
	Future 2045		17,600			4
Old Highway 99: Ivan St SW to I-5 NB Ramps	Existing	40	7,600	1 thru lanes per direction	Marked, less than 7 feet	4
	Future 2045		11,300			4
Elderberry Street: Old Hwy 99 to 196th Ave SW	Existing	35	7,900	1 thru lane per direction	NA	4
	Future 2045		9,650			4
Old Highway 99: 216th Ave SW to Prather Rd SW	Existing	40	8,050	1 thru lane per direction	NA	4
	Future 2045		10,300			4
Harrison Avenue: I-5 NB Ramps to E High St	Existing	30	20,250	2 thru lanes per direction	Marked, less than 7 feet	3
	Future 2045		24,800			3
Harrison Avenue: I-5 SB Ramps to I-5 NB Ramps	Existing	30	24,350	2 thru lanes per direction	Combined use path, greater than 7 feet	3
	Future 2045		30,550			3
Harrison Avenue: Belmont Ave to I-5 SB Ramps	Existing	30	29,200	2 thru lanes per direction	Marked, less than 7 feet	3
	Future 2045		36,250			3
Harrison Avenue: Johnson Rd to Belmont Ave	Existing	30	17,800	2 thru lanes per direction	Marked, less than 7 feet	3
	Future 2045		21,800			3
Harrison Avenue: Reynolds Ave to Johnson Rd	Existing	30	1,1050	1 thru lane per direction	NA	3
	Future 2045		14,250			3
Harrison Avenue: Foron Rd to Reynolds Ave	Existing	30	9,950	1 thru lane per direction	NA	3
	Future 2045		11,900			3
Reynolds Avenue: Johnson Rd to Lum Rd	Existing	35	5,300	1 thru lane per direction	Marked, less than 7 feet	4
	Future 2045		6,800			4
Johnson Road: Harrison Ave to Earl St	Existing	25	4,000	1 thru lane per direction	NA	3
	Future 2045		4,450			3
Belmont Avenue: Harrison Ave to Haviland St	Existing	20	8,850	1 thru lane per direction	NA	2
	Future 2045	20	11,150			2

Notes:
1. AADT was estimated using PM peak hour volume multiplied by 10.
2. Source: WSDOT Development Division Multimodal Development and Delivery Designing for Level of Traffic Stress Bulletin #2022-01, BLTS and PLTS for mixed traffic (no marked bicycle lane, with or without shoulder), BLTS Criteria for Bike Lane without Separation from Traffic (paint stripe or buffer < 2 feet wide).
3. Orange shading represents roadway segments with LTS of 3, and red shading represents roadway segments with LTS of 4. Roadway segments with LTS of 3 or 4 is identified as gaps in the pedestrian and bicycle network.

Table 13-2: Existing and Future Baseline Conditions PLTS Summary

Roadway	Scenario	Speed Limit (mph)	AADT[1] (veh/day)	Lanes	Sidewalk	PLTS
US 12/Old Highway 99: I-5 NB Ramps to Elderberry St	Existing	40	12,950	2 thru lanes per direction	Sidewalk width greater than 6 feet	3
	Future 2045		17,600			3
Old Highway 99: Ivan St SW to I-5 NB Ramps	Existing	40	7,600	1 thru lanes per direction	Sidewalk width greater than 6 feet	3
	Future 2045		11,300			3
Elderberry Street: Old Hwy 99 to 196th Ave SW	Existing	35	7,900	1 thru lane per direction	Partial sidewalk, greater than 6 feet	4
	Future 2045		9,650			4
Old Highway 99: 216th Ave SW to Prather Rd SW	Existing	40	8,050	1 thru lane per direction	NA	4
	Future 2045		10,300			4
Harrison Avenue: I-5 NB Ramps to E High St	Existing	30	20,250	2 thru lanes per direction	Sidewalk width greater than 6 feet	2
	Future 2045		24,800			2
Harrison Avenue: I-5 SB Ramps to I-5 NB Ramps	Existing	30	24,350	2 thru lanes per direction	Wide sidewalk with buffer	2
	Future 2045		30,550			2
Harrison Avenue: Belmont Ave to I-5 SB Ramps	Existing	30	29,200	2 thru lanes per direction	Sidewalk width greater than 6 feet	2
	Future 2045		36,250			2
Harrison Avenue: Johnson Rd to Belmont Ave	Existing	30	17,800	2 thru lanes per direction	Sidewalk width greater than 6 feet	2
	Future 2045		21,800			2
Harrison Avenue: Reynolds Ave to Johnson Rd	Existing	30	1,1050	1 thru lane per direction	Partial sidewalk	3
	Future 2045		14,250			3
Harrison Avenue: Foron Rd to Reynolds Ave	Existing	30	9,950	1 thru lane per direction	Partial sidewalk, greater than 6 feet	3
	Future 2045		11,900			3
Reynolds Avenue: Johnson Rd to Lum Rd	Existing	35	5,300	1 thru lane per direction	NA	4
	Future 2045		6,800			4
Johnson Road: Harrison Ave to Earl St	Existing	25	4,000	1 thru lane per direction	Sidewalk width greater than 6 feet	2
	Future 2045		4,450			2
Belmont Avenue: Harrison Ave to Haviland St	Existing	20	8,850	1 thru lane per direction	Sidewalk width greater than 6 feet	2
	Future 2045	20	11,150			2

Notes:
1. AADT was estimated using PM peak hour volume multiplied by 10.
2. Source: WSDOT Development Division Multimodal Development and Delivery Designing for Level of Traffic Stress Bulletin #2022-01, BLTS and PLTS for mixed traffic (no marked bicycle lane, with or without shoulder), PLTS based on Sidewalk width.
3. Orange shading represents roadway segments with LTS of 3, and red shading represents roadway segments with LTS of 4. Roadway segments with LTS of 3 or 4 is identified as gaps in the pedestrian and bicycle network.

13.1 Summary and Findings

Based on the Synchro analysis for future baseline conditions, most of the targeted study intersections for either AM or PM peak hour are expected to meet jurisdictional mobility standard, except for Elderberry St SW & Old Hwy 99 / US 12 under PM peak hour, and I-5 NB Ramps & Old Hwy 99 under AM peak hour. Per the Synchro queueing analysis, there are several locations where anticipated queues could exceed the available storage length, especially in the Grand Mound interchange area during both peak hours. Similar findings were noted for the Harrison Avenue interchange during the PM peak hour. Additionally, a SimTraffic queueing analysis was performed to validate the Synchro findings with SimTraffic providing slightly higher queueing results and spill-back effects. In general, although most intersections are anticipated to meet the LOS D mobility standard, both the Synchro queueing and SimTraffic queueing results indicate potential congestion and traffic backups at the Grand Mound interchange and Harrison Avenue interchange areas.

WSDOT's Active Transportation Plan designates roadway segments or intersections with LTS scores of 3 or 4 as gaps within the active transportation network. Based on the active transportation existing conditions assessment, most study area roadways currently have BLTS scores of 3 or 4, except for the Belmont Avenue segment. As for Pedestrian Level of Stress, most roadways have PLTS scores of 3 or 4, except for the 4-lane Harrison Avenue segment, the Johnson Road segment and the Belmont Avenue segment. In general, most roadways within the study area currently do not meet WSDOT LTS goals for active transportation, showing significant gaps in the pedestrian and bicycle networks.

APPENDIX A.2 WSDOT CRASH DATA

OFFICER REPORTED CRASHES THAT OCCURRED *at* OR *in the vicinity of* MULTIPLE INTERSECTIONS IN CENTRALIA, LEWIS & THURSTON CO

01/01/2017 - 12/31/2021 *See 2nd tab below for road information & interchange drawings for reference*

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

JURISDICTION	COUNTY	CITY	PRIMARY TRAFFICWAY	MILEPOST	A/B	BLOCK NUMBER	INTERSECTING TRAFFICWAY	CO ONLY Intersecting County Road MP	DIST FROM REF POINT	MI or FT	COMP DIR FROM REF POINT	REFERENCE POINT NAME	SR ONLY HISTORY/ SUSPENSE	REPORT NUMBER	DATE	TIME	MOST SEVERE INJURY TYPE	# INJ	# FAT	# VEH	# PEDS	# BIKES	VEHICLE 1 TYPE	VEHICLE 2 TYPE
City Street	Lewis	Centralia	BELMONT AVE	-	-	0	HARRISON AVE	-	-	-	-	-	No	EA49017	07/20/2020	15:47	No Apparent Injury	0	0	2	0	0	Pickup,Panel Truck or Vanette under 10,000 lb	Passenger Car
City Street	Lewis	Centralia	BELMONT AVE	-	-	0	HARRISON AVE	-	-	-	-	-	No	E891364	02/08/2019	20:34	No Apparent Injury	0	0	2	0	0	Pickup,Panel Truck or Vanette under 10,000 lb	Passenger Car
City Street	Lewis	Centralia	BELMONT AVE	-	-	300	HARRISON AVE	-	-	-	-	-	No	E742877	12/03/2017	21:21	No Apparent Injury	0	0	2	0	0	Passenger Car	Passenger Car
City Street	Lewis	Centralia	BELMONT AVE	-	-	0	HARRISON AVE	-	-	-	-	-	No	E870429	12/01/2018	09:47	No Apparent Injury	0	0	2	0	0	Pickup,Panel Truck or Vanette under 10,000 lb	Passenger Car
City Street	Lewis	Centralia	BELMONT AVE	-	-	-	HARRISON AVE	-	-	-	-	-	No	EB69001	09/19/2021	12:26	Possible Injury	1	0	2	0	0	Pickup,Panel Truck or Vanette under 10,000 lb	Pickup,Panel Truck or Vanette under 10,000 lb
City Street	Lewis	Centralia	BELMONT AVE	-	-	7700	HARRISON AVE	-	-	-	-	-	No	E971059	10/08/2019	14:18	No Apparent Injury	0	0	2	0	0	Passenger Car	Pickup,Panel Truck or Vanette under 10,000 lb
City Street	Lewis	Centralia	BELMONT AVE	-	-	8900	HARRISON AVE	-	-	-	-	-	No	EB53740	07/30/2021	15:15	No Apparent Injury	0	0	2	0	0	Pickup,Panel Truck or Vanette under 10,000 lb	Pickup,Panel Truck or Vanette under 10,000 lb
City Street	Lewis	Centralia	BELMONT AVE	-	-	-	HARRISON AVE	-	-	-	-	-	No	EA59400	08/22/2020	13:08	No Apparent Injury	0	0	2	0	0	Passenger Car	Pickup,Panel Truck or Vanette under 10,000 lb
City Street	Lewis	Centralia	BELMONT AVE	-	-	9600	HARRISON AVE	-	-	-	-	-	No	E721325	10/08/2017	12:31	No Apparent Injury	0	0	2	0	0	Passenger Car	Pickup,Panel Truck or Vanette under 10,000 lb
City Street	Lewis	Centralia	BELMONT AVE	-	-	0	HARRISON AVE	-	-	-	-	-	No	E799866	05/17/2018	13:33	Possible Injury	1	0	1	1	0	Pickup,Panel Truck or Vanette under 10,000 lb	-
City Street	Lewis	Centralia	BELMONT AVE	-	-	8900	HARRISON AVE	-	-	-	-	-	No	EB09131	02/17/2021	05:20	No Apparent Injury	0	0	2	0	0	Pickup,Panel Truck or Vanette under 10,000 lb	Pickup,Panel Truck or Vanette under 10,000 lb
City Street	Lewis	Centralia	BELMONT AVE	-	-	0	HARRISON AVE	-	-	-	-	-	No	EA15090	02/13/2020	20:02	No Apparent Injury	0	0	2	0	0	Pickup,Panel Truck or Vanette under 10,000 lb	Passenger Car
City Street	Lewis	Centralia	BELMONT AVE	-	-	0	HARRISON AVE	-	-	-	-	-	No	E678576	04/21/2017	07:45	No Apparent Injury	0	0	2	0	0	Passenger Car	Pickup,Panel Truck or Vanette under 10,000 lb
City Street	Lewis	Centralia	BELMONT AVE	-	-	-	HARRISON AVE	-	-	-	-	-	No	EB75129	10/05/2021	08:04	Suspected Minor Injury	1	0	1	0	1	Pickup,Panel Truck or Vanette under 10,000 lb	-

REPORT NUMBER	JUNCTION RELATIONSHIP	WEATHER	ROADWAY SURFACE CONDITION	LIGHTING CONDITION	FIRST COLLISION TYPE / OBJECT STRUCK	VEHICLE 1 ACTION	VEHICLE 2 ACTION	VEHICLE 1 COMPASS DIRECTION FROM	VEHICLE 1 COMPASS DIRECTION TO	VEHICLE 2 COMPASS DIRECTION FROM	VEHICLE 2 COMPASS DIRECTION TO	MV DRIVER CONTRIBUTING CIRCUMSTANCE 1 (UNIT 1)	MV DRIVER CONTRIBUTING CIRCUMSTANCE 2 (UNIT 1)	MV DRIVER CONTRIBUTING CIRCUMSTANCE 3 (UNIT 1)
EA49017	At Intersection and Related	Clear or Partly Cloudy	Dry	Daylight	Entering at angle	Going Straight Ahead	Going Straight Ahead	East	West	South	North	Disregard Traffic Sign and Signals	-	-
E891364	At Intersection and Related	Snowing	Snow/Slush	Dark-Street Lights On	Entering at angle	Making Right Turn	Going Straight Ahead	West	South	North	South	Did Not Grant RW to Vehicle	-	-
E742877	At Intersection and Related	Clear or Partly Cloudy	Wet	Dark-Street Lights On	Entering at angle	Making Right Turn	Going Straight Ahead	North	West	East	West	Disregard Stop and Go Light	-	-
E870429	At Intersection and Related	Clear or Partly Cloudy	Standing Water	Daylight	Same direction -- both turning left -- both moving -- sideswipe	Making Left Turn	Making Left Turn	North	East	North	East	Improper Turn/Merge	-	-
EB69001	At Intersection and Related	Overcast	Wet	Daylight	Same direction -- both turning left -- both moving -- sideswipe	Making Left Turn	Making Left Turn	North	East	North	East	None	-	-
E971059	At Intersection and Related	Clear or Partly Cloudy	Dry	Daylight	Entering at angle	Making Right Turn	Going Straight Ahead	East	North	South	North	Inattention	Did Not Grant RW to Vehicle	-
EB53740	At Intersection and Related	Clear	Dry	Daylight	From same direction - both going straight - both moving - sideswipe	Merging (Entering Traffic)	Going Straight Ahead	South	North	South	North	Did Not Grant RW to Vehicle	-	-
EA59400	At Intersection and Related	Overcast	Dry	Daylight	Same direction -- both turning left -- both moving -- sideswipe	Making Left Turn	Making Left Turn	North	East	North	East	Improper Turn/Merge	-	-
E721325	At Intersection and Related	Clear or Partly Cloudy	Dry	Daylight	Entering at angle	Making Right Turn	Going Straight Ahead	East	North	South	North	Did Not Grant RW to Vehicle	-	-
E799866	At Intersection and Related	Clear or Partly Cloudy	Dry	Daylight	Vehicle turning right hits pedestrian	Making Right Turn	-	South	East	-	-	None	-	-
EB09131	At Intersection and Related	Clear	Wet	Dark-Street Lights On	Entering at angle	Making Right Turn	Going Straight Ahead	East	North	South	North	Did Not Grant RW to Vehicle	-	-
EA15090	At Intersection and Related	Overcast	Wet	Dark-Street Lights On	From same direction - one left turn - one straight	Going Straight Ahead	Making Left Turn	North	South	South	West	Other Distractions	-	-
E678576	At Intersection and Related	Clear or Partly Cloudy	Dry	Daylight	Entering at angle	Making Left Turn	Going Straight Ahead	West	East	East	West	Inattention	-	-
EB75129	At Intersection and Related	Overcast	Wet	Daylight	Vehicle Strikes Pedalcyclist	Making Right Turn	-	South	East	-	-	None	-	-

REPORT NUMBER	MV DRIVER CONTRIBUTING CIRCUMSTANCE 1 (UNIT 2)	MV DRIVER CONTRIBUTING CIRCUMSTANCE 2 (UNIT 2)	MV DRIVER CONTRIBUTING CIRCUMSTANCE 3 (UNIT 2)	BICYCLIST CONTRIBUTING CIRCUMSTANCE 1 (UNIT 1)	BICYCLIST CONTRIBUTING CIRCUMSTANCE 2 (UNIT 1)	BICYCLIST CONTRIBUTING CIRCUMSTANCE 3 (UNIT 1)	BICYCLIST CONTRIBUTING CIRCUMSTANCE 1 (UNIT 2)	BICYCLIST CONTRIBUTING CIRCUMSTANCE 2 (UNIT 2)	BICYCLIST CONTRIBUTING CIRCUMSTANCE 3 (UNIT 2)	PEDESTRIAN CONTRIBUTING CIRCUMSTANCE 1 (UNIT 2)	PEDESTRIAN CONTRIBUTING CIRCUMSTANCE 2 (UNIT 2)	PEDESTRIAN CONTRIBUTING CIRCUMSTANCE 3 (UNIT 2)	FIRST IMPACT LOCATION (City, County & Misc Trafficways - 2010 forward)	WA STATE PLANE SOUTH - X 2010 - FORWARD	WA STATE PLANE SOUTH - Y 2010 - FORWARD
EA49017	None	-	-	-	-	-	-	-	-	-	-	-	Lane of Primary Trafficway	1018674.55	518493.06
E891364	None	-	-	-	-	-	-	-	-	-	-	-	Lane of Primary Trafficway	1018690.83	518520.58
E742877	None	-	-	-	-	-	-	-	-	-	-	-	Lane of Primary Trafficway	1018697.82	518532.38
E870429	None	-	-	-	-	-	-	-	-	-	-	-	Lane of Primary Trafficway	1018674.55	518493.04
EB69001	None	-	-	-	-	-	-	-	-	-	-	-	Lane of Primary Trafficway	1018652.51	518506.17
E971059	None	-	-	-	-	-	-	-	-	-	-	-	Lane of Primary Trafficway	1018737.22	518585.59
EB53740	None	-	-	-	-	-	-	-	-	-	-	-	Lane of Primary Trafficway	1018721.2	518607.41
EA59400	None	-	-	-	-	-	-	-	-	-	-	-	Lane of Primary Trafficway	1018690.83	518520.6
E721325	None	-	-	-	-	-	-	-	-	-	-	-	Lane of Primary Trafficway	1018739.63	518605.48
E799866	-	-	-	-	-	-	-	-	-	None	-	-	Lane of Primary Trafficway	1018824.21	518391.72
EB09131	None	-	-	-	-	-	-	-	-	-	-	-	Lane of Primary Trafficway	1018721.42	518608.29
EA15090	None	-	-	-	-	-	-	-	-	-	-	-	Lane of Primary Trafficway	1018674.55	518493.06
E678576	None	-	-	-	-	-	-	-	-	-	-	-	Lane of Primary Trafficway	1018674.55	518493.04
EB75129	-	-	-	-	-	-	Did Not Grant RW to Vehicle	-	-	-	-	-	Lane of Primary Trafficway	1018823.93	518392.41

OFFICER REPORTED CRASHES THAT OCCURRED *at* OR *in the vicinity of* MULTIPLE INTERSECTIONS IN CENTRALIA, LEWIS & THURSTON CO

01/01/2017 - 12/31/2021 *See 2nd tab below for road information & interchange drawings for reference*

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

JURISDICTION	COUNTY	CITY	PRIMARY TRAFFICWAY	MILEPOST	A/B	BLOCK NUMBER	INTERSECTING TRAFFICWAY	CO ONLY Intersecting County Road MP	DIST FROM REF POINT	MI or FT	COMP DIR FROM REF POINT	REFERENCE POINT NAME	SR ONLY HISTORY/ SUSPENSE	REPORT NUMBER	DATE	TIME	MOST SEVERE INJURY TYPE	# INJ	# FAT	# VEH	# PEDS	# BIKES
State Route	Lewis	Centralia	005LX08273	0.06	-	-	-	-	-	-	-	-	No	EB09423	01/24/2021	15:38	Possible Injury	2	0	2	0	0
State Route	Lewis	Centralia	005LX08273	0.06	-	-	-	-	-	-	-	-	No	EB97762	11/19/2021	17:08	No Apparent Injury	0	0	2	0	0
State Route	Lewis	Centralia	005LX08273	0.06	-	-	-	-	-	-	-	-	No	E870918	12/10/2018	06:22	No Apparent Injury	0	0	2	0	0
State Route	Lewis	Centralia	005LX08273	0.06	-	-	-	-	-	-	-	-	No	E708965	09/05/2017	14:50	No Apparent Injury	0	0	2	0	0
State Route	Lewis	Centralia	005LX08273	0.06	-	-	-	-	-	-	-	-	No	EB57820	09/09/2020	20:54	No Apparent Injury	0	0	2	0	0
State Route	Lewis	Centralia	005LX08273	0.06	-	-	-	-	-	-	-	-	No	E923175	05/17/2019	00:50	No Apparent Injury	0	0	1	0	0
State Route	Lewis	Centralia	005LX08273	0.06	-	-	-	-	-	-	-	-	No	EA74759	10/23/2020	19:51	No Apparent Injury	0	0	2	0	0
State Route	Lewis	Centralia	005LX08273	0.06	-	-	-	-	-	-	-	-	No	EA52788	07/31/2020	06:08	No Apparent Injury	0	0	2	0	0
State Route	Lewis	Centralia	005LX08273	0.06	-	-	-	-	-	-	-	-	No	EB10452	02/26/2021	14:14	No Apparent Injury	0	0	2	0	0
State Route	Lewis	Centralia	005LX08273	0.06	-	-	-	-	-	-	-	-	No	E919861	05/12/2019	19:55	No Apparent Injury	0	0	2	0	0
State Route	Lewis	Centralia	005LX08273	0.06	-	-	-	-	-	-	-	-	No	EB99685	12/11/2021	18:00	Suspected Minor Injury	1	0	1	1	0
State Route	Lewis	Centralia	005LX08273	0.06	-	-	-	-	-	-	-	-	No	E769439	02/13/2018	16:43	Possible Injury	1	0	2	0	0
State Route	Lewis	Centralia	005LX08273	0.06	-	-	-	-	-	-	-	-	No	E887933	01/30/2019	08:43	No Apparent Injury	0	0	2	0	0
State Route	Lewis	Centralia	005LX08273	0.06	-	-	-	-	-	-	-	-	No	E722030	10/12/2017	09:06	Possible Injury	1	0	2	0	0
State Route	Lewis	Centralia	005LX08273	0.06	-	-	-	-	-	-	-	-	No	E784349	03/31/2018	12:55	No Apparent Injury	0	0	2	0	0
State Route	Lewis	Centralia	005LX08273	0.06	-	-	-	-	-	-	-	-	No	E999252	12/31/2019	22:01	No Apparent Injury	0	0	2	0	0

REPORT NUMBER	VEHICLE 1 TYPE	VEHICLE 2 TYPE	JUNCTION RELATIONSHIP	WEATHER	ROADWAY SURFACE CONDITION	LIGHTING CONDITION	FIRST COLLISION TYPE / OBJECT STRUCK	VEHICLE 1 ACTION	VEHICLE 2 ACTION	VEHICLE 1 COMPASS DIRECTION FROM	VEHICLE 1 COMPASS DIRECTION TO	VEHICLE 2 COMPASS DIRECTION FROM	VEHICLE 2 COMPASS DIRECTION TO
EB09423	Passenger Car	Pickup,Panel Truck or Vanette under 10,000 lb	At Intersection and Related	Raining	Wet	Daylight	From opposite direction - one left turn - one straight	Going Straight Ahead	Making Left Turn	West	East	East	South
EB97762	Passenger Car	Pickup,Panel Truck or Vanette under 10,000 lb	At Intersection and Related	Clear or Partly Cloudy	Dry	Dark-Street Lights On	From same direction - both going straight - one stopped - rear-end	Going Straight Ahead	Stopped at Signal or Stop Sign	West	South	Vehicle Stopped	Vehicle Stopped
E870918	Pickup,Panel Truck or Vanette under 10,000 lb	Passenger Car	At Intersection and Related	Raining	Wet	Dark-Street Lights On	Entering at angle	Going Straight Ahead	Going Straight Ahead	East	West	North	South
E708965	Passenger Car	Pickup,Panel Truck or Vanette under 10,000 lb	At Intersection and Related	Clear or Partly Cloudy	Dry	Daylight	From same direction - both going straight - one stopped - rear-end	Going Straight Ahead	Stopped at Signal or Stop Sign	East	West	Vehicle Stopped	Vehicle Stopped
EB57820	Passenger Car	Passenger Car	At Intersection and Related	Clear	Dry	Dark-Street Lights On	Entering at angle	Going Straight Ahead	Going Straight Ahead	Southeast	Northwest	North	South
E923175	Passenger Car	-	At Intersection and Related	Clear or Partly Cloudy	Dry	Dark-Street Lights On	Concrete Barrier/Jersey Barrier - Face	Making Left Turn	-	West	East	-	-
EA74759	Pickup,Panel Truck or Vanette under 10,000 lb	Passenger Car	At Intersection and Related	Raining	Wet	Dark-Street Lights On	Same direction -- both turning left -- both moving -- sideswipe	Making Left Turn	Making Left Turn	North	East	North	East
EA52788	Passenger Car	Pickup,Panel Truck or Vanette under 10,000 lb	At Intersection and Related	Clear	Dry	Dawn	From same direction - both going straight - one stopped - rear-end	Going Straight Ahead	Stopped at Signal or Stop Sign	West	East	Vehicle Stopped	Vehicle Stopped
EB10452	Pickup,Panel Truck or Vanette under 10,000 lb	Pickup,Panel Truck or Vanette under 10,000 lb	At Intersection and Related	Raining	Wet	Daylight	From same direction - both going straight - one stopped - rear-end	Going Straight Ahead	Stopped at Signal or Stop Sign	West	South	West	South
E919861	Passenger Car	Pickup,Panel Truck or Vanette under 10,000 lb	At Intersection and Related	Clear or Partly Cloudy	Dry	Daylight	Entering at angle	Going Straight Ahead	Going Straight Ahead	East	West	North	South
EB99685	Pickup,Panel Truck or Vanette under 10,000 lb	-	At Intersection and Related	Raining	Wet	Dark-Street Lights On	Vehicle turning right hits pedestrian	Making Right Turn	-	West	South	-	-
E769439	Pickup,Panel Truck or Vanette under 10,000 lb	Passenger Car	At Intersection and Related	Clear or Partly Cloudy	Dry	Daylight	From same direction - both going straight - one stopped - rear-end	Going Straight Ahead	Stopped at Signal or Stop Sign	West	East	West	Vehicle Stopped
E887933	Pickup,Panel Truck or Vanette under 10,000 lb	Passenger Car	At Intersection and Related	Clear or Partly Cloudy	Dry	Daylight	Same direction -- both turning right -- one stopped -- rear end	Making Right Turn	Stopped for Traffic	West	East	West	East
E722030	Pickup,Panel Truck or Vanette under 10,000 lb	Passenger Car	At Intersection and Related	Raining	Wet	Daylight	From same direction - both going straight - one stopped - rear-end	Going Straight Ahead	Stopped at Signal or Stop Sign	West	East	Vehicle Stopped	Vehicle Stopped
E784349	Passenger Car	Pickup,Panel Truck or Vanette under 10,000 lb	At Intersection and Related	Clear or Partly Cloudy	Dry	Daylight	Same direction -- both turning right -- both moving -- sideswipe	Making Right Turn	Making Right Turn	East	West	East	West
E999252	Pickup,Panel Truck or Vanette under 10,000 lb	Passenger Car	At Intersection and Related	Wet		Dark-Street Lights On	Entering at angle	Going Straight Ahead	Going Straight Ahead	North	East	West	East

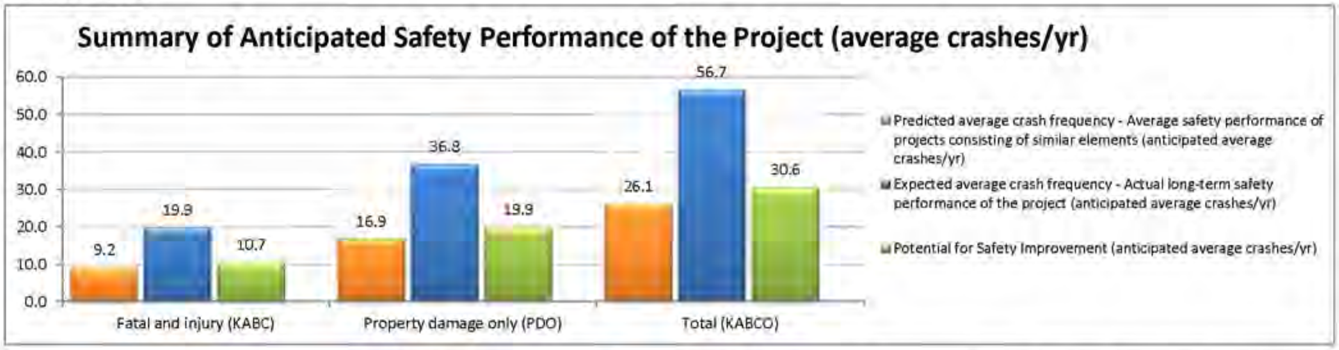
REPORT NUMBER	MV DRIVER CONTRIBUTING CIRCUMSTANCE 1 (UNIT 1)	MV DRIVER CONTRIBUTING CIRCUMSTANCE 2 (UNIT 1)	MV DRIVER CONTRIBUTING CIRCUMSTANCE 3 (UNIT 1)	MV DRIVER CONTRIBUTING CIRCUMSTANCE 1 (UNIT 2)	MV DRIVER CONTRIBUTING CIRCUMSTANCE 2 (UNIT 2)	MV DRIVER CONTRIBUTING CIRCUMSTANCE 3 (UNIT 2)	BICYCLIST CONTRIBUTING CIRCUMSTANCE 1 (UNIT 1)	BICYCLIST CONTRIBUTING CIRCUMSTANCE 2 (UNIT 1)	BICYCLIST CONTRIBUTING CIRCUMSTANCE 3 (UNIT 1)	BICYCLIST CONTRIBUTING CIRCUMSTANCE 1 (UNIT 2)	BICYCLIST CONTRIBUTING CIRCUMSTANCE 2 (UNIT 2)	BICYCLIST CONTRIBUTING CIRCUMSTANCE 3 (UNIT 2)	PEDESTRIAN CONTRIBUTING CIRCUMSTANCE 1 (UNIT 2)	PEDESTRIAN CONTRIBUTING CIRCUMSTANCE 2 (UNIT 2)	PEDESTRIAN CONTRIBUTING CIRCUMSTANCE 3 (UNIT 2)	FIRST IMPACT LOCATION (City, County & Misc Trafficways - 2010 forward)	WA STATE PLANE SOUTH - X 2010 - FORWARD	WA STATE PLANE SOUTH - Y 2010 - FORWARD
EB09423	Exceeding Reas. Safe Speed	Disregard Traffic Sign and Signals	-	None	-	-	-	-	-	-	-	-	-	-	-	Lane 3 LX Increasing Milepost (Prior to 2002 Impact Location Code was not lane specific)	1019162.11	518199.49
EB97762	Distracted by Other Occupant	-	-	None	-	-	-	-	-	-	-	-	-	-	-	Lane 1 LX Increasing Milepost (Prior to 2002 Impact Location Code was not lane specific)	1019170.43	518202.05
E870918	Disregard Stop and Go Light	Inattention	-	None	-	-	-	-	-	-	-	-	-	-	-	Lane 2 LX Decreasing Milepost	1019167.89	518200.96
E708965	Follow Too Closely	-	-	None	-	-	-	-	-	-	-	-	-	-	-	Lane 2 LX Increasing Milepost (Prior to 2002 Impact Location Code was not lane specific)	1019161.62	518201.75
EB57820	Disregard Traffic Sign and Signals	-	-	None	-	-	-	-	-	-	-	-	-	-	-	Lane 2 LX Decreasing Milepost	1019173.07	518200.64
E923175	Inattention	Unknown Distraction	-	-	-	-	-	-	-	-	-	-	-	-	-	Right Shoulder LX Increasing Milepost (Prior to 2002 Impact Location Code was not lane specific)	1019167.65	518200.74
EA74759	None	-	-	None	-	-	-	-	-	-	-	-	-	-	-	Lane 2 LX Increasing Milepost (Prior to 2002 Impact Location Code was not lane specific)	1019175.58	518189.25
EA52788	Follow Too Closely	-	-	None	-	-	-	-	-	-	-	-	-	-	-	Lane 1 LX Increasing Milepost (Prior to 2002 Impact Location Code was not lane specific)	1019166.92	518201.64
EB10452	Follow Too Closely	-	-	None	-	-	-	-	-	-	-	-	-	-	-	Lane 1 LX Increasing Milepost (Prior to 2002 Impact Location Code was not lane specific)	1019167.89	518200.96
E919861	Disregard Stop and Go Light	-	-	None	-	-	-	-	-	-	-	-	-	-	-	Lane 1 LX Decreasing Milepost	1019167.89	518200.96
EB99685	Other Distractions	-	-	-	-	-	-	-	-	-	-	-	None	-	-	Intersecting Road Increasing Milepost	1019167.89	518200.96
E769439	Distractions Outside Vehicle	-	-	None	-	-	-	-	-	-	-	-	-	-	-	Lane 1 LX Increasing Milepost (Prior to 2002 Impact Location Code was not lane specific)	1019167.42	518201.87
E887933	Inattention	-	-	None	-	-	-	-	-	-	-	-	-	-	-	Lane 1 LX Increasing Milepost (Prior to 2002 Impact Location Code was not lane specific)	1019167.89	518200.96
E722030	Inattention	Follow Too Closely	-	None	-	-	-	-	-	-	-	-	-	-	-	Lane 1 LX Increasing Milepost (Prior to 2002 Impact Location Code was not lane specific)	1019165.63	518200.37
E784349	Did Not Grant RW to Vehicle	-	-	None	-	-	-	-	-	-	-	-	-	-	-	Lane 2 LX Decreasing Milepost	1019163.07	518201.43
E999252	None	-	-	None	-	-	-	-	-	-	-	-	-	-	-	Lane 2 LX Increasing Milepost (Prior to 2002 Impact Location Code was not lane specific)	1019165.24	518201.13

APPENDIX A.3 2022 AND 2045 BASELINE SAFETY ANALYSIS

PROJECT SAFETY PERFORMANCE SUMMARY REPORT

General Information		
Project Name	North Lewis County Industrial Access	
Project Description	Transportation Study	
Reference Number	0	
Analyst	Edith Victoria	
Agency/Company	WSDOT	
Contact Email	edith.lopezvictoria@wsp.com	
Contact Phone	(503) 274-2293	
Date Completed	05/12/11	Years of crash data incorporated into the analysis: 5

PROJECT SUMMARY



Project Element	Total Crashes/yr (KABCO)			Fatal and Injury Crashes/yr (KABC)			Property Damage Only Crashes/yr (PDO)		
	Predicted average crash frequency $N_{predicted\ (KABCO)}$	Expected average crash frequency $N_{expected\ (KABCO)}$	Potential for Improvement	Predicted average crash frequency $N_{predicted\ (KABC)}$	Expected average crash frequency $N_{expected\ (KABC)}$	Potential for Improvement	Predicted average crash frequency $N_{predicted\ (O)}$	Expected average crash frequency $N_{expected\ (O)}$	Potential for Improvement
INDIVIDUAL INTERSECTIONS									
Intersection 1	3.7	7.5	3.8	1.3	2.7	1.4	2.3	4.8	2.5
Intersection 2	4.5	6.7	2.2	1.6	2.3	0.8	2.9	4.4	1.4
Intersection 3	3.4	4.0	0.6	1.1	1.3	0.2	2.3	2.7	0.4
Intersection 4	1.0	0.4	0.0	0.4	0.2	0.0	0.6	0.3	0.0
Intersection 5	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Intersection 6	0.8	1.4	0.6	0.3	0.5	0.2	0.5	0.9	0.4
Intersection 7	0.7	0.3	0.0	0.3	0.1	0.0	0.4	0.1	0.0
Intersection 8	1.4	4.0	2.6	0.5	1.3	0.9	0.9	2.7	1.8
Intersection 9	0.1	0.1	0.0	0.1	0.1	0.0	0.0	0.1	0.0
Intersection 10	2.8	9.4	6.6	1.0	3.4	2.4	1.8	6.0	4.2
Intersection 11	3.5	11.4	7.9	1.2	4.0	2.8	2.3	7.3	5.1
Intersection 12	4.0	10.9	6.9	1.4	3.7	2.4	2.6	7.2	4.6
Intersection 13	0.2	0.4	0.2	0.1	0.2	0.1	0.1	0.2	0.1
COMBINED (sum of column)	26.1	56.7	30.6	9.2	19.9	10.7	16.9	36.8	19.9

PROJECT SUMMARY -- Site-Specific EB Method Summary Results for Urban and Suburban Arterial Project

Crash severity level	$N_{predicted(PROJECT)}$ Predicted average crash frequency -Average safety performance of projects consisting of similar elements (anticipated average crashes/yr)	$N_{expected\ (PROJECT)}$ Expected average crash frequency - Actual long-term safety performance of the project (anticipated average crashes/yr)	$N_{potential\ for\ improvement\ (PROJECT)}$ Potential for Safety Improvement (anticipated average crashes/yr)
Fatal and injury (KABC)	9.2	19.9	10.7
Property damage only (PDO)	16.9	36.8	19.9
Total (KABCO)	26.1	56.7	30.6

HSM1 Extended Spreadsheet for Part C Chapter 12 v.9

Discussion of Results

Given the potential effects of project characteristics on safety performance, results indicate that:

1. It is anticipated that the project will, on average, experience 56.7 crashes per year (19.9 fatal and injury crashes per year; and 36.8 property damage only crashes per year).

2. A similar project is anticipated, on average, to experience 26.1 crashes per year (9.2 fatal and injury crashes per year; and 16.9 property damage only crashes per year).

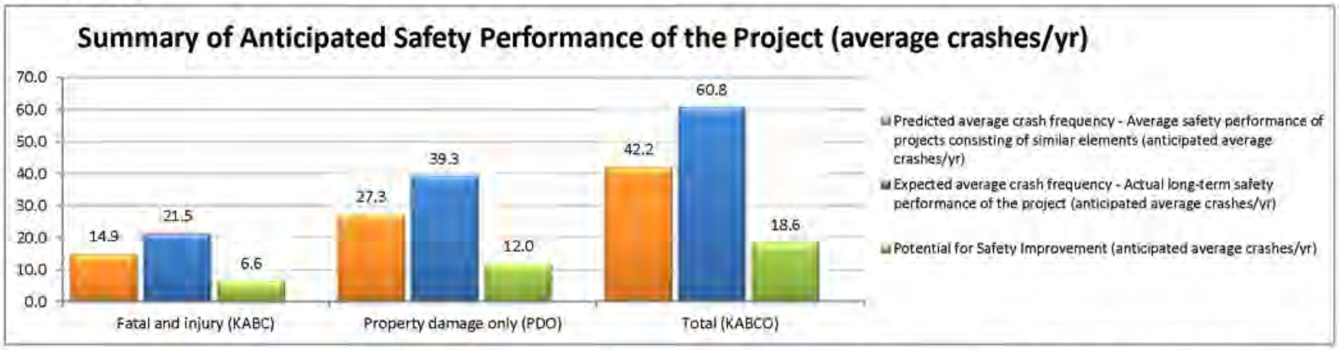
3. It is anticipated the project has, on average, a potential for safety improvement of 30.6 crashes per year (10.7 fatal and injury crashes per year; and 19.9 property damage only crashes per year).

PROJECT SAFETY PERFORMANCE SUMMARY REPORT

General Information	
Project Name	North Lewis County Industrial Access
Project Description	Transportation Study
Reference Number	0
Analyst	Edith Victoria
Agency/Company	WSDOT
Contact Email	edith.lopezvictoria@wsp.com
Contact Phone	(503) 274-2293
Date Completed	05/12/11

Years of crash data incorporated into the analysis: 5

PROJECT SUMMARY



Project Element	Total Crashes/yr (KABCO)			Fatal and Injury Crashes/yr (KABC)			Property Damage Only Crashes/yr (PDO)		
	Predicted average crash frequency $N_{predicted\ (KABCO)}$	Expected average crash frequency $N_{expected\ (KABCO)}$	Potential for Improvement	Predicted average crash frequency $N_{predicted\ (KABC)}$	Expected average crash frequency $N_{expected\ (KABC)}$	Potential for Improvement	Predicted average crash frequency $N_{predicted\ (O)}$	Expected average crash frequency $N_{expected\ (O)}$	Potential for Improvement
INDIVIDUAL INTERSECTIONS									
Intersection 1	5.9	8.0	2.1	2.1	2.9	0.8	3.8	5.1	1.4
Intersection 2	8.7	7.3	0.0	3.1	2.6	0.0	5.6	4.7	0.0
Intersection 3	7.0	4.5	0.0	2.2	1.4	0.0	4.9	3.1	0.0
Intersection 4	1.8	0.6	0.0	0.7	0.2	0.0	1.1	0.3	0.0
Intersection 5	0.1	0.1	0.0	0.1	0.1	0.0	0.0	0.0	0.0
Intersection 6	1.2	1.7	0.5	0.5	0.7	0.2	0.7	1.0	0.3
Intersection 7	1.1	0.3	0.0	0.5	0.1	0.0	0.6	0.2	0.0
Intersection 8	2.0	4.5	2.4	0.7	1.5	0.8	1.4	3.0	1.6
Intersection 9	0.2	0.2	0.0	0.1	0.1	0.0	0.1	0.1	0.0
Intersection 10	4.0	10.0	6.0	1.4	3.6	2.2	2.5	6.4	3.8
Intersection 11	4.7	11.9	7.2	1.7	4.3	2.6	3.0	7.7	4.6
Intersection 12	5.1	11.3	6.2	1.7	3.9	2.1	3.3	7.4	4.1
Intersection 13	0.4	0.5	0.2	0.1	0.2	0.1	0.2	0.3	0.1
COMBINED (sum of column)	42.2	60.8	18.6	14.9	21.5	6.6	27.3	39.3	12.0

PROJECT SUMMARY -- Site-Specific EB Method Summary Results for Urban and Suburban Arterial Project

Crash severity level	$N_{predicted(PROJECT)}$ Predicted average crash frequency -Average safety performance of projects consisting of similar elements (anticipated average crashes/yr)	$N_{expected\ (PROJECT)}$ Expected average crash frequency - Actual long-term safety performance of the project (anticipated average crashes/yr)	$N_{potential\ for\ improvement\ (PROJECT)}$ Potential for Safety Improvement (anticipated average crashes/yr)
Fatal and injury (KABC)	14.9	21.5	6.6
Property damage only (PDO)	27.3	39.3	12.0
Total (KABCO)	42.2	60.8	18.6

HSM1 Extended Spreadsheet for Part C Chapter 12 v.9

Discussion of Results

Given the potential effects of project characteristics on safety performance, results indicate that:

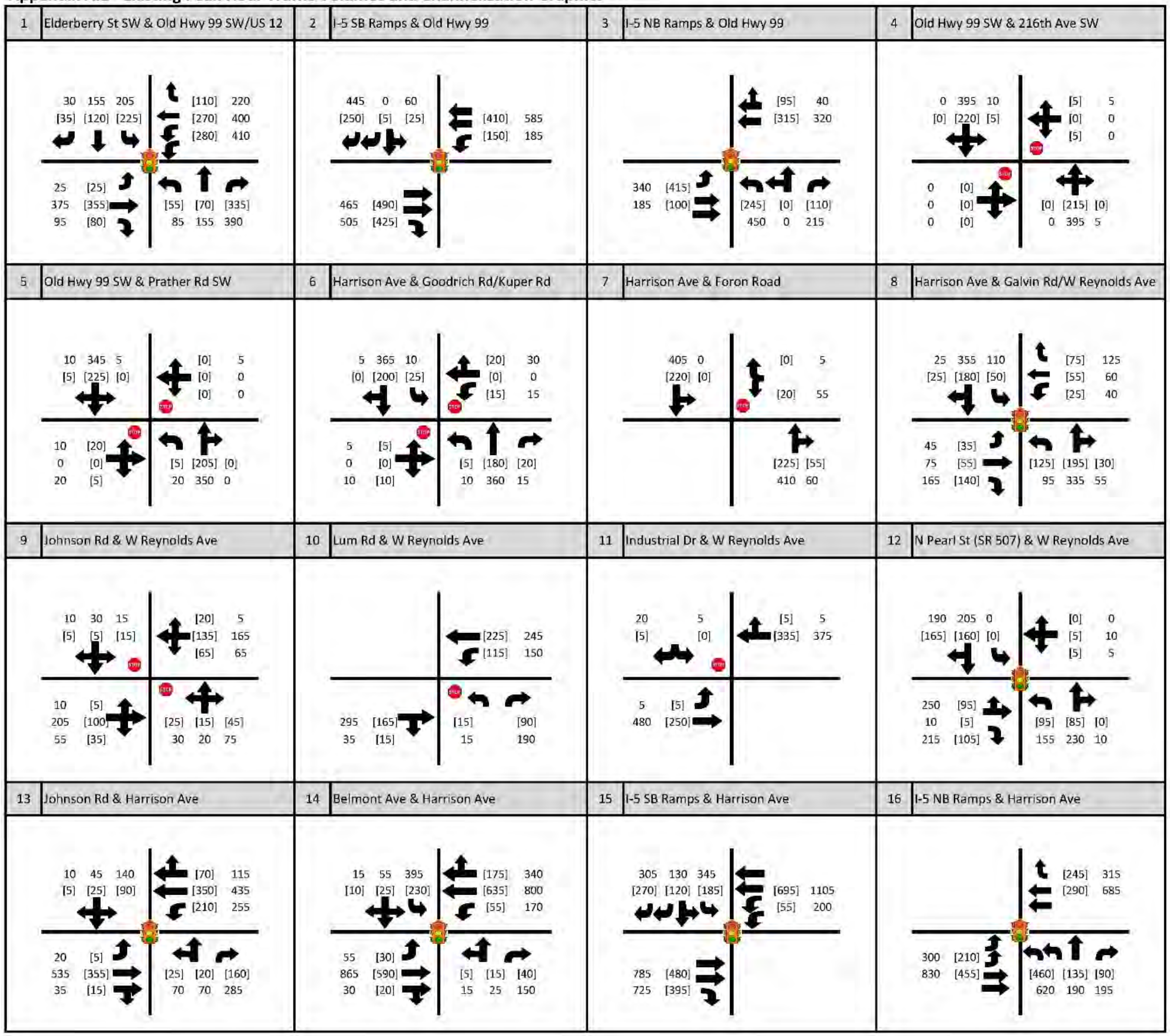
1. It is anticipated that the project will, on average, experience 60.8 crashes per year (21.5 fatal and injury crashes per year; and 39.3 property damage only crashes per year).

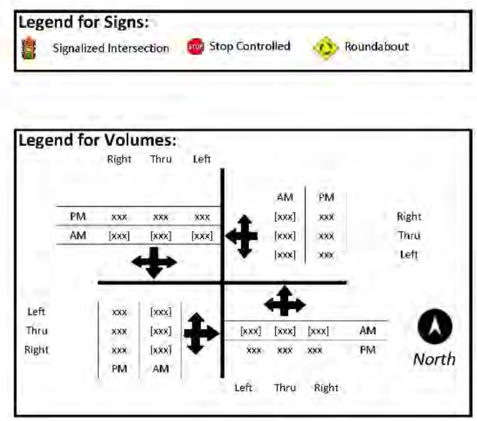
2. A similar project is anticipated, on average, to experience 42.2 crashes per year (14.9 fatal and injury crashes per year; and 27.3 property damage only crashes per year).

3. It is anticipated the project has, on average, a potential for safety improvement of 18.6 crashes per year (6.6 fatal and injury crashes per year; and 12 property damage only crashes per year).

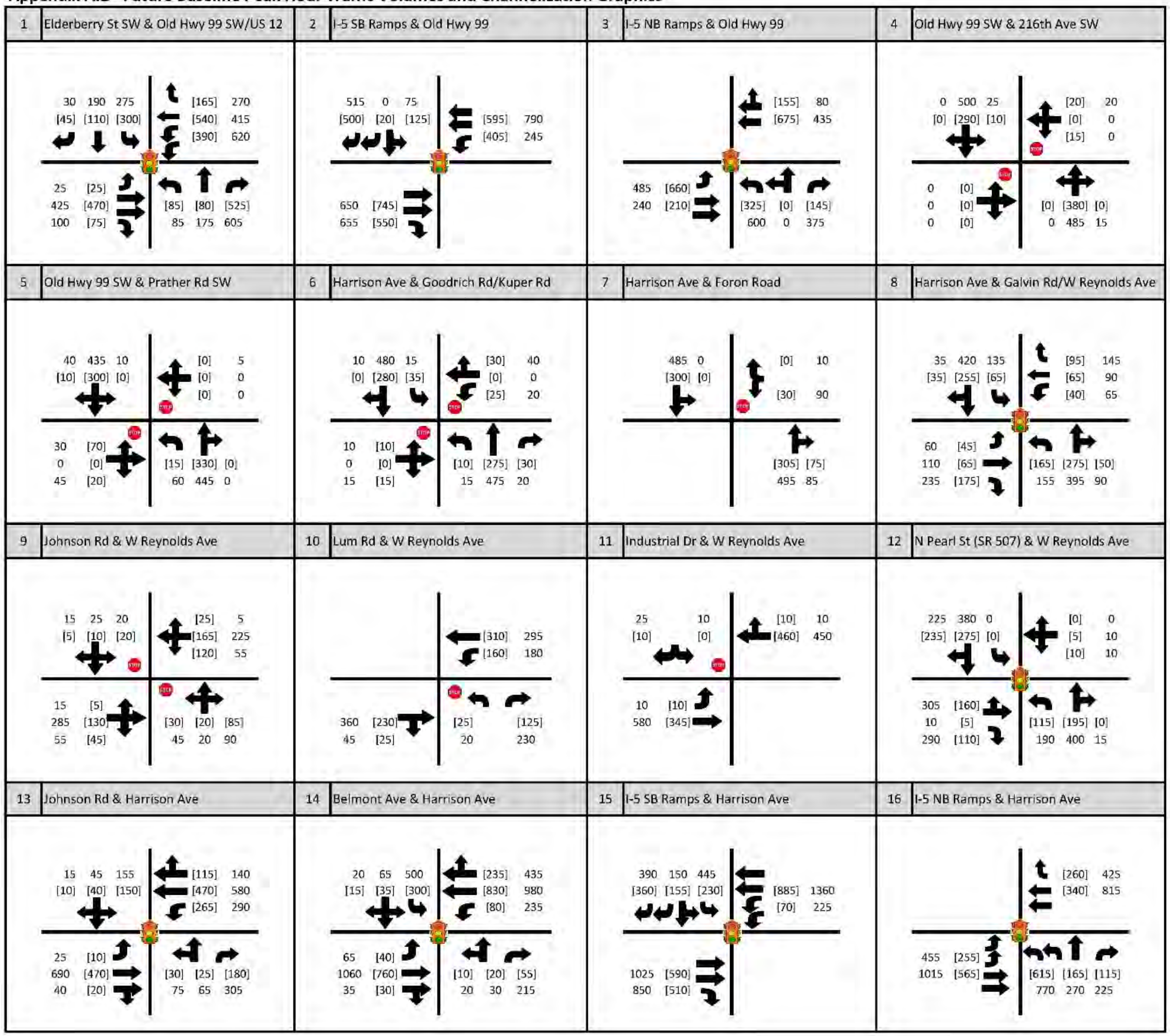
APPENDIX A.4 INTERSECTION VOLUME AND CHANNELIZATION

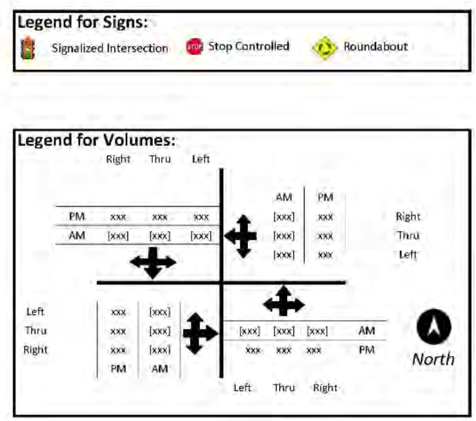
Appendix A.1 - Existing Peak Hour Traffic Volumes and Channelization Graphics





Appendix A.2 - Future Baseline Peak Hour Traffic Volumes and Channelization Graphics





APPENDIX A.5 INTERSECTION OPERATION RESULTS

Existing & Future Baseline Conditions Traffic Analysis Technical Memorandum Appendix B - Intersection Operation Results

Table B.1 - Intersection Operation Metrics; Existing & Future Baseline Conditions

ID	Intersection	Traffic Control	Jurisdiction	Standard	AM Peak						PM Peak					
					2022 Existing			2045 Future Baseline			2022 Existing			2045 Future Baseline		
					Average Vehicle Delay (sec/veh)	LOS	VC Ratio/Worst Movment	Average Vehicle Delay (sec/veh)	LOS	VC Ratio/Worst Movment	Average Vehicle Delay (sec/veh)	LOS	VC Ratio/Worst Movment	Average Vehicle Delay (sec/veh)	LOS	VC Ratio/Worst Movment
1	Elderberry St SW & Old Hwy 99 SW/US 12	Signal	WSDOT/Thurston County	D	38.2	D	0.67	52.9	D	0.91	50.3	D	0.68	158.9	F	0.91
2	I-5 SB Ramps & Old Hwy 99	Signal	WSDOT	D	15.4	B	0.43	28	C	0.73	30.7	C	0.44	30.9	C	0.55
3	I-5 NB Ramps & Old Hwy 99	Signal	WSDOT	D	31.7	C	0.68	61.8	E	0.93	27.5	C	0.63	39.9	D	0.78
4	Old Hwy 99 SW & 216th Ave SW	TWSC	Thurston County	C	11.2	B	0.02 (WB)	12.9	B	0.07 (WB)	11.0	B	0.01 (WB)	11.4	B	0.03 (WB)
5	Old Hwy 99 SW & Prather Rd SW	TWSC	Thurston County	C	12.4	B	0.06 (EB)	15.9	C	0.21 (EB)	13.8	B	0.07 (EB)	19.3	C	0.23 (EB)
6	Harrison Ave & Goodrich Rd/Kuper Rd	TWSC	Lewis County	D	15.0	B	0.04 (WBL)	18.3	C	0.08 (WBL)	20.6	C	0.07 (WBL)	25.9	D	0.10 (WBL)
7	Harrison Ave & Foron Road	TWSC	Lewis County	D	12.1	B	0.04 (WB)	13.9	B	0.07 (WB)	20.5	C	0.23 (WB)	25.1	D	0.36 (WB)
8	Harrison Ave & Galvin Rd/W Reynolds Ave	Signal	Centralia	D	20.7	C	0.52	29.3	C	0.64	21.9	C	0.60	38.3	D	0.70
9	Johnson Rd & W Reynolds Ave	TWSC	Centralia	D	15.9	C	0.09 (SB)	19.2	C	0.12 (SB)	15.8	C	0.15 (SB)	17.6	C	0.17 (SB)
10	Lum Rd & W Reynolds Ave	TWSC	Centralia	D	15.8	C	0.05 (NBL)	19.1	C	0.09 (NBL)	19.8	C	0.06 (NBL)	23.4	C	0.09 (NBL)
11	Industrial Dr & W Reynolds Ave	TWSC	Centralia	D	10.7	B	0.01 (SB)	11.1	B	0.02 (SB)	12.1	B	0.05 (SB)	14.1	B	0.08 (SB)
12	N Pearl St (SR 507) & W Reynolds Ave	Signal	Lewis County/Centralia	D	13.6	B	0.51	16.3	B	0.63	21.8	C	0.71	27.3	C	0.82
13	Johnson Rd & Harrison Ave	Signal	Centralia	D	23.0	C	0.54	28.1	C	0.62	24.5	C	0.67	26.2	C	0.73
14	Belmont Ave & Harrison Ave	Signal	Centralia	D	17.4	B	0.55	17.1	B	0.63	29.1	C	0.77	34.0	C	0.87
15	I-5 SB Ramps & Harrison Ave	Signal	WSDOT/Centralia	D	15.3	B	0.59	15.9	B	0.63	26.2	C	0.86	33.8	C	0.97
16	I-5 NB Ramps & Harrison Ave	Signal	WSDOT/Centralia	D	20.6	C	0.43	20.9	C	0.50	26.1	C	0.60	29.7	C	0.74

Notes:

- Delay, Level-of-Service and Intersection v/c measures were obtained from HCM 2000.
- Worst movement reported for TWSC intersections
- The yellow highlight indicates an intersection operating at capacity while a pink highlight denotes failing conditions with severe delays

Existing & Future Baseline Conditions Traffic Analysis Technical Memorandum Appendix B - Intersection Operation Results

Table B.2 - Intersection Operation Metrics; Existing & Future Baseline Conditions

			AM Peak							PM Peak						
			2022 Existing			2045 Future Baseline				2022 Existing			2045 Future Baseline			
ID	Intersection	Lane Group	Average Vehicle Delay (sec/veh)	LOS	V/C	Average Vehicle Delay (sec/veh)	LOS	V/C	Delta	Average Vehicle Delay (sec/veh)	LOS	V/C	Average Vehicle Delay (sec/veh)	LOS	V/C	Delta
1	Elderberry St SW & Old Hwy 99 SW/US 12	EBL	54.2	D	0.40	72.1	E	0.61	18	64.8	E	0.40	70.7	E	0.51	6
		EBT	36.1	D	0.72	31.5	C	0.53	-5	29.8	C	0.53	20.5	C	0.28	-9
		EBR	24.4	C	0.06	26.8	C	0.05	2	21.8	C	0.07	18.2	B	0.07	-4
		WBL	48.1	D	0.70	42.8	D	0.71	-5	57.3	E	0.77	372.6	F	1.16	315
		WBT	20.9	C	0.43	28.9	C	0.77	8	16.6	B	0.43	21.4	C	0.43	5
		WBR	17.3	B	0.09	17.0	B	0.15	0	8.4	A	0.16	37.4	D	0.19	29
		NBL	41.1	D	0.26	37.2	D	0.31	-4	55.0	E	0.45	58.5	E	0.52	4
		NBT	45.7	D	0.41	49.1	D	0.56	3	61.6	E	0.68	59.9	E	0.69	-2
		NBR	44.5	D	0.27	132.6	F	1.16	88	51.2	D	0.28	196.9	F	1.29	146
		SBL	49.6	D	0.76	41.5	D	0.74	-8	172.4	F	1.15	365.9	F	1.63	194
		SBT	41.1	D	0.46	38.6	D	0.39	-3	65.0	E	0.72	62.0	E	0.73	-3
		SBR	36.9	D	0.03	35.4	D	0.03	-2	49.6	D	0.02	46.8	D	0.02	-3
		Overall	**38.2**	**D**	**0.67**	**52.9**	**D**	**0.91**	**15**	**50.3**	**D**	**0.68**	**158.9**	**F**	**0.91**	**109**
2	I-5 SB Ramps & Old Hwy 99	EBT	17.4	B	0.53	30.5	C	0.70	13	14.0	B	0.24	15.6	B	0.35	2
		EBR	16.1	B	0.34	27.3	C	0.53	11	42.0	D	0.36	42.7	D	0.46	1
		WBL	22.7	C	0.50	42.5	D	0.83	20	64.4	E	0.75	70.9	E	0.84	7
		WBT	4.9	A	0.23	5.1	A	0.27	0	3.2	A	0.23	3.4	A	0.31	0
		SBTL	22.3	C	0.13	42.5	D	0.59	20	56.6	E	0.38	58.4	E	0.47	2
		SBR	22.1	C	0.12	36.2	D	0.22	14	53.9	D	0.18	54.4	D	0.21	1
		Overall	**15.4**	**B**	**0.43**	**28.0**	**C**	**0.73**	**13**	**30.7**	**C**	**0.44**	**30.9**	**C**	**0.55**	**0**
3	I-5 NB Ramps & Old Hwy 99	EBL	31.5	C	0.78	65.5	E	0.97	34	31.9	C	0.71	46.4	D	0.85	15
		EBT	4.8	A	0.05	4.3	A	0.09	-1	8.0	A	0.10	8.9	A	0.12	1
		WBTR	34.8	C	0.64	72.4	E	0.97	38	32.6	C	0.58	46.8	D	0.74	14
		NBL	37.7	D	0.54	68.9	E	0.74	31	29.6	C	0.57	45.0	D	0.73	15
		NBLT	37.7	D	0.54	69.2	E	0.75	32	29.7	C	0.57	45.0	D	0.73	15
		NBR	32.2	C	0.10	50.1	D	0.11	18	24.4	C	0.16	33.6	C	0.27	9
		Overall	**31.7**	**C**	**0.68**	**61.8**	**E**	**0.93**	**30**	**27.5**	**C**	**0.63**	**39.9**	**D**	**0.78**	**12**
4	Old Hwy 99 SW & 216th Ave SW	EBLTR	0.0	A	0.00	0.0	A	0.00	0	0.0	A	0.00	0.0	A	0.00	0
		WBLTR	11.2	B	0.02	12.9	B	0.07	2	11.0	B	0.01	11.4	B	0.03	0
		NBLTR	0.0	A	0.00	0.0	A	0.00	0	0.0	A	0.00	0.0	A	0.00	0
		SBLTR	0.2	A	0.00	0.4	A	0.01	0	0.3	A	0.01	0.7	A	0.02	0
		Overall	**0.4**	**A**	**-**	**0.8**	**A**	**-**	**0**	**0.2**	**A**	**-**	**0.6**	**B**	**-**	**0**
5	Old Hwy 99 SW & Prather Rd SW	EBLTR	12.4	B	0.06	15.9	C	0.21	4	13.8	B	0.07	19.3	C	0.23	6
		WBLTR	0.0	A	0.00	0.0	A	0.00	0	10.9	B	0.07	11.3	B	0.01	0
		NBL	7.9	A	0.00	8.0	A	0.01	0	8.2	A	0.02	8.5	A	0.06	0
		NBTR	0.0	A	0.14	0.0	A	0.19	0	0.0	A	0.23	0.0	A	0.26	0
		SBLTR	0.0	A	0.00	0.0	A	0.00	0	0.2	A	0.01	0.3	A	0.01	0
		Overall	**0.8**	**A**	**-**	**2.1**	**A**	**-**	**1**	**0.9**	**A**	**-**	**2.0**	**B**	**-**	**1**

Existing & Future Baseline Conditions Traffic Analysis Technical Memorandum Appendix B - Intersection Operation Results

Table B.2 - Intersection Operation Metrics; Existing & Future Baseline Conditions

			AM Peak							PM Peak						
			2022 Existing			2045 Future Baseline				2022 Existing			2045 Future Baseline			
ID	Intersection	Lane Group	Average Vehicle Delay (sec/veh)	LOS	V/C	Average Vehicle Delay (sec/veh)	LOS	V/C	Delta	Average Vehicle Delay (sec/veh)	LOS	V/C	Average Vehicle Delay (sec/veh)	LOS	V/C	Delta
6	Harrison Ave & Goodrich Rd/Kuper Rd	EBT	10.9	B	0.03	12.4	B	0.05	2	14.5	B	0.04	17.8	C	0.08	3
		WBL	15.0	B	0.04	18.3	C	0.08	3	20.6	C	0.07	25.9	D	0.10	5
		WBTR	10.2	B	0.03	10.8	B	0.05	1	11.2	B	0.05	11.8	B	0.07	1
		NBL	7.8	A	0.00	7.9	A	0.01	0	8.2	A	0.01	8.4	A	0.01	0
		NBT	0.0	A	0.12	0.0	A	0.16	0	0.0	A	0.24	0.0	A	0.28	0
		NBR	0.0	A	0.01	0.0	A	0.02	0	0.0	A	0.01	0.0	A	0.01	0
		SBL	7.8	A	0.02	8.1	A	0.03	0	8.3	A	0.01	8.5	A	0.01	0
		SBTR	0.0	A	0.14	0.0	A	0.16	0	0.0	A	0.25	0.0	A	0.29	0
		Overall	**1.7**	**A**	**-**	**2.0**	**A**	**-**	**0**	**1.2**	**A**	**-**	**1.5**	**A**	**-**	**0**
7	Harrison Ave & Foron Road	WBLR	12.1	B	0.04	13.9	B	0.07	2	20.5	C	0.23	25.1	D	0.36	5
		NBTR	0.0	A	0.17	0.0	A	0.22	0	0.0	A	0.31	0.0	A	0.34	0
		SBLT	0.0	A	0.00	0.0	A	0.00	0	0.0	A	0.00	0.0	A	0.00	0
		Overall	**0.5**	**A**	**-**	**0.6**	**A**	**-**	**0**	**1.3**	**A**	**-**	**2.2**	**A**	**-**	**1**
8	Harrison Ave & Galvin Rd/W Reynolds Ave	EBL	30.8	C	0.54	39.3	D	0.62	9	42.0	D	0.64	31.9	C	0.50	-10
		EBT	18.7	B	0.26	19.0	B	0.26	0	20.8	C	0.30	25.6	C	0.42	5
		EBR	18.0	B	0.12	18.4	B	0.14	0	19.9	B	0.13	23.9	C	0.17	4
		WBL	40.2	D	0.58	29.9	C	0.53	-10	33.1	C	0.55	32.2	C	0.51	-1
		WBT	19.5	B	0.28	18.9	B	0.25	-1	20.4	C	0.23	24.8	C	0.32	4
		WBR	18.4	B	0.06	18.0	B	0.07	0	19.7	B	0.09	23.4	C	0.10	4
		NBL	43.9	D	0.80	98.1	F	1.02	54	28.7	C	0.59	152.5	F	1.15	124
		NBTR	12.5	B	0.46	18.7	B	0.68	6	19.5	B	0.71	22.0	C	0.75	3
		SBL	25.4	C	0.50	23.1	C	0.42	-2	32.7	C	0.67	96.8	F	0.97	64
		SBTR	14.0	B	0.46	16.7	B	0.60	3	17.9	B	0.67	19.1	B	0.68	1
		Overall	**20.7**	**C**	**0.52**	**29.3**	**C**	**0.64**	**9**	**21.9**	**C**	**0.60**	**38.3**	**D**	**0.70**	**16**
9	Johnson Rd & W Reynolds Ave	EBLTR	0.3	A	0.00	0.2	A	0.00	0	0.4	A	0.01	0.4	A	0.01	0
		WBLTR	2.7	A	0.06	3.6	A	0.09	1	2.6	A	0.05	1.9	A	0.05	-1
		NBLTR	12.9	B	0.19	13.7	B	0.25	1	13.8	B	0.24	16.2	C	0.33	2
		SBLTR	15.9	C	0.09	19.2	C	0.12	3	15.8	C	0.15	17.6	C	0.17	2
		Overall	**4.6**	**A**	**-**	**5.6**	**A**	**-**	**1**	**4.8**	**A**	**-**	**5.0**	**B**	**-**	**0**
10	Lum Rd & W Reynolds Ave	EBTR	0.0	A	0.12	0.0	A	0.15	0	0.0	A	0.21	0.0	A	0.24	0
		WBL	8.0	A	0.10	8.2	A	0.13	0	8.5	A	0.13	8.7	A	0.16	0
		WBT	0.0	A	0.15	0.0	A	0.18	0	0.0	A	0.15	0.0	A	0.17	0
		NBL	15.8	C	0.05	19.1	C	0.09	3	19.8	C	0.06	23.4	C	0.09	4
		NBR	9.9	A	0.12	10.4	B	0.16	1	12.2	B	0.29	13.3	B	0.35	1
		Overall	**3.3**	**A**	**-**	**3.5**	**A**	**-**	**0**	**4.2**	**A**	**-**	**4.5**	**A**	**-**	**0**
11	Industrial Dr & W Reynolds Ave	EBL	8.3	A	0.01	8.4	A	0.01	0	8.1	A	0.00	8.3	A	0.01	0
		EBT	0.0	A	0.18	0.0	A	0.20	0	0.0	A	0.30	0.0	A	0.34	0
		WBTR	0.0	A	0.25	0.0	A	0.28	0	0.0	A	0.24	0.0	A	0.27	0
		SBLR	10.7	B	0.01	11.1	B	0.02	0	12.1	B	0.05	14.1	B	0.08	2
		Overall	**0.2**	**A**	**-**	**0.2**	**A**	**-**	**0**	**0.4**	**A**	**-**	**0.5**	**A**	**-**	**0**

Existing & Future Baseline Conditions Traffic Analysis Technical Memorandum Appendix B - Intersection Operation Results

Table B.2 - Intersection Operation Metrics; Existing & Future Baseline Conditions

			AM Peak							PM Peak						
			2022 Existing			2045 Future Baseline				2022 Existing			2045 Future Baseline			
ID	Intersection	Lane Group	Average Vehicle Delay (sec/veh)	LOS	V/C	Average Vehicle Delay (sec/veh)	LOS	V/C	Delta	Average Vehicle Delay (sec/veh)	LOS	V/C	Average Vehicle Delay (sec/veh)	LOS	V/C	Delta
12	N Pearl St (SR 507) & W Reynolds Ave	EBLT	17.3	B	0.42	23.5	C	0.57	6	30.7	C	0.75	43.6	D	0.84	13
		EBR	15.1	B	0.09	18.5	B	0.08	3	18.6	B	0.20	23.4	C	0.24	5
		WBLTR	14.8	B	0.03	18.3	B	0.04	4	17.5	B	0.03	21.7	C	0.04	4
		NBL	7.9	A	0.27	9.1	A	0.33	1	13.3	B	0.47	18.4	B	0.62	5
		NBTR	5.1	A	0.11	6.0	A	0.21	1	9.6	A	0.30	10.8	B	0.43	1
		SBL	0.0	A	0.00	0.0	A	0.00	0	0.0	A	0.00	0.0	A	0.00	0
		SBTR	15.7	B	0.64	19.0	B	0.73	3	28.6	C	0.77	35.0	C	0.87	6
		Overall	**13.6**	**B**	**0.51**	**16.3**	**B**	**0.63**	**3**	**21.8**	**C**	**0.71**	**27.3**	**C**	**0.82**	**6**
13	Johnson Rd & Harrison Ave	EBL	62.9	E	0.40	68.2	E	0.45	5	61.5	E	0.45	62.5	E	0.50	1
		EBTR	36.5	D	0.67	39.1	D	0.66	3	31.4	C	0.54	34.3	C	0.65	3
		WBL	25.1	C	0.48	36.8	D	0.62	12	32.9	C	0.83	47.8	D	0.92	15
		WBTR	11.4	B	0.30	15.2	B	0.38	4	4.5	A	0.35	4.4	A	0.44	0
		NBLT	41.1	D	0.33	50.0	D	0.40	9	52.4	D	0.64	50.9	D	0.60	-2
		NBR	0.2	A	0.13	0.2	A	0.13	0	0.3	A	0.21	0.3	A	0.21	0
		SBLTR	40.7	D	0.60	44.6	D	0.66	4	61.7	E	0.79	58.5	E	0.78	-3
		Overall	**23.0**	**C**	**0.54**	**28.1**	**C**	**0.62**	**5**	**24.5**	**C**	**0.67**	**26.2**	**C**	**0.73**	**2**
14	Belmont Ave & Harrison Ave	EBL	48.1	D	0.48	93.4	F	0.77	45	66.2	E	0.51	123.1	F	0.90	57
		EBTR	15.2	B	0.46	15.5	B	0.51	0	14.1	B	0.66	21.8	C	0.79	8
		WBL	5.1	A	0.17	3.4	A	0.24	-2	15.8	B	0.62	49.9	D	0.81	34
		WBTR	9.8	A	0.58	6.6	A	0.65	-3	24.7	C	0.81	19.0	B	0.89	-6
		NBLT	42.8	D	0.23	46.7	D	0.40	4	52.0	D	0.34	53.0	D	0.40	1
		NBR	41.4	D	0.03	42.8	D	0.04	1	50.1	D	0.11	54.5	D	0.48	4
		SBL	39.7	D	0.60	40.3	D	0.64	1	61.8	E	0.83	67.0	E	0.88	5
		SBLTR	38.9	D	0.57	40.0	D	0.63	1	59.5	E	0.82	67.7	E	0.89	8
		Overall	**17.4**	**B**	**0.55**	**17.1**	**B**	**0.63**	**0**	**29.1**	**C**	**0.77**	**34.0**	**C**	**0.87**	**5**
15	I-5 SB Ramps & Harrison Ave	EBT	7.8	A	0.32	6.1	A	0.32	-2	15.9	B	0.46	13.8	B	0.56	-2
		EBR	11.5	B	0.59	10.6	B	0.63	-1	44.5	D	0.97	62.4	E	1.07	18
		WBL	44.5	D	0.32	58.2	E	0.55	14	46.5	D	0.59	129.4	F	1.09	83
		WBT	3.8	A	0.38	6.1	A	0.42	2	5.4	A	0.51	8.2	A	0.63	3
		SBL	37.9	D	0.61	37.1	D	0.61	-1	47.9	D	0.71	47.3	D	0.75	-1
		SBLT	37.5	D	0.60	36.9	D	0.61	-1	47.5	D	0.70	47.1	D	0.75	0
		SBR	32.3	C	0.29	32.6	C	0.41	0	38.3	D	0.37	37.5	D	0.51	-1
		Overall	**15.3**	**B**	**0.59**	**15.9**	**B**	**0.63**	**1**	**26.2**	**C**	**0.86**	**33.8**	**C**	**0.97**	**8**
16	I-5 NB Ramps & Harrison Ave	EBL	34.5	C	0.57	33.5	C	0.62	-1	46.7	D	0.68	46.5	D	0.79	0
		EBT	7.4	A	0.24	6.9	A	0.30	-1	12.2	B	0.41	14.3	B	0.51	2
		WBT	15.4	B	0.21	17.8	B	0.25	2	21.8	C	0.46	30.7	C	0.63	9
		WBR	15.5	B	0.19	17.5	B	0.18	2	19.2	B	0.24	29.7	C	0.50	11
		NBL	34.6	C	0.68	33.9	C	0.74	-1	47.5	D	0.82	45.5	D	0.84	-2
		NBT	29.9	C	0.37	27.5	C	0.36	-2	37.3	D	0.46	35.6	D	0.55	-2
		NBR	0.1	A	0.07	0.1	A	0.08	0	0.2	A	0.14	0.2	A	0.16	0
		Overall	**20.6**	**C**	**0.43**	**20.9**	**C**	**0.50**	**0**	**26.1**	**C**	**0.60**	**29.7**	**C**	**0.74**	**4**

Notes:

[1] -Delay, Level-of-Service and intersection v/c measures were obtained from HCM 2000.

- The yellow highlight indicates an intersection operating at capacity while a pink highlight denotes failing conditions with severe delays.

Existing & Future Baseline Conditions Traffic Analysis Technical Memorandum Appendix B - Intersection Operation Results

Table B.3 - Intersection Operation Metrics; Existing & Future Baseline Conditions

ID	Intersection	Lane Group	Storage Length (feet)[1]	AM Peak – 2022 Existing – 95th Percentile Queue (feet)	AM Peak – 2022 Existing – % of Distance in 95th Percentile Queue[2]	AM Peak – 2045 Future Baseline – 95th Percentile Queue (feet)	AM Peak – 2045 Future Baseline – % of Distance in 95th Percentile Queue[2]	PM Peak – 2022 Existing – 95th Percentile Queue (feet)	PM Peak – 2022 Existing – % of Distance in 95th Percentile Queue[2]	PM Peak – 2045 Future Baseline – 95th Percentile Queue (feet)	PM Peak – 2045 Future Baseline – % of Distance in 95th Percentile Queue[2]
1	Elderberry St SW & Old Hwy 99 SW/US 12	EBL	560	50	9%	50	9%	50	9%	50	9%
		EBT	2500	425	17%	200	8%	375	15%	175	7%
		EBR	50	25	50%	0	0%	0	0%	0	0%
		WBL	825	150	18%	225	27%	200	24%	525	64%
		WBT	1020	250	25%	475	47%	350	34%	350	34%
		WBR	1020	25	2%	50	5%	25	2%	50	5%
		NBL	350	75	21%	100	29%	125	36%	125	36%
		NBT	480	100	21%	100	21%	200	42%	200	42%
		NBR	390	100	26%	550	141%	100	26%	675	173%
		SBL	280	300	107%	375	134%	375	134%	500	179%
		SBT	330	150	45%	125	38%	200	61%	225	68%
		SBR	50	0	0%	0	0%	0	0%	0	0%
2	I-5 SB Ramps & Old Hwy 99	EBT	1020	150	15%	325	32%	150	15%	150	15%
		EBR	310	50	16%	200	65%	100	32%	50	16%
		WBL	200	125	63%	400	200%	225	113%	325	163%
		WBT	610	50	8%	75	12%	75	12%	100	16%
		SBTL	2150	50	2%	175	8%	100	5%	100	5%
		SBR	370	25	7%	50	14%	50	14%	50	14%
3	I-5 NB Ramps & Old Hwy 99	EBL	300	450	150%	875	292%	375	125%	550	183%
		EBT	610	25	4%	50	8%	50	8%	50	8%
		WBTR	310	225	73%	550	177%	200	65%	300	97%
		NBL	240	175	73%	225	94%	275	115%	400	167%
		NBLT	1390	175	13%	225	16%	275	20%	400	29%
		NBR	400	50	13%	50	13%	50	13%	75	19%
8	Harrison Ave & Galvin Rd/W Reynolds Ave	EBL	100	50	50%	50	50%	50	50%	100	100%
		EBT	1220	50	4%	50	4%	75	6%	100	8%
		EBR	200	50	25%	50	25%	50	25%	50	25%
		WBL	150	25	17%	50	33%	50	33%	100	67%
		WBT	380	50	13%	50	13%	50	13%	75	20%
		WBR	150	25	17%	25	17%	50	33%	50	33%
		NBL	135	150	111%	200	148%	125	93%	225	167%
		NBTR	2380	125	5%	175	7%	225	9%	275	12%
		SBL	150	50	33%	75	50%	150	100%	200	133%
		SBTR	290	125	43%	150	52%	200	69%	250	86%

Existing & Future Baseline Conditions Traffic Analysis Technical Memorandum Appendix B - Intersection Operation Results

Table B.3 - Intersection Operation Metrics; Existing & Future Baseline Conditions

ID	Intersection	Lane Group	Storage Length (feet)[1]	AM Peak – 2022 Existing: 95th Percentile Queue (feet)	AM Peak – 2022 Existing: % of Distance in 95th Percentile Queue[2]	AM Peak – 2045 Future Baseline: 95th Percentile Queue (feet)	AM Peak – 2045 Future Baseline: % of Distance in 95th Percentile Queue[2]	PM Peak – 2022 Existing: 95th Percentile Queue (feet)	PM Peak – 2022 Existing: % of Distance in 95th Percentile Queue[2]	PM Peak – 2045 Future Baseline: 95th Percentile Queue (feet)	PM Peak – 2045 Future Baseline: % of Distance in 95th Percentile Queue[2]
12	N Pearl St (SR 507) & W Reynolds Ave	EBLT	5420	75	1%	150	3%	300	6%	350	6%
		EBR	120	25	21%	50	42%	50	42%	75	63%
		WBLTR	180	25	14%	25	14%	25	14%	25	14%
		NBL	120	25	21%	50	42%	75	63%	100	83%
		NBTR	760	25	3%	75	10%	125	16%	200	26%
		SBL	90	0	0%	0	0%	0	0%	0	0%
		SBTR	970	175	18%	325	34%	300	31%	525	54%
13	Johnson Rd & Harrison Ave	EBL	90	25	28%	25	28%	50	56%	50	56%
		EBTR	460	225	49%	350	76%	275	60%	400	87%
		WBL	150	275	183%	375	250%	275	183%	300	200%
		WBTR	540	175	32%	275	51%	50	9%	200	37%
		NBLT	390	75	19%	100	26%	150	38%	150	38%
		NBR	90	0	0%	0	0%	0	0%	0	0%
		SBLTR	320	175	55%	300	94%	250	78%	225	70%
14	Belmont Ave & Harrison Ave	EBL	200	50	25%	75	38%	75	38%	100	50%
		EBTR	540	225	42%	250	46%	175	32%	325	60%
		WBL	330	25	8%	25	8%	75	23%	225	68%
		WBTR	520	200	38%	125	24%	650	125%	650	125%
		NBLT	110	25	23%	50	45%	75	68%	75	68%
		NBR	150	0	0%	0	0%	75	50%	150	100%
		SBL	185	125	68%	150	81%	300	162%	375	203%
		SBLTR	290	125	43%	150	52%	300	103%	375	129%
15	I-5 SB Ramps & Harrison Ave	EBT	520	125	24%	75	14%	300	58%	250	48%
		EBR	275	200	73%	125	45%	925	336%	1000	364%
		WBL	160	25	16%	50	31%	100	63%	150	94%
		WBT	450	100	22%	125	28%	250	56%	325	72%
		SBL	920	150	16%	150	16%	250	27%	300	33%
		SBLT	1920	150	8%	175	9%	250	13%	300	16%
		SBR	450	50	11%	75	17%	100	22%	150	33%
16	I-5 NB Ramps & Harrison Ave	EBL	180	75	42%	100	56%	150	83%	225	125%
		EBT	450	100	22%	100	22%	275	61%	325	72%
		WBT	460	100	22%	125	27%	275	60%	350	76%
		WBR	240	50	21%	50	21%	75	31%	225	94%
		NBL	2490	175	7%	200	8%	300	12%	350	14%
		NBT	480	100	21%	125	26%	200	42%	250	52%
		NBR	400	0	0%	0	0%	0	0%	0	0%

Notes:

1 -Rounded to nearest 10, if storage length beyond 2500 feet, 2500 feet used

2 -Percentage of storage space utilized by vehicles in queue

- The yellow highlight indicates an intersection operating at capacity while a pink highlight denotes failing conditions with severe delays.

APPENDIX A.6 SIMTRAFFIC QUEUEING RESULTS

Existing & Future Baseline Conditions Traffic Analysis Technical Memorandum Appendix C - SimTraffic Queueing Results

Table C.1 - SimTraffic Intersection Lane Group Queuing Metrics; By Lane Group; Future Baseline Conditions

ID	Intersection	Lane Group	Storage Length (feet)[1]	AM Peak 2045 Future Baseline: 95th Percentile Queue (feet)	AM Peak 2045 Future Baseline: % of Distance in 95th Percentile Queue[2]	PM Peak 2045 Future Baseline: 95th Percentile Queue (feet)	PM Peak 2045 Future Baseline: % of Distance in 95th Percentile Queue[2]
1	Elderberry St SW & Old Hwy 99 SW/US 12	EBL	560	62	11%	69	12%
		EBT	2500	268	11%	196	8%
		EBR	50	121	242%	118	236%
		WBL	825	176	21%	1094	133%
		WBT	1020	301	30%	1424	140%
		WBR	1020	69	7%	1321	130%
		NBL	350	131	37%	137	39%
		NBT	480	852	178%	382	80%
		NBR	390	564	145%	411	105%
		SBL	280	339	121%	317	113%
		SBT	330	370	112%	455	138%
		SBR	50	83	166%	54	108%
2	I-5 SB Ramps & Old Hwy 99	EBT	1020	1458	143%	261	26%
		EBR	310	371	120%	276	89%
		WBL	200	297	149%	328	164%
		WBT	610	371	61%	889	146%
		SBTL	2150	211	10%	105	5%
		SBR	370	194	52%	582	157%
3	I-5 NB Ramps & Old Hwy 99	EBL	300	384	128%	418	139%
		EBT	610	844	138%	349	57%
		WBTR	310	385	124%	410	132%
		NBL	240	321	134%	416	173%
		NBLT	1390	273	20%	589	42%
		NBR	400	80	20%	146	37%
8	Harrison Ave & Galvin Rd/W Reynolds Ave	EBL	100	72	72%	74	74%
		EBT	1220	65	5%	505	41%
		EBR	200	73	37%	274	137%
		WBL	150	60	40%	199	133%
		WBT	380	50	13%	372	98%
		WBR	150	42	28%	57	38%
		NBL	135	208	154%	224	166%
		NBTR	2380	678	28%	2262	95%
		SBL	150	95	63%	261	174%
		SBTR	290	171	59%	472	163%
12	N Pearl St (SR 507) & W Reynolds Ave	EBLT	5420	161	3%	274	5%
		EBR	120	80	67%	197	164%
		WBLTR	180	34	19%	46	26%
		NBL	120	105	88%	183	153%
		NBTR	760	93	12%	209	28%
		SBL	90	0	0%	0	0%
		SBTR	970	228	24%	669	69%
13	Johnson Rd & Harrison Ave	EBL	90	38	42%	87	97%
		EBTR	460	293	64%	683	148%
		WBL	150	210	140%	203	135%
		WBTR	540	363	67%	603	112%
		NBLT	390	104	27%	567	145%
		NBR	90	58	64%	161	179%
		SBLTR	320	273	85%	386	121%
14	Belmont Ave & Harrison Ave	EBL	200	101	51%	255	128%
		EBT	540	271	50%	713	132%
		EBTR	540	377	70%	735	136%
		WBL	330	92	28%	451	137%
		WBT	520	281	54%	585	113%
		WBTR	520	312	60%	575	111%
		NBLT	110	60	55%	203	185%
		NBR	150	66	44%	180	120%
		SBL	185	171	92%	254	137%
		SBLTR	290	273	94%	367	127%
15	I-5 SB Ramps & Harrison Ave	EBT	520	259	50%	643	124%
		EBR	275	313	114%	400	145%
		WBL	160	63	39%	297	186%
		WBT	450	169	38%	607	135%
		SBL	920	125	14%	247	27%
		SBLT	1920	159	8%	245	13%
		SBR	450	127	28%	202	45%
16	I-5 NB Ramps & Harrison Ave	EBL	180	204	113%	314	174%
		EBT	450	150	33%	609	135%
		WBT	460	163	35%	524	114%
		WBR	240	77	32%	354	148%
		NBL	2490	229	9%	755	30%
		NBT	480	140	29%	253	53%
		NBR	400	0	0%	89	22%

Notes:

1 -Rounded to nearest 10, if storage length beyond 2500 feet, 2500 feet used

2 -Percentage of storage space utilized by vehicles in queue

APPENDIX A.7 SYNCHRO OUTPUT SHEETS

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	25	355	80	280	270	110	55	70	335	225	120	35
Future Volume (vph)	25	355	80	280	270	110	55	70	335	225	120	35
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	4.5	4.9	4.9	4.5	4.9	4.9	4.5	4.9	4.9	4.5	4.9	4.9
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1568	1651	1403	2932	1591	1352	1554	1636	1390	1583	1667	1417
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1568	1651	1403	2932	1591	1352	1554	1636	1390	1583	1667	1417
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	28	403	91	318	307	125	62	80	381	256	136	40
RTOR Reduction (vph)	0	0	60	0	0	69	0	0	335	0	0	33
Lane Group Flow (vph)	28	403	31	318	307	56	63	80	46	256	136	7
Heavy Vehicles (%)	6%	6%	6%	10%	10%	10%	7%	7%	7%	5%	5%	5%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6			8			4
Actuated Green, G (s)	4.9	36.8	36.8	16.9	48.8	48.8	16.8	13.0	13.0	23.2	19.4	19.4
Effective Green, g (s)	4.9	36.8	36.8	16.9	48.8	48.8	16.8	13.0	13.0	23.2	19.4	19.4
Actuated g/C Ratio	0.05	0.34	0.34	0.16	0.45	0.45	0.15	0.12	0.12	0.21	0.18	0.18
Clearance Time (s)	4.5	4.9	4.9	4.5	4.9	4.9	4.5	4.9	4.9	4.5	4.9	4.9
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	70	558	474	455	714	606	240	195	166	337	297	252
v/s Ratio Prot	0.02	c0.24		c0.11	0.19		c0.04	c0.05		c0.16	0.08	
v/s Ratio Perm			0.02			0.04			0.03			0.01
v/c Ratio	0.40	0.72	0.06	0.70	0.43	0.09	0.26	0.41	0.27	0.76	0.46	0.03
Uniform Delay, d1	50.5	31.5	24.3	43.5	20.5	17.2	40.5	44.3	43.6	40.1	39.9	36.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.7	4.6	0.1	4.7	0.4	0.1	0.6	1.4	0.9	9.5	1.1	0.0
Delay (s)	54.2	36.1	24.4	48.1	20.9	17.3	41.1	45.7	44.5	49.6	41.1	36.9
Level of Service	D	D	C	D	C	B	D	D	D	D	D	D
Approach Delay (s)		35.0			31.8			44.2			45.7	
Approach LOS		D			C			D			D	

Intersection Summary			
HCM 2000 Control Delay	38.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	108.7	Sum of lost time (s)	18.8
Intersection Capacity Utilization	68.3%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	490	425	150	410	0	0	0	0	25	5	250
Future Volume (vph)	0	490	425	150	410	0	0	0	0	25	5	250
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)		5.9	5.9	5.5	5.9						5.9	5.9
Lane Util. Factor		0.95	1.00	1.00	0.95						1.00	0.88
Frt		1.00	0.85	1.00	1.00						1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00						0.96	1.00
Satd. Flow (prot)		3107	1390	1539	3079						1487	2317
Flt Permitted		1.00	1.00	0.95	1.00						0.96	1.00
Satd. Flow (perm)		3107	1390	1539	3079						1487	2317
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	0	551	478	169	461	0	0	0	0	28	6	281
RTOR Reduction (vph)	0	0	319	0	0	0	0	0	0	0	0	233
Lane Group Flow (vph)	0	551	159	169	461	0	0	0	0	0	34	48
Heavy Vehicles (%)	7%	7%	7%	8%	8%	8%	0%	0%	0%	13%	13%	13%
Turn Type		NA	Perm	Prot	NA					Perm	NA	Perm
Protected Phases		2		1	6						4	
Permitted Phases			2							4		4
Actuated Green, G (s)		20.8	20.8	13.7	40.0						10.6	10.6
Effective Green, g (s)		20.8	20.8	13.7	40.0						10.6	10.6
Actuated g/C Ratio		0.33	0.33	0.22	0.64						0.17	0.17
Clearance Time (s)		5.9	5.9	5.5	5.9						5.9	5.9
Vehicle Extension (s)		3.0	3.0	3.5	5.0						4.0	4.0
Lane Grp Cap (vph)		1035	463	337	1973						252	393
v/s Ratio Prot		c0.18		c0.11	0.15							
v/s Ratio Perm			0.11								0.02	0.02
v/c Ratio		0.53	0.34	0.50	0.23						0.13	0.12
Uniform Delay, d1		16.9	15.7	21.4	4.7						22.0	22.0
Progression Factor		1.00	1.00	1.00	1.00						1.00	1.00
Incremental Delay, d2		0.5	0.4	1.4	0.1						0.3	0.2
Delay (s)		17.4	16.1	22.7	4.9						22.3	22.1
Level of Service		B	B	C	A						C	C
Approach Delay (s)		16.8			9.7			0.0			22.2	
Approach LOS		B			A			A			C	

Intersection Summary			
HCM 2000 Control Delay	15.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	62.4	Sum of lost time (s)	17.3
Intersection Capacity Utilization	60.5%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	415	100	0	0	315	95	245	0	110	0	0	0
Future Volume (vph)	415	100	0	0	315	95	245	0	110	0	0	0
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	5.5	5.9			5.9		5.9	5.9	5.9			
Lane Util. Factor	1.00	0.95			0.95		0.95	0.95	1.00			
Frpb, ped/bikes	1.00	1.00			1.00		1.00	1.00	1.00			
Flpb, ped/bikes	1.00	1.00			1.00		1.00	1.00	1.00			
Frt	1.00	1.00			0.97		1.00	1.00	0.85			
Flt Protected	0.95	1.00			1.00		0.95	0.95	1.00			
Satd. Flow (prot)	1539	3079			3028		1398	1398	1316			
Flt Permitted	0.95	1.00			1.00		0.95	0.95	1.00			
Satd. Flow (perm)	1539	3079			3028		1398	1398	1316			
Peak-hour factor, PHF	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Adj. Flow (vph)	477	115	0	0	362	109	282	0	126	0	0	0
RTOR Reduction (vph)	0	0	0	0	20	0	0	0	102	0	0	0
Lane Group Flow (vph)	477	115	0	0	451	0	141	141	24	0	0	0
Confl. Peds. (#/hr)			1	1								
Heavy Vehicles (%)	8%	8%	8%	6%	6%	6%	13%	13%	13%	0%	0%	0%
Turn Type	Prot	NA			NA		Perm	NA	Perm			
Protected Phases	5	2			6			8				
Permitted Phases							8		8			
Actuated Green, G (s)	37.7	65.3			22.1		17.7	17.7	17.7			
Effective Green, g (s)	37.7	65.3			22.1		17.7	17.7	17.7			
Actuated g/C Ratio	0.40	0.69			0.23		0.19	0.19	0.19			
Clearance Time (s)	5.5	5.9			5.9		5.9	5.9	5.9			
Vehicle Extension (s)	4.0	3.0			3.5		4.0	4.0	4.0			
Lane Grp Cap (vph)	612	2120			705		261	261	245			
v/s Ratio Prot	c0.31	0.04			c0.15							
v/s Ratio Perm							c0.10	0.10	0.02			
v/c Ratio	0.78	0.05			0.64		0.54	0.54	0.10			
Uniform Delay, d1	24.9	4.8			32.8		34.9	34.9	31.9			
Progression Factor	1.00	1.00			1.00		1.00	1.00	1.00			
Incremental Delay, d2	6.6	0.0			2.0		2.8	2.8	0.2			
Delay (s)	31.5	4.8			34.8		37.7	37.7	32.2			
Level of Service	C	A			C		D	D	C			
Approach Delay (s)		26.3			34.8			36.0			0.0	
Approach LOS		C			C			D			A	

Intersection Summary			
HCM 2000 Control Delay	31.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	94.8	Sum of lost time (s)	17.3
Intersection Capacity Utilization	60.5%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥			✥			✥	
Traffic Volume (veh/h)	0	0	0	5	0	5	0	215	0	5	220	0
Future Volume (Veh/h)	0	0	0	5	0	5	0	215	0	5	220	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Hourly flow rate (vph)	0	0	0	6	0	6	0	250	0	6	256	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	524	518	256	518	518	250	256			250		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	524	518	256	518	518	250	256			250		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.3			4.2		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.4			2.3		
p0 queue free %	100	100	100	99	100	99	100			100		
cM capacity (veh/h)	462	462	788	470	462	794	1226			1259		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	0	12	250	262
Volume Left	0	6	0	6
Volume Right	0	6	0	0
cSH	1700	590	1226	1259
Volume to Capacity	0.00	0.02	0.00	0.00
Queue Length 95th (ft)	0	2	0	0
Control Delay (s)	0.0	11.2	0.0	0.2
Lane LOS	A	B		A
Approach Delay (s)	0.0	11.2	0.0	0.2
Approach LOS	A	B		

Intersection Summary				
Average Delay		0.4		
Intersection Capacity Utilization		26.9%	ICU Level of Service	A
Analysis Period (min)		15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	20	0	5	0	0	0	5	205	0	0	225	5
Future Volume (Veh/h)	20	0	5	0	0	0	5	205	0	0	225	5
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Hourly flow rate (vph)	23	0	6	0	0	0	6	236	0	0	259	6
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	510	510	262	516	513	236	265			236		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	510	510	262	516	513	236	265			236		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.2			4.2		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.3			2.3		
p0 queue free %	95	100	99	100	100	100	100			100		
cM capacity (veh/h)	475	467	782	467	465	808	1259			1280		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1
Volume Total	29	0	6	236	265
Volume Left	23	0	6	0	0
Volume Right	6	0	0	0	6
cSH	517	1700	1259	1700	1280
Volume to Capacity	0.06	0.00	0.00	0.14	0.00
Queue Length 95th (ft)	4	0	0	0	0
Control Delay (s)	12.4	0.0	7.9	0.0	0.0
Lane LOS	B	A	A		
Approach Delay (s)	12.4	0.0	0.2		0.0
Approach LOS	B	A			

Intersection Summary			
Average Delay	0.8		
Intersection Capacity Utilization	23.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑		↰	↱		↰	↑	↱	↰	↱	
Traffic Volume (veh/h)	5	0	10	15	0	20	5	180	20	25	200	0
Future Volume (Veh/h)	5	0	10	15	0	20	5	180	20	25	200	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Hourly flow rate (vph)	6	0	11	17	0	23	6	207	23	29	230	0
Pedestrians					1							
Lane Width (ft)					12.0							
Walking Speed (ft/s)					3.5							
Percent Blockage					0							
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	530	531	230	519	508	208	230			231		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	530	531	230	519	508	208	230			231		
tC, single (s)	7.1	6.5	6.2	7.7	7.1	6.8	4.2			4.2		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	4.0	4.5	3.8	2.3			2.3		
p0 queue free %	99	100	99	96	100	97	100			98		
cM capacity (veh/h)	438	444	814	378	388	713	1309			1295		

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2	NB 3	SB 1	SB 2
Volume Total	17	17	23	6	207	23	29	230
Volume Left	6	17	0	6	0	0	29	0
Volume Right	11	0	23	0	0	23	0	0
cSH	625	378	713	1309	1700	1700	1295	1700
Volume to Capacity	0.03	0.04	0.03	0.00	0.12	0.01	0.02	0.14
Queue Length 95th (ft)	2	4	2	0	0	0	2	0
Control Delay (s)	10.9	15.0	10.2	7.8	0.0	0.0	7.8	0.0
Lane LOS	B	B	B	A			A	
Approach Delay (s)	10.9	12.2		0.2			0.9	
Approach LOS	B	B						

Intersection Summary			
Average Delay	1.7		
Intersection Capacity Utilization	30.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	20	0	225	55	0	220
Future Volume (Veh/h)	20	0	225	55	0	220
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96
Hourly flow rate (vph)	21	0	234	57	0	229
Pedestrians	1					
Lane Width (ft)	12.0					
Walking Speed (ft/s)	3.5					
Percent Blockage	0					
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	492	264			292	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	492	264			292	
tC, single (s)	6.4	6.2			4.2	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.3	
p0 queue free %	96	100			100	
cM capacity (veh/h)	530	767			1208	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	21	291	229
Volume Left	21	0	0
Volume Right	0	57	0
cSH	530	1700	1208
Volume to Capacity	0.04	0.17	0.00
Queue Length 95th (ft)	3	0	0
Control Delay (s)	12.1	0.0	0.0
Lane LOS	B		
Approach Delay (s)	12.1	0.0	0.0
Approach LOS	B		

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	26.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	35	55	140	25	55	75	125	195	30	50	180	25
Future Volume (vph)	35	55	140	25	55	75	125	195	30	50	180	25
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5		4.5	4.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.98	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	0.98	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1421	1496	1271	1498	1577	1310	1421	1462		1484	1529	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1421	1496	1271	1498	1577	1310	1421	1462		1484	1529	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	39	61	156	28	61	83	139	217	33	56	200	28
RTOR Reduction (vph)	0	0	131	0	0	71	0	5	0	0	5	0
Lane Group Flow (vph)	39	61	25	28	61	12	139	245	0	56	223	0
Confl. Bikes (#/hr)						1			1			3
Heavy Vehicles (%)	17%	17%	17%	11%	11%	11%	17%	17%	17%	12%	12%	12%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8						
Actuated Green, G (s)	2.5	7.8	7.8	1.6	6.9	6.9	6.0	18.0		3.7	15.7	
Effective Green, g (s)	2.5	7.8	7.8	1.6	6.9	6.9	6.0	18.0		3.7	15.7	
Actuated g/C Ratio	0.05	0.16	0.16	0.03	0.14	0.14	0.12	0.37		0.08	0.32	
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5		4.5	4.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	72	237	201	48	221	184	173	535		111	488	
v/s Ratio Prot	c0.03	c0.04		0.02	0.04		c0.10	c0.17		0.04	0.15	
v/s Ratio Perm			0.02			0.01						
v/c Ratio	0.54	0.26	0.12	0.58	0.28	0.06	0.80	0.46		0.50	0.46	
Uniform Delay, d1	22.7	18.1	17.7	23.4	18.9	18.3	21.0	11.8		21.8	13.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	8.1	0.6	0.3	16.8	0.7	0.1	23.0	0.6		3.6	0.7	
Delay (s)	30.8	18.7	18.0	40.2	19.5	18.4	43.9	12.5		25.4	14.0	
Level of Service	C	B	B	D	B	B	D	B		C	B	
Approach Delay (s)		20.1			22.4			23.7			16.2	
Approach LOS		C			C			C			B	

Intersection Summary				
HCM 2000 Control Delay	20.7	HCM 2000 Level of Service	C	
HCM 2000 Volume to Capacity ratio	0.52			
Actuated Cycle Length (s)	49.1	Sum of lost time (s)	18.0	
Intersection Capacity Utilization	39.5%	ICU Level of Service	A	
Analysis Period (min)	15			

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	100	35	65	135	20	25	15	45	15	5	5
Future Volume (Veh/h)	5	100	35	65	135	20	25	15	45	15	5	5
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81
Hourly flow rate (vph)	6	123	43	80	167	25	31	19	56	19	6	6
Pedestrians								1				
Lane Width (ft)								12.0				
Walking Speed (ft/s)								3.5				
Percent Blockage								0				
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	192			167			506	510	146	562	518	180
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	192			167			506	510	146	562	518	180
tC, single (s)	4.2			4.2			7.4	6.8	6.5	7.7	7.1	6.8
tC, 2 stage (s)												
tF (s)	2.3			2.3			3.7	4.2	3.5	4.0	4.5	3.8
p0 queue free %	100			94			92	95	93	94	98	99
cM capacity (veh/h)	1358			1340			408	405	839	311	365	738

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	172	272	106	31
Volume Left	6	80	31	19
Volume Right	43	25	56	6
cSH	1358	1340	559	362
Volume to Capacity	0.00	0.06	0.19	0.09
Queue Length 95th (ft)	0	5	17	7
Control Delay (s)	0.3	2.7	12.9	15.9
Lane LOS	A	A	B	C
Approach Delay (s)	0.3	2.7	12.9	15.9
Approach LOS			B	C

Intersection Summary			
Average Delay	4.6		
Intersection Capacity Utilization	37.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	165	15	115	225	15	90
Future Volume (Veh/h)	165	15	115	225	15	90
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86
Hourly flow rate (vph)	192	17	134	262	17	105
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			209		730	200
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			209		730	200
tC, single (s)			4.2		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.3		3.5	3.3
p0 queue free %			90		95	88
cM capacity (veh/h)			1327		350	840

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2
Volume Total	209	134	262	17	105
Volume Left	0	134	0	17	0
Volume Right	17	0	0	0	105
cSH	1700	1327	1700	350	840
Volume to Capacity	0.12	0.10	0.15	0.05	0.12
Queue Length 95th (ft)	0	8	0	4	11
Control Delay (s)	0.0	8.0	0.0	15.8	9.9
Lane LOS		A		C	A
Approach Delay (s)	0.0	2.7		10.7	
Approach LOS				B	

Intersection Summary			
Average Delay	3.3		
Intersection Capacity Utilization	30.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	5	250	335	5	0	5
Future Volume (Veh/h)	5	250	335	5	0	5
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80
Hourly flow rate (vph)	6	312	419	6	0	6
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	425				746	422
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	425				746	422
tC, single (s)	4.2				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.3				3.5	3.3
p0 queue free %	99				100	99
cM capacity (veh/h)	1108				382	636

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	6	312	425	6
Volume Left	6	0	0	0
Volume Right	0	0	6	6
cSH	1108	1700	1700	636
Volume to Capacity	0.01	0.18	0.25	0.01
Queue Length 95th (ft)	0	0	0	1
Control Delay (s)	8.3	0.0	0.0	10.7
Lane LOS	A			B
Approach Delay (s)	0.2		0.0	10.7
Approach LOS				B

Intersection Summary			
Average Delay	0.2		
Intersection Capacity Utilization	29.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	95	5	105	5	5	0	95	85	0	0	160	165
Future Volume (vph)	95	5	105	5	5	0	95	85	0	0	160	165
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)		5.0	5.0		5.0		4.5	5.0			5.0	
Lane Util. Factor		1.00	1.00		1.00		1.00	1.00			1.00	
Frpb, ped/bikes		1.00	1.00		1.00		1.00	1.00			0.99	
Flpb, ped/bikes		1.00	1.00		1.00		1.00	1.00			1.00	
Frt		1.00	0.85		1.00		1.00	1.00			0.92	
Flt Protected		0.95	1.00		0.98		0.95	1.00			1.00	
Satd. Flow (prot)		1561	1390		1707		1484	1562			1508	
Flt Permitted		0.73	1.00		0.87		0.43	1.00			1.00	
Satd. Flow (perm)		1191	1390		1524		668	1562			1508	
Peak-hour factor, PHF	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Adj. Flow (vph)	112	6	124	6	6	0	112	100	0	0	188	194
RTOR Reduction (vph)	0	0	95	0	0	0	0	0	0	0	37	0
Lane Group Flow (vph)	0	118	29	0	12	0	112	100	0	0	345	0
Confl. Peds. (#/hr)							2		1	1		2
Heavy Vehicles (%)	7%	7%	7%	0%	0%	0%	12%	12%	12%	6%	6%	6%
Turn Type	Perm	NA	Perm	Perm	NA		D.P+P	NA		D.P+P	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8			6			2		
Actuated Green, G (s)		11.7	11.7		11.7		23.8	28.3			18.0	
Effective Green, g (s)		11.7	11.7		11.7		23.8	28.3			18.0	
Actuated g/C Ratio		0.23	0.23		0.23		0.48	0.57			0.36	
Clearance Time (s)		5.0	5.0		5.0		4.5	5.0			5.0	
Vehicle Extension (s)		3.0	3.0		3.0		3.0	3.0			3.0	
Lane Grp Cap (vph)		278	325		356		412	884			542	
v/s Ratio Prot							c0.03	0.06			c0.23	
v/s Ratio Perm		c0.10	0.02		0.01		0.10					
v/c Ratio		0.42	0.09		0.03		0.27	0.11			0.64	
Uniform Delay, d1		16.3	15.0		14.8		7.6	5.0			13.3	
Progression Factor		1.00	1.00		1.00		1.00	1.00			1.00	
Incremental Delay, d2		1.0	0.1		0.0		0.4	0.1			2.5	
Delay (s)		17.3	15.1		14.8		7.9	5.1			15.7	
Level of Service		B	B		B		A	A			B	
Approach Delay (s)		16.2			14.8			6.6			15.7	
Approach LOS		B			B			A			B	

Intersection Summary			
HCM 2000 Control Delay	13.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	50.0	Sum of lost time (s)	14.5
Intersection Capacity Utilization	48.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	5	355	15	210	350	70	25	20	160	90	25	5
Future Volume (vph)	5	355	15	210	350	70	25	20	160	90	25	5
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	4.0	4.5		4.0	4.5			4.0	4.0		4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00	1.00		1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	0.99		1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00		1.00	
Frt	1.00	0.99		1.00	0.98			1.00	0.85		0.99	
Flt Protected	0.95	1.00		0.95	1.00			0.97	1.00		0.96	
Satd. Flow (prot)	1433	2847		1458	2834			1653	1423		1396	
Flt Permitted	0.95	1.00		0.95	1.00			0.97	1.00		0.96	
Satd. Flow (perm)	1433	2847		1458	2834			1653	1423		1396	
Peak-hour factor, PHF	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Adj. Flow (vph)	6	408	17	241	402	80	29	23	184	103	29	6
RTOR Reduction (vph)	0	2	0	0	6	0	0	0	0	0	1	0
Lane Group Flow (vph)	6	423	0	241	476	0	0	52	184	0	137	0
Confl. Peds. (#/hr)	1					1			8	8		
Confl. Bikes (#/hr)			1						1			1
Heavy Vehicles (%)	16%	16%	16%	14%	14%	14%	3%	3%	3%	20%	20%	20%
Turn Type	Prot	NA		Prot	NA		Split	NA	Free	Split	NA	
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases									Free			
Actuated Green, G (s)	1.0	20.9		32.4	52.3			9.0	94.3		15.5	
Effective Green, g (s)	1.0	20.9		32.4	52.3			9.0	94.3		15.5	
Actuated g/C Ratio	0.01	0.22		0.34	0.55			0.10	1.00		0.16	
Clearance Time (s)	4.0	4.5		4.0	4.5			4.0			4.0	
Vehicle Extension (s)	3.0	3.5		3.0	3.5			3.0			3.0	
Lane Grp Cap (vph)	15	630		500	1571			157	1423		229	
v/s Ratio Prot	0.00	c0.15		c0.17	0.17			c0.03			c0.10	
v/s Ratio Perm									0.13			
v/c Ratio	0.40	0.67		0.48	0.30			0.33	0.13		0.60	
Uniform Delay, d1	46.4	33.6		24.3	11.2			39.8	0.0		36.5	
Progression Factor	1.00	1.00		1.00	1.00			1.00	1.00		1.00	
Incremental Delay, d2	16.6	2.9		0.7	0.1			1.2	0.2		4.2	
Delay (s)	62.9	36.5		25.1	11.4			41.1	0.2		40.7	
Level of Service	E	D		C	B			D	A		D	
Approach Delay (s)		36.9			15.9			9.2			40.7	
Approach LOS		D			B			A			D	

Intersection Summary			
HCM 2000 Control Delay	23.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	94.3	Sum of lost time (s)	16.5
Intersection Capacity Utilization	48.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	30	590	20	55	635	175	5	15	40	230	25	10
Future Volume (vph)	30	590	20	55	635	175	5	15	40	230	25	10
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	4.5	5.0		4.5	5.0			4.5	4.5	4.5	4.5	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00	1.00	0.95	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	0.99			1.00	1.00	1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00	1.00	1.00	
Frt	1.00	1.00		1.00	0.97			1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00			0.99	1.00	0.95	0.96	
Satd. Flow (prot)	1484	2952		1539	2964			1727	1488	1564	1568	
Flt Permitted	0.95	1.00		0.33	1.00			0.99	1.00	0.95	0.96	
Satd. Flow (perm)	1484	2952		527	2964			1727	1488	1564	1568	
Peak-hour factor, PHF	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Adj. Flow (vph)	34	678	23	63	730	201	6	17	46	264	29	11
RTOR Reduction (vph)	0	2	0	0	20	0	0	0	43	0	3	0
Lane Group Flow (vph)	34	699	0	63	911	0	0	23	3	153	148	0
Confl. Peds. (#/hr)	1					1	10					10
Confl. Bikes (#/hr)			1			2						
Heavy Vehicles (%)	12%	12%	12%	8%	8%	8%	0%	0%	0%	1%	1%	1%
Turn Type	Prot	NA		pm+pt	NA		Split	NA	Perm	Split	NA	
Protected Phases	1	6		5	2		4	4		8	8	
Permitted Phases				2					4			
Actuated Green, G (s)	4.5	48.1		54.8	49.2			5.5	5.5	15.3	15.3	
Effective Green, g (s)	4.5	48.1		54.8	49.2			5.5	5.5	15.3	15.3	
Actuated g/C Ratio	0.05	0.52		0.59	0.53			0.06	0.06	0.16	0.16	
Clearance Time (s)	4.5	5.0		4.5	5.0			4.5	4.5	4.5	4.5	
Vehicle Extension (s)	3.0	3.5		3.0	3.5			3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	71	1526		371	1568			102	88	257	257	
v/s Ratio Prot	c0.02	0.24		0.01	c0.31			c0.01		c0.10	0.09	
v/s Ratio Perm				0.09					0.00			
v/c Ratio	0.48	0.46		0.17	0.58			0.23	0.03	0.60	0.57	
Uniform Delay, d1	43.1	14.2		8.5	14.9			41.7	41.2	36.0	35.8	
Progression Factor	1.00	1.00		0.58	0.56			1.00	1.00	1.00	1.00	
Incremental Delay, d2	5.0	1.0		0.2	1.5			1.1	0.1	3.7	3.1	
Delay (s)	48.1	15.2		5.1	9.8			42.8	41.4	39.7	38.9	
Level of Service	D	B		A	A			D	D	D	D	
Approach Delay (s)		16.7			9.5			41.9			39.3	
Approach LOS		B			A			D			D	

Intersection Summary			
HCM 2000 Control Delay	17.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	93.0	Sum of lost time (s)	18.5
Intersection Capacity Utilization	57.4%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	480	395	55	695	0	0	0	0	185	120	270
Future Volume (vph)	0	480	395	55	695	0	0	0	0	185	120	270
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)		5.0	5.0	4.5	5.0					4.5	4.5	4.5
Lane Util. Factor		0.95	1.00	0.97	0.95					0.95	0.95	0.88
Frpb, ped/bikes		1.00	0.98	1.00	1.00					1.00	1.00	1.00
Flpb, ped/bikes		1.00	1.00	1.00	1.00					1.00	1.00	1.00
Frt		1.00	0.85	1.00	1.00					1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95	0.99	1.00
Satd. Flow (prot)		3050	1344	2986	3079					1504	1566	2493
Flt Permitted		1.00	1.00	0.95	1.00					0.95	0.99	1.00
Satd. Flow (perm)		3050	1344	2986	3079					1504	1566	2493
Peak-hour factor, PHF	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Adj. Flow (vph)	0	565	465	65	818	0	0	0	0	218	141	318
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	179
Lane Group Flow (vph)	0	565	465	65	818	0	0	0	0	177	182	139
Confl. Peds. (#/hr)	4		2	2		4						
Confl. Bikes (#/hr)			3			2						
Heavy Vehicles (%)	9%	9%	9%	8%	8%	8%	0%	0%	0%	5%	5%	5%
Turn Type		NA	Perm	Prot	NA					Split	NA	Perm
Protected Phases		2		1	6					4	4	
Permitted Phases			2									4
Actuated Green, G (s)		54.6	54.6	6.3	65.4					18.1	18.1	18.1
Effective Green, g (s)		54.6	54.6	6.3	65.4					18.1	18.1	18.1
Actuated g/C Ratio		0.59	0.59	0.07	0.70					0.19	0.19	0.19
Clearance Time (s)		5.0	5.0	4.5	5.0					4.5	4.5	4.5
Vehicle Extension (s)		3.5	3.5	3.0	3.5					3.5	3.5	3.5
Lane Grp Cap (vph)		1790	789	202	2165					292	304	485
v/s Ratio Prot		0.19		0.02	c0.27					c0.12	0.12	
v/s Ratio Perm			c0.35									0.06
v/c Ratio		0.32	0.59	0.32	0.38					0.61	0.60	0.29
Uniform Delay, d1		9.7	12.1	41.3	5.6					34.2	34.1	31.9
Progression Factor		0.75	0.70	1.06	0.60					1.00	1.00	1.00
Incremental Delay, d2		0.4	3.0	0.9	0.5					3.7	3.3	0.4
Delay (s)		7.8	11.5	44.5	3.8					37.9	37.5	32.3
Level of Service		A	B	D	A					D	D	C
Approach Delay (s)		9.5			6.8			0.0			35.2	
Approach LOS		A			A			A			D	

Intersection Summary			
HCM 2000 Control Delay	15.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	93.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	56.2%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	210	455	0	0	290	245	460	135	90	0	0	0
Future Volume (vph)	210	455	0	0	290	245	460	135	90	0	0	0
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	4.5	5.0			5.0	5.0	6.0	6.0	4.0			
Lane Util. Factor	0.97	0.95			0.95	1.00	0.97	1.00	1.00			
Frpb, ped/bikes	1.00	1.00			1.00	0.98	1.00	1.00	0.99			
Flpb, ped/bikes	1.00	1.00			1.00	1.00	1.00	1.00	1.00			
Frt	1.00	1.00			1.00	0.85	1.00	1.00	0.85			
Flt Protected	0.95	1.00			1.00	1.00	0.95	1.00	1.00			
Satd. Flow (prot)	3072	3167			3228	1415	3014	1636	1372			
Flt Permitted	0.95	1.00			1.00	1.00	0.95	1.00	1.00			
Satd. Flow (perm)	3072	3167			3228	1415	3014	1636	1372			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	228	495	0	0	315	266	500	147	98	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	144	0	0	0	0	0	0
Lane Group Flow (vph)	228	495	0	0	315	122	500	147	98	0	0	0
Confl. Peds. (#/hr)	7		4	4		7			3	3		
Confl. Bikes (#/hr)			3			2						
Heavy Vehicles (%)	5%	5%	5%	3%	3%	3%	7%	7%	7%	0%	0%	0%
Turn Type	Prot	NA			NA	Perm	Split	NA	Free			
Protected Phases	5	2			6		8	8				
Permitted Phases						6			Free			
Actuated Green, G (s)	12.2	59.4			42.7	42.7	22.6	22.6	93.0			
Effective Green, g (s)	12.2	59.4			42.7	42.7	22.6	22.6	93.0			
Actuated g/C Ratio	0.13	0.64			0.46	0.46	0.24	0.24	1.00			
Clearance Time (s)	4.5	5.0			5.0	5.0	6.0	6.0				
Vehicle Extension (s)	3.0	3.5			3.5	3.5	3.0	3.0				
Lane Grp Cap (vph)	402	2022			1482	649	732	397	1372			
v/s Ratio Prot	c0.07	c0.16			0.10		c0.17	0.09				
v/s Ratio Perm						0.09			0.07			
v/c Ratio	0.57	0.24			0.21	0.19	0.68	0.37	0.07			
Uniform Delay, d1	37.9	7.2			15.1	14.9	31.9	29.3	0.0			
Progression Factor	0.86	0.99			1.00	1.00	1.00	1.00	1.00			
Incremental Delay, d2	1.8	0.3			0.3	0.6	2.6	0.6	0.1			
Delay (s)	34.5	7.4			15.4	15.5	34.6	29.9	0.1			
Level of Service	C	A			B	B	C	C	A			
Approach Delay (s)		15.9			15.5			29.1			0.0	
Approach LOS		B			B			C			A	

Intersection Summary			
HCM 2000 Control Delay	20.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	93.0	Sum of lost time (s)	15.5
Intersection Capacity Utilization	56.2%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	28	403	91	318	307	125	63	80	381	256	136	40
v/c Ratio	0.25	0.74	0.17	0.68	0.42	0.18	0.24	0.43	0.77	0.74	0.45	0.11
Control Delay	54.8	42.9	3.3	50.4	23.8	4.6	40.5	53.4	16.3	53.3	48.0	0.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	54.8	42.9	3.3	50.4	23.8	4.6	40.5	53.4	16.3	53.3	48.0	0.6
Queue Length 50th (ft)	19	243	0	107	149	0	36	53	0	160	89	0
Queue Length 95th (ft)	49	#426	20	157	247	36	81	103	89	#288	155	0
Internal Link Dist (ft)		868			1020			559			326	
Turn Bay Length (ft)	560		50	825			350		390	280		50
Base Capacity (vph)	298	550	547	977	771	719	443	461	665	382	423	449
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.09	0.73	0.17	0.33	0.40	0.17	0.14	0.17	0.57	0.67	0.32	0.09

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBT	EBR	WBL	WBT	SBT	SBR
Lane Group Flow (vph)	551	478	169	461	34	281
v/c Ratio	0.54	0.61	0.50	0.23	0.14	0.45
Control Delay	19.4	5.7	28.7	4.9	27.6	6.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	19.4	5.7	28.7	4.9	27.6	6.8
Queue Length 50th (ft)	84	0	54	31	11	0
Queue Length 95th (ft)	148	55	128	52	40	34
Internal Link Dist (ft)	1020			607	372	
Turn Bay Length (ft)		310	200			180
Base Capacity (vph)	1776	999	704	2990	971	1611
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.31	0.48	0.24	0.15	0.04	0.17

Intersection Summary

Lane Group	EBL	EBT	WBT	NBL	NBT	NBR
Lane Group Flow (vph)	477	115	471	141	141	126
v/c Ratio	0.79	0.05	0.66	0.54	0.54	0.36
Control Delay	37.4	5.5	38.6	47.0	47.0	10.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	37.4	5.5	38.6	47.0	47.0	10.4
Queue Length 50th (ft)	249	10	131	83	83	0
Queue Length 95th (ft)	451	23	220	169	169	47
Internal Link Dist (ft)		607	306		404	
Turn Bay Length (ft)	300			240		
Base Capacity (vph)	852	2753	1189	619	619	653
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.56	0.04	0.40	0.23	0.23	0.19

Intersection Summary

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	39	61	156	28	61	83	139	250	56	228
v/c Ratio	0.22	0.19	0.39	0.15	0.22	0.26	0.72	0.38	0.31	0.46
Control Delay	26.4	19.3	7.9	25.1	21.1	6.2	52.5	16.3	28.3	17.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	26.4	19.3	7.9	25.1	21.1	6.2	52.5	16.3	28.3	17.9
Queue Length 50th (ft)	11	11	0	8	16	0	40	59	15	54
Queue Length 95th (ft)	38	47	42	30	46	24	#147	127	#56	115
Internal Link Dist (ft)		1222			378			2383		291
Turn Bay Length (ft)	100		200	150		150	135		150	
Base Capacity (vph)	174	1314	1135	183	1385	1165	192	1252	182	1301
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.22	0.05	0.14	0.15	0.04	0.07	0.72	0.20	0.31	0.18

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBT	EBR	WBT	NBL	NBT	SBT
Lane Group Flow (vph)	118	124	12	112	100	382
v/c Ratio	0.42	0.30	0.03	0.25	0.12	0.66
Control Delay	25.0	6.9	19.0	6.9	5.8	19.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	25.0	6.9	19.0	6.9	5.8	19.0
Queue Length 50th (ft)	30	0	3	12	11	78
Queue Length 95th (ft)	85	33	15	36	33	178
Internal Link Dist (ft)	5421		175		763	967
Turn Bay Length (ft)		120		120		
Base Capacity (vph)	767	939	982	784	1257	1206
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.15	0.13	0.01	0.14	0.08	0.32

Intersection Summary

Lane Group	EBL	EBT	WBL	WBT	NBT	NBR	SBT
Lane Group Flow (vph)	6	425	241	482	52	184	138
v/c Ratio	0.06	0.64	0.52	0.29	0.26	0.13	0.57
Control Delay	51.6	38.5	36.0	13.5	43.7	0.2	48.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	51.6	38.5	36.0	13.5	43.7	0.2	48.6
Queue Length 50th (ft)	3	111	109	62	27	0	70
Queue Length 95th (ft)	19	213	272	180	72	0	167
Internal Link Dist (ft)		457		542	390		318
Turn Bay Length (ft)	90		150			90	
Base Capacity (vph)	337	1847	515	2111	779	1423	658
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.02	0.23	0.47	0.23	0.07	0.13	0.21

Intersection Summary

Lane Group	EBL	EBT	WBL	WBT	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	34	701	63	931	23	46	153	151
v/c Ratio	0.31	0.44	0.16	0.56	0.19	0.20	0.60	0.58
Control Delay	48.3	17.3	6.2	10.8	44.0	2.0	44.3	42.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	48.3	17.3	6.2	10.8	44.0	2.0	44.3	42.4
Queue Length 50th (ft)	19	134	6	135	13	0	90	86
Queue Length 95th (ft)	48	226	21	211	36	0	130	126
Internal Link Dist (ft)		542		515	105			290
Turn Bay Length (ft)	200		330			150	185	
Base Capacity (vph)	119	1584	403	1671	139	238	428	432
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.29	0.44	0.16	0.56	0.17	0.19	0.36	0.35

Intersection Summary

Lane Group	EBT	EBR	WBL	WBT	SBL	SBT	SBR
Lane Group Flow (vph)	565	465	65	818	177	182	318
v/c Ratio	0.31	0.58	0.27	0.38	0.60	0.60	0.48
Control Delay	9.0	13.8	44.7	4.4	41.8	41.2	12.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	9.0	13.8	44.7	4.4	41.8	41.2	12.0
Queue Length 50th (ft)	72	123	20	75	102	104	27
Queue Length 95th (ft)	121	203	36	104	143	145	52
Internal Link Dist (ft)	515			447		580	
Turn Bay Length (ft)		275	160				450
Base Capacity (vph)	1818	800	465	2163	590	614	1113
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.31	0.58	0.14	0.38	0.30	0.30	0.29

Intersection Summary

Lane Group	EBL	EBT	WBT	WBR	NBL	NBT	NBR
Lane Group Flow (vph)	228	495	315	266	500	147	98
v/c Ratio	0.57	0.24	0.21	0.34	0.68	0.37	0.07
Control Delay	37.9	8.4	17.6	4.2	36.3	30.5	0.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	37.9	8.4	17.6	4.2	36.3	30.5	0.1
Queue Length 50th (ft)	54	57	55	0	140	73	0
Queue Length 95th (ft)	87	102	108	54	164	110	0
Internal Link Dist (ft)		447	460			581	
Turn Bay Length (ft)	180			240			400
Base Capacity (vph)	611	2023	1484	793	1037	562	1372
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.37	0.24	0.21	0.34	0.48	0.26	0.07

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱	↰↰	↑	↱	↰	↑	↱	↰	↑	↱
Traffic Volume (vph)	25	375	95	410	400	220	85	155	390	205	155	30
Future Volume (vph)	25	375	95	410	400	220	85	155	390	205	155	30
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	4.5	4.9	4.9	4.5	4.9	4.9	4.5	4.9	4.9	4.5	4.9	4.9
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1599	1683	1430	3101	1683	1430	1614	1699	1444	1630	1716	1458
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1599	1683	1430	3101	1683	1430	1614	1699	1444	1630	1716	1458
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	26	383	97	418	408	224	87	158	398	209	158	31
RTOR Reduction (vph)	0	0	55	0	0	97	0	0	344	0	0	27
Lane Group Flow (vph)	26	383	42	418	408	127	87	158	54	209	158	4
Heavy Vehicles (%)	4%	4%	4%	4%	4%	4%	3%	3%	3%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6			8			4
Actuated Green, G (s)	5.3	56.2	56.2	22.8	73.7	73.7	15.5	17.7	17.7	14.5	16.7	16.7
Effective Green, g (s)	5.3	56.2	56.2	22.8	73.7	73.7	15.5	17.7	17.7	14.5	16.7	16.7
Actuated g/C Ratio	0.04	0.43	0.43	0.18	0.57	0.57	0.12	0.14	0.14	0.11	0.13	0.13
Clearance Time (s)	4.5	4.9	4.9	4.5	4.9	4.9	4.5	4.9	4.9	4.5	4.9	4.9
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	65	727	618	543	954	810	192	231	196	181	220	187
v/s Ratio Prot	0.02	c0.23		c0.13	0.24		0.05	c0.09		c0.13	0.09	
v/s Ratio Perm			0.03			0.09			0.04			0.00
v/c Ratio	0.40	0.53	0.07	0.77	0.43	0.16	0.45	0.68	0.28	1.15	0.72	0.02
Uniform Delay, d1	60.8	27.1	21.6	51.1	16.1	13.4	53.3	53.5	50.4	57.8	54.4	49.5
Progression Factor	1.00	1.00	1.00	1.00	0.95	0.60	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	4.0	2.7	0.2	6.2	1.3	0.4	1.7	8.1	0.8	114.7	10.7	0.0
Delay (s)	64.8	29.8	21.8	57.3	16.6	8.4	55.0	61.6	51.2	172.4	65.0	49.6
Level of Service	E	C	C	E	B	A	E	E	D	F	E	D
Approach Delay (s)		30.1			31.1			54.3			120.2	
Approach LOS		C			C			D			F	

Intersection Summary			
HCM 2000 Control Delay	50.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	18.8
Intersection Capacity Utilization	71.9%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	465	505	185	585	0	0	0	0	60	0	445
Future Volume (vph)	0	465	505	185	585	0	0	0	0	60	0	445
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)		5.9	5.9	5.5	5.9						5.9	5.9
Lane Util. Factor		0.95	1.00	1.00	0.95						1.00	0.88
Frt		1.00	0.85	1.00	1.00						1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00						0.95	1.00
Satd. Flow (prot)		3197	1430	1583	3167						1599	2517
Flt Permitted		1.00	1.00	0.95	1.00						0.95	1.00
Satd. Flow (perm)		3197	1430	1583	3167						1599	2517
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	0	474	515	189	597	0	0	0	0	61	0	454
RTOR Reduction (vph)	0	0	203	0	0	0	0	0	0	0	0	408
Lane Group Flow (vph)	0	474	312	189	597	0	0	0	0	0	61	46
Heavy Vehicles (%)	4%	4%	4%	5%	5%	5%	0%	0%	0%	4%	4%	4%
Turn Type		NA	Perm	Prot	NA					Perm	NA	Perm
Protected Phases		2		1	6						4	
Permitted Phases			2							4		4
Actuated Green, G (s)		78.8	78.8	20.7	105.0						13.2	13.2
Effective Green, g (s)		78.8	78.8	20.7	105.0						13.2	13.2
Actuated g/C Ratio		0.61	0.61	0.16	0.81						0.10	0.10
Clearance Time (s)		5.9	5.9	5.5	5.9						5.9	5.9
Vehicle Extension (s)		3.0	3.0	3.5	5.0						4.0	4.0
Lane Grp Cap (vph)		1937	866	252	2557						162	255
v/s Ratio Prot		0.15		c0.12	0.19							
v/s Ratio Perm			c0.22								0.04	0.02
v/c Ratio		0.24	0.36	0.75	0.23						0.38	0.18
Uniform Delay, d1		11.8	12.9	52.2	3.0						54.6	53.5
Progression Factor		1.17	3.19	1.00	1.00						1.00	1.00
Incremental Delay, d2		0.2	0.8	12.2	0.2						2.0	0.5
Delay (s)		14.0	42.0	64.4	3.2						56.6	53.9
Level of Service		B	D	E	A						E	D
Approach Delay (s)		28.6			17.9			0.0			54.2	
Approach LOS		C			B			A			D	

Intersection Summary			
HCM 2000 Control Delay	30.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	19.3
Intersection Capacity Utilization	67.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	340	185	0	0	320	40	450	0	215	0	0	0
Future Volume (vph)	340	185	0	0	320	40	450	0	215	0	0	0
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	5.5	5.9			5.9		5.9	5.9	5.9			
Lane Util. Factor	1.00	0.95			0.95		0.95	0.95	1.00			
Frt	1.00	1.00			0.98		1.00	1.00	0.85			
Flt Protected	0.95	1.00			1.00		0.95	0.95	1.00			
Satd. Flow (prot)	1614	3228			3084		1504	1504	1417			
Flt Permitted	0.95	1.00			1.00		0.95	0.95	1.00			
Satd. Flow (perm)	1614	3228			3084		1504	1504	1417			
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	362	197	0	0	340	43	479	0	229	0	0	0
RTOR Reduction (vph)	0	0	0	0	7	0	0	0	165	0	0	0
Lane Group Flow (vph)	362	197	0	0	376	0	239	240	64	0	0	0
Heavy Vehicles (%)	3%	3%	3%	6%	6%	6%	5%	5%	5%	0%	0%	0%
Turn Type	Prot	NA			NA		Perm	NA	Perm			
Protected Phases	5	2			6			8				
Permitted Phases							8		8			
Actuated Green, G (s)	27.8	52.0			18.7		24.6	24.6	24.6			
Effective Green, g (s)	27.8	52.0			18.7		24.6	24.6	24.6			
Actuated g/C Ratio	0.31	0.59			0.21		0.28	0.28	0.28			
Clearance Time (s)	5.5	5.9			5.9		5.9	5.9	5.9			
Vehicle Extension (s)	4.0	3.0			3.5		4.0	4.0	4.0			
Lane Grp Cap (vph)	507	1898			652		418	418	394			
v/s Ratio Prot	c0.22	0.06			c0.12							
v/s Ratio Perm							0.16	0.16	0.04			
v/c Ratio	0.71	0.10			0.58		0.57	0.57	0.16			
Uniform Delay, d1	26.8	8.0			31.3		27.4	27.4	24.1			
Progression Factor	1.00	1.00			1.00		1.00	1.00	1.00			
Incremental Delay, d2	5.1	0.0			1.3		2.3	2.3	0.3			
Delay (s)	31.9	8.0			32.6		29.6	29.7	24.4			
Level of Service	C	A			C		C	C	C			
Approach Delay (s)		23.4			32.6			28.0			0.0	
Approach LOS		C			C			C			A	

Intersection Summary			
HCM 2000 Control Delay	27.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	88.4	Sum of lost time (s)	17.3
Intersection Capacity Utilization	67.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	0	5	0	395	5	10	395	0
Future Volume (Veh/h)	0	0	0	0	0	5	0	395	5	10	395	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Hourly flow rate (vph)	0	0	0	0	0	6	0	459	6	12	459	0
Pedestrians					1							
Lane Width (ft)					12.0							
Walking Speed (ft/s)					3.5							
Percent Blockage					0							
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	951	949	459	946	946	463	459			466		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	951	949	459	946	946	463	459			466		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	99	100			99		
cM capacity (veh/h)	237	259	606	241	260	603	1097			1084		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	0	6	465	471
Volume Left	0	0	0	12
Volume Right	0	6	6	0
cSH	1700	603	1097	1084
Volume to Capacity	0.00	0.01	0.00	0.01
Queue Length 95th (ft)	0	1	0	1
Control Delay (s)	0.0	11.0	0.0	0.3
Lane LOS	A	B		A
Approach Delay (s)	0.0	11.0	0.0	0.3
Approach LOS	A	B		

Intersection Summary			
Average Delay	0.2		
Intersection Capacity Utilization	41.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	0	20	0	0	5	20	350	0	5	345	10
Future Volume (Veh/h)	10	0	20	0	0	5	20	350	0	5	345	10
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Hourly flow rate (vph)	11	0	22	0	0	6	22	393	0	6	388	11
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	848	842	394	864	848	393	399			393		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	848	842	394	864	848	393	399			393		
tC, single (s)	7.1	6.5	6.2	7.3	6.7	6.4	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.7	4.2	3.5	2.2			2.2		
p0 queue free %	96	100	97	100	100	99	98			99		
cM capacity (veh/h)	271	291	651	242	273	618	1149			1149		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1
Volume Total	33	6	22	393	405
Volume Left	11	0	22	0	6
Volume Right	22	6	0	0	11
cSH	444	618	1149	1700	1149
Volume to Capacity	0.07	0.01	0.02	0.23	0.01
Queue Length 95th (ft)	6	1	1	0	0
Control Delay (s)	13.8	10.9	8.2	0.0	0.2
Lane LOS	B	B	A		A
Approach Delay (s)	13.8	10.9	0.4		0.2
Approach LOS	B	B			

Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	40.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	0	10	15	0	30	10	360	15	10	365	5
Future Volume (Veh/h)	5	0	10	15	0	30	10	360	15	10	365	5
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	6	0	11	17	0	34	11	409	17	11	415	6
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	905	888	418	879	874	409	421			426		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	905	888	418	879	874	409	421			426		
tC, single (s)	7.2	6.6	6.3	7.2	6.6	6.3	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.1	3.4	3.6	4.1	3.4	2.2			2.2		
p0 queue free %	97	100	98	93	100	95	99			99		
cM capacity (veh/h)	236	273	626	248	271	619	1133			1117		

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2	NB 3	SB 1	SB 2
Volume Total	17	17	34	11	409	17	11	421
Volume Left	6	17	0	11	0	0	11	0
Volume Right	11	0	34	0	0	17	0	6
cSH	395	248	619	1133	1700	1700	1117	1700
Volume to Capacity	0.04	0.07	0.05	0.01	0.24	0.01	0.01	0.25
Queue Length 95th (ft)	3	5	4	1	0	0	1	0
Control Delay (s)	14.5	20.6	11.2	8.2	0.0	0.0	8.3	0.0
Lane LOS	B	C	B	A			A	
Approach Delay (s)	14.5	14.3		0.2			0.2	
Approach LOS	B	B						

Intersection Summary			
Average Delay	1.2		
Intersection Capacity Utilization	33.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	55	5	410	60	0	405
Future Volume (Veh/h)	55	5	410	60	0	405
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	62	6	466	68	0	460
Pedestrians	1					
Lane Width (ft)	12.0					
Walking Speed (ft/s)	3.5					
Percent Blockage	0					
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	961	501			535	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	961	501			535	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	78	99			100	
cM capacity (veh/h)	286	574			1027	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	68	534	460
Volume Left	62	0	0
Volume Right	6	68	0
cSH	300	1700	1027
Volume to Capacity	0.23	0.31	0.00
Queue Length 95th (ft)	21	0	0
Control Delay (s)	20.5	0.0	0.0
Lane LOS	C		
Approach Delay (s)	20.5	0.0	0.0
Approach LOS	C		

Intersection Summary			
Average Delay	1.3		
Intersection Capacity Utilization	37.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	45	75	165	40	60	125	95	335	55	110	355	25
Future Volume (vph)	45	75	165	40	60	125	95	335	55	110	355	25
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5		4.5	4.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	0.98	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1554	1636	1359	1630	1716	1428	1568	1609		1614	1680	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1554	1636	1359	1630	1716	1428	1568	1609		1614	1680	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	47	79	174	42	63	132	100	353	58	116	374	26
RTOR Reduction (vph)	0	0	146	0	0	111	0	5	0	0	3	0
Lane Group Flow (vph)	47	79	28	42	63	21	100	406	0	116	397	0
Confl. Peds. (#/hr)	1		4	4		1	7		8	8		7
Confl. Bikes (#/hr)									3			1
Heavy Vehicles (%)	7%	7%	7%	2%	2%	2%	6%	6%	6%	3%	3%	3%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8						
Actuated Green, G (s)	2.6	8.8	8.8	2.6	8.8	8.8	5.9	19.3		5.9	19.3	
Effective Green, g (s)	2.6	8.8	8.8	2.6	8.8	8.8	5.9	19.3		5.9	19.3	
Actuated g/C Ratio	0.05	0.16	0.16	0.05	0.16	0.16	0.11	0.35		0.11	0.35	
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5		4.5	4.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	74	263	219	77	276	230	169	568		174	593	
v/s Ratio Prot	c0.03	c0.05		0.03	0.04		0.06	c0.25		c0.07	0.24	
v/s Ratio Perm			0.02			0.01						
v/c Ratio	0.64	0.30	0.13	0.55	0.23	0.09	0.59	0.71		0.67	0.67	
Uniform Delay, d1	25.5	20.2	19.6	25.4	19.9	19.5	23.2	15.3		23.4	15.0	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	16.5	0.6	0.3	7.7	0.4	0.2	5.5	4.3		9.3	3.0	
Delay (s)	42.0	20.8	19.9	33.1	20.4	19.7	28.7	19.5		32.7	17.9	
Level of Service	D	C	B	C	C	B	C	B		C	B	
Approach Delay (s)		23.6			22.2			21.3			21.2	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM 2000 Control Delay	21.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	54.6	Sum of lost time (s)	18.0
Intersection Capacity Utilization	55.6%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	205	55	65	165	5	30	20	75	15	30	10
Future Volume (Veh/h)	10	205	55	65	165	5	30	20	75	15	30	10
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	11	218	59	69	176	5	32	21	80	16	32	11
Pedestrians					1						3	
Lane Width (ft)					12.0						12.0	
Walking Speed (ft/s)					3.5						3.5	
Percent Blockage					0						0	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	184			277			613	592	248	680	618	182
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	184			277			613	592	248	680	618	182
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			95			91	95	90	95	92	99
cM capacity (veh/h)	1381			1274			356	392	789	298	379	859

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	288	250	133	59
Volume Left	11	69	32	16
Volume Right	59	5	80	11
cSH	1381	1274	543	391
Volume to Capacity	0.01	0.05	0.24	0.15
Queue Length 95th (ft)	1	4	24	13
Control Delay (s)	0.4	2.6	13.8	15.8
Lane LOS	A	A	B	C
Approach Delay (s)	0.4	2.6	13.8	15.8
Approach LOS			B	C

Intersection Summary			
Average Delay	4.8		
Intersection Capacity Utilization	49.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	295	35	150	245	15	190
Future Volume (Veh/h)	295	35	150	245	15	190
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	317	38	161	263	16	204
Pedestrians					2	
Lane Width (ft)					12.0	
Walking Speed (ft/s)					3.5	
Percent Blockage					0	
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			357		923	338
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			357		923	338
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			87		94	71
cM capacity (veh/h)			1199		260	705

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2
Volume Total	355	161	263	16	204
Volume Left	0	161	0	16	0
Volume Right	38	0	0	0	204
cSH	1700	1199	1700	260	705
Volume to Capacity	0.21	0.13	0.15	0.06	0.29
Queue Length 95th (ft)	0	12	0	5	30
Control Delay (s)	0.0	8.5	0.0	19.8	12.2
Lane LOS		A		C	B
Approach Delay (s)	0.0	3.2		12.7	
Approach LOS				B	

Intersection Summary			
Average Delay	4.2		
Intersection Capacity Utilization	41.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	5	480	375	5	5	20
Future Volume (Veh/h)	5	480	375	5	5	20
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	5	511	399	5	5	21
Pedestrians					1	
Lane Width (ft)					12.0	
Walking Speed (ft/s)					3.5	
Percent Blockage					0	
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	405				924	402
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	405				924	402
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				98	97
cM capacity (veh/h)	1158				300	652

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	5	511	404	26
Volume Left	5	0	0	5
Volume Right	0	0	5	21
cSH	1158	1700	1700	532
Volume to Capacity	0.00	0.30	0.24	0.05
Queue Length 95th (ft)	0	0	0	4
Control Delay (s)	8.1	0.0	0.0	12.1
Lane LOS	A			B
Approach Delay (s)	0.1		0.0	12.1
Approach LOS				B

Intersection Summary			
Average Delay	0.4		
Intersection Capacity Utilization	37.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	250	10	215	5	10	0	155	230	10	0	205	190
Future Volume (vph)	250	10	215	5	10	0	155	230	10	0	205	190
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)		5.0	5.0		5.0		4.5	5.0			5.0	
Lane Util. Factor		1.00	1.00		1.00		1.00	1.00			1.00	
Frpb, ped/bikes		1.00	0.98		1.00		1.00	1.00			0.99	
Flpb, ped/bikes		1.00	1.00		1.00		1.00	1.00			1.00	
Frt		1.00	0.85		1.00		1.00	0.99			0.93	
Flt Protected		0.95	1.00		0.98		0.95	1.00			1.00	
Satd. Flow (prot)		1621	1412		1720		1599	1671			1575	
Flt Permitted		0.72	1.00		0.90		0.28	1.00			1.00	
Satd. Flow (perm)		1226	1412		1579		467	1671			1575	
Peak-hour factor, PHF	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Adj. Flow (vph)	287	11	247	6	11	0	178	264	11	0	236	218
RTOR Reduction (vph)	0	0	157	0	0	0	0	1	0	0	34	0
Lane Group Flow (vph)	0	298	90	0	17	0	178	274	0	0	420	0
Confl. Peds. (#/hr)									1	1		
Confl. Bikes (#/hr)			2			1			1			2
Heavy Vehicles (%)	3%	3%	3%	0%	0%	0%	4%	4%	4%	2%	2%	2%
Turn Type	Perm	NA	Perm	Perm	NA		D.P+P	NA		D.P+P	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8			6			2		
Actuated Green, G (s)		24.4	24.4		24.4		36.5	41.0			26.1	
Effective Green, g (s)		24.4	24.4		24.4		36.5	41.0			26.1	
Actuated g/C Ratio		0.32	0.32		0.32		0.48	0.54			0.35	
Clearance Time (s)		5.0	5.0		5.0		4.5	5.0			5.0	
Vehicle Extension (s)		3.0	3.0		3.0		3.0	3.0			3.0	
Lane Grp Cap (vph)		396	456		510		382	908			545	
v/s Ratio Prot							c0.06	0.16			c0.27	
v/s Ratio Perm		c0.24	0.06		0.01		0.16					
v/c Ratio		0.75	0.20		0.03		0.47	0.30			0.77	
Uniform Delay, d1		22.8	18.4		17.4		12.4	9.4			22.0	
Progression Factor		1.00	1.00		1.00		1.00	1.00			1.00	
Incremental Delay, d2		7.9	0.2		0.0		0.9	0.2			6.7	
Delay (s)		30.7	18.6		17.5		13.3	9.6			28.6	
Level of Service		C	B		B		B	A			C	
Approach Delay (s)		25.2			17.5			11.1			28.6	
Approach LOS		C			B			B			C	

Intersection Summary			
HCM 2000 Control Delay	21.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	75.4	Sum of lost time (s)	14.5
Intersection Capacity Utilization	68.0%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	20	535	35	255	435	115	70	70	285	140	45	10
Future Volume (vph)	20	535	35	255	435	115	70	70	285	140	45	10
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	4.0	4.5		4.0	4.5			4.0	4.0		4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00	1.00		1.00	
Frpb, ped/bikes	1.00	1.00		1.00	0.99			1.00	0.99		1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00		1.00	
Frt	1.00	0.99		1.00	0.97			1.00	0.85		0.99	
Flt Protected	0.95	1.00		0.95	1.00			0.98	1.00		0.97	
Satd. Flow (prot)	1599	3162		1599	3070			1690	1453		1626	
Flt Permitted	0.95	1.00		0.95	1.00			0.98	1.00		0.97	
Satd. Flow (perm)	1599	3162		1599	3070			1690	1453		1626	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	21	569	37	271	463	122	74	74	303	149	48	11
RTOR Reduction (vph)	0	4	0	0	16	0	0	0	0	0	2	0
Lane Group Flow (vph)	21	602	0	271	569	0	0	148	303	0	206	0
Confl. Peds. (#/hr)	8		4	4		8	3		4	4		3
Confl. Bikes (#/hr)			1			3						
Heavy Vehicles (%)	4%	4%	4%	4%	4%	4%	1%	1%	1%	3%	3%	3%
Turn Type	Prot	NA		Prot	NA		Split	NA	Free	Split	NA	
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases									Free			
Actuated Green, G (s)	3.4	40.8		23.4	60.8			15.9	115.0		18.4	
Effective Green, g (s)	3.4	40.8		23.4	60.8			15.9	115.0		18.4	
Actuated g/C Ratio	0.03	0.35		0.20	0.53			0.14	1.00		0.16	
Clearance Time (s)	4.0	4.5		4.0	4.5			4.0			4.0	
Vehicle Extension (s)	3.0	3.5		3.0	3.5			3.0			3.0	
Lane Grp Cap (vph)	47	1121		325	1623			233	1453		260	
v/s Ratio Prot	0.01	c0.19		c0.17	0.19			c0.09			c0.13	
v/s Ratio Perm									0.21			
v/c Ratio	0.45	0.54		0.83	0.35			0.64	0.21		0.79	
Uniform Delay, d1	54.9	29.6		43.9	15.7			46.8	0.0		46.5	
Progression Factor	1.00	1.00		0.51	0.26			1.00	1.00		1.00	
Incremental Delay, d2	6.6	1.8		10.3	0.3			5.6	0.3		15.2	
Delay (s)	61.5	31.4		32.9	4.5			52.4	0.3		61.7	
Level of Service	E	C		C	A			D	A		E	
Approach Delay (s)		32.4			13.5			17.4			61.7	
Approach LOS		C			B			B			E	

Intersection Summary			
HCM 2000 Control Delay	24.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	115.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	63.4%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	55	865	30	170	800	340	15	25	150	395	55	15
Future Volume (vph)	55	865	30	170	800	340	15	25	150	395	55	15
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	4.5	5.0		4.5	5.0			4.5	4.5	4.5	4.5	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00	1.00	0.95	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	0.98			1.00	1.00	1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00	1.00	1.00	
Frt	1.00	0.99		1.00	0.96			1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00			0.98	1.00	0.95	0.97	
Satd. Flow (prot)	1599	3178		1614	3034			1718	1488	1564	1572	
Flt Permitted	0.95	1.00		0.18	1.00			0.98	1.00	0.95	0.97	
Satd. Flow (perm)	1599	3178		302	3034			1718	1488	1564	1572	
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	60	951	33	187	879	374	16	27	165	434	60	16
RTOR Reduction (vph)	0	2	0	0	34	0	0	0	153	0	2	0
Lane Group Flow (vph)	60	982	0	187	1219	0	0	43	12	256	252	0
Confl. Peds. (#/hr)	10		6	6		10	15					15
Confl. Bikes (#/hr)			2			1						1
Heavy Vehicles (%)	4%	4%	4%	3%	3%	3%	0%	0%	0%	1%	1%	1%
Turn Type	Prot	NA		pm+pt	NA		Split	NA	Perm	Split	NA	
Protected Phases	1	6		5	2		4	4		8	8	
Permitted Phases				2					4			
Actuated Green, G (s)	8.5	54.2		67.9	56.8			8.6	8.6	22.6	22.6	
Effective Green, g (s)	8.5	54.2		67.9	56.8			8.6	8.6	22.6	22.6	
Actuated g/C Ratio	0.07	0.47		0.59	0.49			0.07	0.07	0.20	0.20	
Clearance Time (s)	4.5	5.0		4.5	5.0			4.5	4.5	4.5	4.5	
Vehicle Extension (s)	3.0	3.5		3.0	3.5			3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	118	1497		304	1498			128	111	307	308	
v/s Ratio Prot	0.04	0.31		c0.06	c0.40			c0.03		c0.16	0.16	
v/s Ratio Perm				0.30					0.01			
v/c Ratio	0.51	0.66		0.62	0.81			0.34	0.11	0.83	0.82	
Uniform Delay, d1	51.2	23.3		14.3	24.6			50.5	49.6	44.4	44.2	
Progression Factor	1.23	0.52		0.87	0.82			1.00	1.00	1.00	1.00	
Incremental Delay, d2	3.1	2.1		3.3	4.5			1.6	0.4	17.4	15.3	
Delay (s)	66.2	14.1		15.8	24.7			52.0	50.1	61.8	59.5	
Level of Service	E	B		B	C			D	D	E	E	
Approach Delay (s)		17.1			23.5			50.5			60.7	
Approach LOS		B			C			D			E	

Intersection Summary			
HCM 2000 Control Delay	29.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	115.0	Sum of lost time (s)	18.5
Intersection Capacity Utilization	72.7%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	785	725	200	1105	0	0	0	0	345	130	305
Future Volume (vph)	0	785	725	200	1105	0	0	0	0	345	130	305
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)		5.0	5.0	4.5	5.0					4.5	4.5	4.5
Lane Util. Factor		0.95	1.00	0.97	0.95					0.95	0.95	0.88
Frpb, ped/bikes		1.00	0.98	1.00	1.00					1.00	1.00	0.98
Flpb, ped/bikes		1.00	1.00	1.00	1.00					1.00	1.00	1.00
Frt		1.00	0.85	1.00	1.00					1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95	0.98	1.00
Satd. Flow (prot)		3260	1429	3162	3260					1548	1593	2511
Flt Permitted		1.00	1.00	0.95	1.00					0.95	0.98	1.00
Satd. Flow (perm)		3260	1429	3162	3260					1548	1593	2511
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	818	755	208	1151	0	0	0	0	359	135	318
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	111
Lane Group Flow (vph)	0	818	755	208	1151	0	0	0	0	244	250	207
Confl. Peds. (#/hr)	10		5	5		10	1					1
Confl. Bikes (#/hr)			5			8						
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	0%	0%	0%	2%	2%	2%
Turn Type		NA	Perm	Prot	NA					Split	NA	Perm
Protected Phases		2		1	6					4	4	
Permitted Phases			2									4
Actuated Green, G (s)		62.4	62.4	12.9	79.8					25.7	25.7	25.7
Effective Green, g (s)		62.4	62.4	12.9	79.8					25.7	25.7	25.7
Actuated g/C Ratio		0.54	0.54	0.11	0.69					0.22	0.22	0.22
Clearance Time (s)		5.0	5.0	4.5	5.0					4.5	4.5	4.5
Vehicle Extension (s)		3.5	3.5	3.0	3.5					3.5	3.5	3.5
Lane Grp Cap (vph)		1768	775	354	2262					345	356	561
v/s Ratio Prot		0.25		0.07	c0.35					c0.16	0.16	
v/s Ratio Perm			c0.53									0.08
v/c Ratio		0.46	0.97	0.59	0.51					0.71	0.70	0.37
Uniform Delay, d1		16.1	25.5	48.5	8.3					41.2	41.1	37.8
Progression Factor		0.95	0.86	0.92	0.57					1.00	1.00	1.00
Incremental Delay, d2		0.7	22.4	2.0	0.7					6.7	6.4	0.5
Delay (s)		15.9	44.5	46.5	5.4					47.9	47.5	38.3
Level of Service		B	D	D	A					D	D	D
Approach Delay (s)		29.6			11.7			0.0			44.0	
Approach LOS		C			B			A			D	

Intersection Summary			
HCM 2000 Control Delay	26.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	115.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	81.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	300	830	0	0	685	315	620	190	195	0	0	0
Future Volume (vph)	300	830	0	0	685	315	620	190	195	0	0	0
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	4.5	5.0			5.0	5.0	6.0	6.0	4.0			
Lane Util. Factor	0.97	0.95			0.95	1.00	0.97	1.00	1.00			
Frpb, ped/bikes	1.00	1.00			1.00	0.97	1.00	1.00	0.99			
Flpb, ped/bikes	1.00	1.00			1.00	1.00	1.00	1.00	1.00			
Frt	1.00	1.00			1.00	0.85	1.00	1.00	0.85			
Flt Protected	0.95	1.00			1.00	1.00	0.95	1.00	1.00			
Satd. Flow (prot)	3162	3260			3292	1428	3131	1699	1427			
Flt Permitted	0.95	1.00			1.00	1.00	0.95	1.00	1.00			
Satd. Flow (perm)	3162	3260			3292	1428	3131	1699	1427			
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	312	865	0	0	714	328	646	198	203	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	168	0	0	0	0	0	0
Lane Group Flow (vph)	313	865	0	0	714	160	646	198	203	0	0	0
Confl. Peds. (#/hr)	12		7	7		12						
Confl. Bikes (#/hr)			6			7			1			
Heavy Vehicles (%)	2%	2%	2%	1%	1%	1%	3%	3%	3%	0%	0%	0%
Turn Type	Prot	NA			NA	Perm	Split	NA	Free			
Protected Phases	5	2			6		8	8				
Permitted Phases						6			Free			
Actuated Green, G (s)	16.8	75.1			53.8	53.8	28.9	28.9	115.0			
Effective Green, g (s)	16.8	75.1			53.8	53.8	28.9	28.9	115.0			
Actuated g/C Ratio	0.15	0.65			0.47	0.47	0.25	0.25	1.00			
Clearance Time (s)	4.5	5.0			5.0	5.0	6.0	6.0				
Vehicle Extension (s)	3.0	3.5			3.5	3.5	3.0	3.0				
Lane Grp Cap (vph)	461	2128			1540	668	786	426	1427			
v/s Ratio Prot	c0.10	0.27			c0.22		c0.21	0.12				
v/s Ratio Perm						0.11			0.14			
v/c Ratio	0.68	0.41			0.46	0.24	0.82	0.46	0.14			
Uniform Delay, d1	46.5	9.4			20.8	18.3	40.6	36.5	0.0			
Progression Factor	0.93	1.24			1.00	1.00	1.00	1.00	1.00			
Incremental Delay, d2	3.6	0.5			1.0	0.8	6.9	0.8	0.2			
Delay (s)	46.7	12.2			21.8	19.2	47.5	37.3	0.2			
Level of Service	D	B			C	B	D	D	A			
Approach Delay (s)		21.4			21.0			36.4			0.0	
Approach LOS		C			C			D			A	

Intersection Summary			
HCM 2000 Control Delay	26.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	115.0	Sum of lost time (s)	15.5
Intersection Capacity Utilization	81.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	26	383	97	418	408	224	87	158	398	209	158	31
v/c Ratio	0.28	0.53	0.14	0.77	0.42	0.24	0.45	0.68	0.74	1.15	0.72	0.10
Control Delay	65.2	32.7	0.4	60.2	18.0	1.9	61.2	67.9	13.4	164.8	72.0	0.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	65.2	32.7	0.4	60.2	18.0	1.9	61.2	67.9	13.4	164.8	72.0	0.7
Queue Length 50th (ft)	21	235	0	159	198	0	69	128	0	~207	129	0
Queue Length 95th (ft)	52	386	0	191	344	14	124	196	101	#368	199	0
Internal Link Dist (ft)		868			1020			559			326	
Turn Bay Length (ft)	560		50	825			350		390	280		50
Base Capacity (vph)	129	727	714	799	977	924	204	301	583	181	278	348
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.20	0.53	0.14	0.52	0.42	0.24	0.43	0.52	0.68	1.15	0.57	0.09

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBT	EBR	WBL	WBT	SBT	SBR
Lane Group Flow (vph)	474	515	189	597	61	454
v/c Ratio	0.24	0.48	0.75	0.23	0.38	0.69
Control Delay	15.4	5.4	69.9	3.4	60.3	10.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	15.4	5.4	69.9	3.4	60.3	10.3
Queue Length 50th (ft)	91	69	153	48	49	0
Queue Length 95th (ft)	m145	m92	227	82	92	52
Internal Link Dist (ft)	1020			607	372	
Turn Bay Length (ft)		310	200			180
Base Capacity (vph)	1937	1069	322	2558	271	804
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.24	0.48	0.59	0.23	0.23	0.56

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	EBL	EBT	WBT	NBL	NBT	NBR
Lane Group Flow (vph)	362	197	383	239	240	229
v/c Ratio	0.72	0.10	0.60	0.58	0.58	0.41
Control Delay	38.3	9.2	38.5	36.2	36.3	6.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	38.3	9.2	38.5	36.2	36.3	6.6
Queue Length 50th (ft)	170	22	96	115	115	0
Queue Length 95th (ft)	368	52	203	263	264	59
Internal Link Dist (ft)		607	306		404	
Turn Bay Length (ft)	300			240		
Base Capacity (vph)	975	2960	1309	727	727	803
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.37	0.07	0.29	0.33	0.33	0.29

Intersection Summary

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	47	79	174	42	63	132	100	411	116	400
v/c Ratio	0.30	0.29	0.47	0.26	0.22	0.38	0.58	0.70	0.66	0.65
Control Delay	33.4	26.1	9.7	32.1	24.9	9.2	45.3	22.3	50.3	20.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	33.4	26.1	9.7	32.1	24.9	9.2	45.3	22.3	50.3	20.6
Queue Length 50th (ft)	15	24	0	13	19	0	33	116	39	112
Queue Length 95th (ft)	#53	66	49	47	55	42	#124	219	#143	208
Internal Link Dist (ft)		1222			378			2383		291
Turn Bay Length (ft)	100		200	150		150	135		150	
Base Capacity (vph)	155	1316	1124	163	1380	1173	172	1237	177	1291
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.30	0.06	0.15	0.26	0.05	0.11	0.58	0.33	0.66	0.31

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBT	EBR	WBT	NBL	NBT	SBT
Lane Group Flow (vph)	298	247	17	178	275	454
v/c Ratio	0.76	0.40	0.03	0.47	0.30	0.80
Control Delay	39.5	6.5	21.7	13.7	10.9	32.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	39.5	6.5	21.7	13.7	10.9	32.0
Queue Length 50th (ft)	123	5	5	43	71	179
Queue Length 95th (ft)	#291	56	22	76	117	299
Internal Link Dist (ft)	5421		175		763	967
Turn Bay Length (ft)		120		120		
Base Capacity (vph)	512	725	658	570	1030	900
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.58	0.34	0.03	0.31	0.27	0.50

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBL	EBT	WBL	WBT	NBT	NBR	SBT
Lane Group Flow (vph)	21	606	271	585	148	303	208
v/c Ratio	0.21	0.51	0.93	0.34	0.64	0.21	0.80
Control Delay	55.8	31.0	53.2	4.6	58.2	0.3	67.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	55.8	31.0	53.2	4.6	58.2	0.3	67.9
Queue Length 50th (ft)	15	181	183	8	106	0	146
Queue Length 95th (ft)	41	272	m#285	m43	160	0	#242
Internal Link Dist (ft)		457		542	390		318
Turn Bay Length (ft)	90		150			90	
Base Capacity (vph)	152	1192	291	1704	352	1453	298
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.14	0.51	0.93	0.34	0.42	0.21	0.70

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	EBL	EBT	WBL	WBT	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	60	984	187	1253	43	165	256	254
v/c Ratio	0.45	0.66	0.61	0.81	0.34	0.63	0.83	0.82
Control Delay	70.3	15.2	18.4	25.7	56.7	18.6	66.8	64.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	70.3	15.2	18.4	25.7	56.7	18.6	66.8	64.1
Queue Length 50th (ft)	46	137	54	429	31	0	187	183
Queue Length 95th (ft)	m87	172	86	#659	66	65	#307	#300
Internal Link Dist (ft)		542		515	105			290
Turn Bay Length (ft)	200		330			150	185	
Base Capacity (vph)	187	1498	334	1555	186	308	346	350
Starvation Cap Reductn	0	0	0	4	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.32	0.66	0.56	0.81	0.23	0.54	0.74	0.73

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	EBT	EBR	WBL	WBT	SBL	SBT	SBR
Lane Group Flow (vph)	818	755	208	1151	244	250	318
v/c Ratio	0.46	0.97	0.59	0.51	0.71	0.70	0.47
Control Delay	17.9	47.9	49.8	6.1	51.5	51.0	21.8
Queue Delay	0.0	0.0	0.0	0.2	0.0	0.0	0.0
Total Delay	17.9	47.9	49.8	6.3	51.5	51.0	21.8
Queue Length 50th (ft)	165	350	77	190	176	181	61
Queue Length 95th (ft)	295	#927	m105	257	240	245	97
Internal Link Dist (ft)	515			447		580	
Turn Bay Length (ft)		275	160				450
Base Capacity (vph)	1770	775	536	2262	491	505	894
Starvation Cap Reductn	0	0	0	413	0	0	0
Spillback Cap Reductn	0	0	0	154	0	0	7
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.46	0.97	0.39	0.62	0.50	0.50	0.36

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	EBL	EBT	WBT	WBR	NBL	NBT	NBR
Lane Group Flow (vph)	313	865	714	328	646	198	203
v/c Ratio	0.68	0.41	0.46	0.39	0.82	0.46	0.14
Control Delay	49.7	12.9	23.3	4.4	49.9	39.7	0.2
Queue Delay	0.0	0.5	0.0	0.0	0.0	0.0	0.0
Total Delay	49.7	13.4	23.3	4.4	49.9	39.7	0.2
Queue Length 50th (ft)	107	190	187	5	229	122	0
Queue Length 95th (ft)	150	278	272	65	292	191	0
Internal Link Dist (ft)		447	460			581	
Turn Bay Length (ft)	180			240			400
Base Capacity (vph)	673	2129	1539	834	871	472	1427
Starvation Cap Reductn	0	741	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.47	0.62	0.46	0.39	0.74	0.42	0.14

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	25	470	75	390	540	165	85	80	525	300	110	45
Future Volume (vph)	25	470	75	390	540	165	85	80	525	300	110	45
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	4.5	4.9	4.9	4.5	4.9	4.9	4.5	4.9	4.5	4.5	4.9	4.9
Lane Util. Factor	1.00	0.95	1.00	0.97	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1568	3137	1403	2932	1591	1352	1554	1636	1390	1583	1667	1417
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1568	3137	1403	2932	1591	1352	1554	1636	1390	1583	1667	1417
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	25	470	75	390	540	165	85	80	525	300	110	45
RTOR Reduction (vph)	0	0	54	0	0	74	0	0	81	0	0	37
Lane Group Flow (vph)	25	470	21	390	540	91	85	80	444	300	110	8
Heavy Vehicles (%)	6%	6%	6%	10%	10%	10%	7%	7%	7%	5%	5%	5%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8	1	7	4	
Permitted Phases			2			6			8			4
Actuated Green, G (s)	2.7	28.7	28.7	19.2	45.2	45.2	18.0	9.0	28.2	26.2	17.2	17.2
Effective Green, g (s)	2.7	28.7	28.7	19.2	45.2	45.2	18.0	9.0	28.2	26.2	17.2	17.2
Actuated g/C Ratio	0.03	0.28	0.28	0.19	0.44	0.44	0.18	0.09	0.28	0.26	0.17	0.17
Clearance Time (s)	4.5	4.9	4.9	4.5	4.9	4.9	4.5	4.9	4.5	4.5	4.9	4.9
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	41	883	395	552	705	599	274	144	384	407	281	239
v/s Ratio Prot	0.02	0.15		0.13	c0.34		0.05	0.05	c0.22	c0.19	0.07	
v/s Ratio Perm			0.02			0.07			0.10			0.01
v/c Ratio	0.61	0.53	0.05	0.71	0.77	0.15	0.31	0.56	1.16	0.74	0.39	0.03
Uniform Delay, d1	49.1	30.9	26.7	38.7	23.9	16.9	36.5	44.5	36.9	34.7	37.7	35.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	23.0	0.6	0.1	4.1	5.0	0.1	0.6	4.6	95.8	6.8	0.9	0.1
Delay (s)	72.1	31.5	26.8	42.8	28.9	17.0	37.2	49.1	132.6	41.5	38.6	35.4
Level of Service	E	C	C	D	C	B	D	D	F	D	D	D
Approach Delay (s)		32.7			32.1			111.2			40.2	
Approach LOS		C			C			F			D	

Intersection Summary			
HCM 2000 Control Delay	52.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	101.9	Sum of lost time (s)	18.8
Intersection Capacity Utilization	79.0%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	745	550	405	595	0	0	0	0	125	20	500
Future Volume (vph)	0	745	550	405	595	0	0	0	0	125	20	500
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)		5.9	5.9	5.5	5.9						5.9	5.9
Lane Util. Factor		0.95	1.00	1.00	0.95						1.00	0.88
Frt		1.00	0.85	1.00	1.00						1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00						0.96	1.00
Satd. Flow (prot)		3107	1390	1539	3079						1485	2317
Flt Permitted		1.00	1.00	0.95	1.00						0.96	1.00
Satd. Flow (perm)		3107	1390	1539	3079						1485	2317
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	745	550	405	595	0	0	0	0	125	20	500
RTOR Reduction (vph)	0	0	301	0	0	0	0	0	0	0	0	417
Lane Group Flow (vph)	0	745	249	405	595	0	0	0	0	0	145	83
Heavy Vehicles (%)	7%	7%	7%	8%	8%	8%	0%	0%	0%	13%	13%	13%
Turn Type		NA	Perm	Prot	NA					Perm	NA	Perm
Protected Phases		2		1	6						4	
Permitted Phases			2							4		4
Actuated Green, G (s)		33.9	33.9	31.7	71.1						16.5	16.5
Effective Green, g (s)		33.9	33.9	31.7	71.1						16.5	16.5
Actuated g/C Ratio		0.34	0.34	0.32	0.72						0.17	0.17
Clearance Time (s)		5.9	5.9	5.5	5.9						5.9	5.9
Vehicle Extension (s)		3.0	3.0	3.5	5.0						4.0	4.0
Lane Grp Cap (vph)		1059	474	490	2202						246	384
v/s Ratio Prot		c0.24		c0.26	0.19							
v/s Ratio Perm			0.18								0.10	0.04
v/c Ratio		0.70	0.53	0.83	0.27						0.59	0.22
Uniform Delay, d1		28.4	26.3	31.3	5.0						38.3	35.9
Progression Factor		1.00	1.00	1.00	1.00						1.00	1.00
Incremental Delay, d2		2.1	1.1	11.2	0.1						4.2	0.4
Delay (s)		30.5	27.3	42.5	5.1						42.5	36.2
Level of Service		C	C	D	A						D	D
Approach Delay (s)		29.2			20.3			0.0			37.7	
Approach LOS		C			C			A			D	

Intersection Summary			
HCM 2000 Control Delay	28.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	99.4	Sum of lost time (s)	17.3
Intersection Capacity Utilization	89.5%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	660	210	0	0	675	155	325	0	145	0	0	0
Future Volume (vph)	660	210	0	0	675	155	325	0	145	0	0	0
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	5.5	5.9			5.9		5.9	5.9	5.9			
Lane Util. Factor	1.00	0.95			0.95		0.95	0.95	1.00			
Frpb, ped/bikes	1.00	1.00			1.00		1.00	1.00	1.00			
Flpb, ped/bikes	1.00	1.00			1.00		1.00	1.00	1.00			
Frt	1.00	1.00			0.97		1.00	1.00	0.85			
Flt Protected	0.95	1.00			1.00		0.95	0.95	1.00			
Satd. Flow (prot)	1539	3079			3049		1398	1398	1316			
Flt Permitted	0.95	1.00			1.00		0.95	0.95	1.00			
Satd. Flow (perm)	1539	3079			3049		1398	1398	1316			
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	660	210	0	0	675	155	325	0	145	0	0	0
RTOR Reduction (vph)	0	0	0	0	14	0	0	0	122	0	0	0
Lane Group Flow (vph)	660	210	0	0	816	0	162	163	23	0	0	0
Confl. Peds. (#/hr)			1	1								
Heavy Vehicles (%)	8%	8%	8%	6%	6%	6%	13%	13%	13%	0%	0%	0%
Turn Type	Prot	NA			NA		Perm	NA	Perm			
Protected Phases	5	2			6			8				
Permitted Phases							8		8			
Actuated Green, G (s)	60.6	104.1			38.0		21.5	21.5	21.5			
Effective Green, g (s)	60.6	104.1			38.0		21.5	21.5	21.5			
Actuated g/C Ratio	0.44	0.76			0.28		0.16	0.16	0.16			
Clearance Time (s)	5.5	5.9			5.9		5.9	5.9	5.9			
Vehicle Extension (s)	4.0	3.0			3.5		4.0	4.0	4.0			
Lane Grp Cap (vph)	678	2332			843		218	218	205			
v/s Ratio Prot	c0.43	0.07			c0.27							
v/s Ratio Perm							0.12	0.12	0.02			
v/c Ratio	0.97	0.09			0.97		0.74	0.75	0.11			
Uniform Delay, d1	37.6	4.3			49.1		55.3	55.4	49.7			
Progression Factor	1.00	1.00			1.00		1.00	1.00	1.00			
Incremental Delay, d2	27.9	0.0			23.3		13.6	13.9	0.3			
Delay (s)	65.5	4.3			72.4		68.9	69.2	50.1			
Level of Service	E	A			E		E	E	D			
Approach Delay (s)		50.8			72.4			63.2			0.0	
Approach LOS		D			E			E			A	

Intersection Summary			
HCM 2000 Control Delay	61.8	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	137.4	Sum of lost time (s)	17.3
Intersection Capacity Utilization	89.5%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Traffic Volume (veh/h)	0	0	0	15	0	20	0	380	0	10	290	0
Future Volume (Veh/h)	0	0	0	15	0	20	0	380	0	10	290	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	15	0	20	0	380	0	10	290	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	710	690	290	690	690	380	290			380		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	710	690	290	690	690	380	290			380		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.3			4.2		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.4			2.3		
p0 queue free %	100	100	100	96	100	97	100			99		
cM capacity (veh/h)	338	367	754	360	367	671	1191			1126		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	0	35	380	300
Volume Left	0	15	0	10
Volume Right	0	20	0	0
cSH	1700	490	1191	1126
Volume to Capacity	0.00	0.07	0.00	0.01
Queue Length 95th (ft)	0	6	0	1
Control Delay (s)	0.0	12.9	0.0	0.4
Lane LOS	A	B		A
Approach Delay (s)	0.0	12.9	0.0	0.4
Approach LOS	A	B		

Intersection Summary			
Average Delay	0.8		
Intersection Capacity Utilization	35.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	70	0	20	0	0	0	15	330	0	0	300	10
Future Volume (Veh/h)	70	0	20	0	0	0	15	330	0	0	300	10
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	70	0	20	0	0	0	15	330	0	0	300	10
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	665	665	305	685	670	330	310			330		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	665	665	305	685	670	330	310			330		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.2			4.2		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.3			2.3		
p0 queue free %	81	100	97	100	100	100	99			100		
cM capacity (veh/h)	373	378	740	352	376	716	1212			1181		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1
Volume Total	90	0	15	330	310
Volume Left	70	0	15	0	0
Volume Right	20	0	0	0	10
cSH	419	1700	1212	1700	1181
Volume to Capacity	0.21	0.00	0.01	0.19	0.00
Queue Length 95th (ft)	20	0	1	0	0
Control Delay (s)	15.9	0.0	8.0	0.0	0.0
Lane LOS	C	A	A		
Approach Delay (s)	15.9	0.0	0.3		0.0
Approach LOS	C	A			

Intersection Summary			
Average Delay	2.1		
Intersection Capacity Utilization	31.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	0	15	25	0	30	10	275	30	35	280	0
Future Volume (Veh/h)	10	0	15	25	0	30	10	275	30	35	280	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	10	0	15	25	0	30	10	275	30	35	280	0
Pedestrians					1							
Lane Width (ft)					12.0							
Walking Speed (ft/s)					3.5							
Percent Blockage					0							
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	675	676	280	661	646	276	280			306		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	675	676	280	661	646	276	280			306		
tC, single (s)	7.1	6.5	6.2	7.7	7.1	6.8	4.2			4.2		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	4.0	4.5	3.8	2.3			2.3		
p0 queue free %	97	100	98	92	100	95	99			97		
cM capacity (veh/h)	343	364	764	296	316	649	1254			1215		

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2	NB 3	SB 1	SB 2
Volume Total	25	25	30	10	275	30	35	280
Volume Left	10	25	0	10	0	0	35	0
Volume Right	15	0	30	0	0	30	0	0
cSH	513	296	649	1254	1700	1700	1215	1700
Volume to Capacity	0.05	0.08	0.05	0.01	0.16	0.02	0.03	0.16
Queue Length 95th (ft)	4	7	4	1	0	0	2	0
Control Delay (s)	12.4	18.3	10.8	7.9	0.0	0.0	8.1	0.0
Lane LOS	B	C	B	A			A	
Approach Delay (s)	12.4	14.2		0.3			0.9	
Approach LOS	B	B						

Intersection Summary			
Average Delay	2.0		
Intersection Capacity Utilization	37.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	30	0	305	75	0	300
Future Volume (Veh/h)	30	0	305	75	0	300
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	30	0	305	75	0	300
Pedestrians	1					
Lane Width (ft)	12.0					
Walking Speed (ft/s)	3.5					
Percent Blockage	0					
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	644	344			381	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	644	344			381	
tC, single (s)	6.4	6.2			4.2	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.3	
p0 queue free %	93	100			100	
cM capacity (veh/h)	432	692			1119	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	30	380	300
Volume Left	30	0	0
Volume Right	0	75	0
cSH	432	1700	1119
Volume to Capacity	0.07	0.22	0.00
Queue Length 95th (ft)	6	0	0
Control Delay (s)	13.9	0.0	0.0
Lane LOS	B		
Approach Delay (s)	13.9	0.0	0.0
Approach LOS	B		

Intersection Summary			
Average Delay	0.6		
Intersection Capacity Utilization	32.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	45	65	175	40	65	95	165	275	50	65	255	35
Future Volume (vph)	45	65	175	40	65	95	165	275	50	65	255	35
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5		4.5	4.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.98	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	0.98	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1421	1496	1271	1498	1577	1310	1421	1456		1484	1530	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1421	1496	1271	1498	1577	1310	1421	1456		1484	1530	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	45	65	175	40	65	95	165	275	50	65	255	35
RTOR Reduction (vph)	0	0	146	0	0	79	0	6	0	0	5	0
Lane Group Flow (vph)	45	65	29	40	65	16	165	319	0	65	285	0
Confl. Bikes (#/hr)						1			1			3
Heavy Vehicles (%)	17%	17%	17%	11%	11%	11%	17%	17%	17%	12%	12%	12%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8						
Actuated Green, G (s)	2.6	8.4	8.4	2.6	8.4	8.4	5.8	16.4		5.3	15.9	
Effective Green, g (s)	2.6	8.4	8.4	2.6	8.4	8.4	5.8	16.4		5.3	15.9	
Actuated g/C Ratio	0.05	0.17	0.17	0.05	0.17	0.17	0.11	0.32		0.10	0.31	
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5		4.5	4.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	72	247	210	76	261	217	162	470		155	479	
v/s Ratio Prot	c0.03	c0.04		0.03	0.04		c0.12	c0.22		0.04	0.19	
v/s Ratio Perm			0.02			0.01						
v/c Ratio	0.62	0.26	0.14	0.53	0.25	0.07	1.02	0.68		0.42	0.60	
Uniform Delay, d1	23.6	18.5	18.1	23.4	18.4	17.9	22.5	14.9		21.3	14.7	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	15.7	0.6	0.3	6.4	0.5	0.1	75.7	3.9		1.8	2.0	
Delay (s)	39.3	19.0	18.4	29.9	18.9	18.0	98.1	18.7		23.1	16.7	
Level of Service	D	B	B	C	B	B	F	B		C	B	
Approach Delay (s)		21.8			20.7			45.5			17.9	
Approach LOS		C			C			D			B	

Intersection Summary			
HCM 2000 Control Delay	29.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	50.7	Sum of lost time (s)	18.0
Intersection Capacity Utilization	47.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥			✥			✥	
Traffic Volume (veh/h)	5	130	45	120	165	25	30	20	85	20	10	5
Future Volume (Veh/h)	5	130	45	120	165	25	30	20	85	20	10	5
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	5	130	45	120	165	25	30	20	85	20	10	5
Pedestrians								1				
Lane Width (ft)								12.0				
Walking Speed (ft/s)								3.5				
Percent Blockage								0				
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	190			176			591	594	154	675	604	178
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	190			176			591	594	154	675	604	178
tC, single (s)	4.2			4.2			7.4	6.8	6.5	7.7	7.1	6.8
tC, 2 stage (s)												
tF (s)	2.3			2.3			3.7	4.2	3.5	4.0	4.5	3.8
p0 queue free %	100			91			91	94	90	92	97	99
cM capacity (veh/h)	1360			1330			345	350	830	241	314	740

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	180	310	135	35
Volume Left	5	120	30	20
Volume Right	45	25	85	5
cSH	1360	1330	548	288
Volume to Capacity	0.00	0.09	0.25	0.12
Queue Length 95th (ft)	0	7	24	10
Control Delay (s)	0.2	3.6	13.7	19.2
Lane LOS	A	A	B	C
Approach Delay (s)	0.2	3.6	13.7	19.2
Approach LOS			B	C

Intersection Summary			
Average Delay	5.6		
Intersection Capacity Utilization	47.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	230	25	160	310	25	125
Future Volume (Veh/h)	230	25	160	310	25	125
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	230	25	160	310	25	125
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			255		872	242
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			255		872	242
tC, single (s)			4.2		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.3		3.5	3.3
p0 queue free %			87		91	84
cM capacity (veh/h)			1276		281	796

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2
Volume Total	255	160	310	25	125
Volume Left	0	160	0	25	0
Volume Right	25	0	0	0	125
cSH	1700	1276	1700	281	796
Volume to Capacity	0.15	0.13	0.18	0.09	0.16
Queue Length 95th (ft)	0	11	0	7	14
Control Delay (s)	0.0	8.2	0.0	19.1	10.4
Lane LOS		A		C	B
Approach Delay (s)	0.0	2.8		11.8	
Approach LOS				B	

Intersection Summary			
Average Delay	3.5		
Intersection Capacity Utilization	37.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	10	345	460	10	0	10
Future Volume (Veh/h)	10	345	460	10	0	10
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	10	345	460	10	0	10
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	470				830	465
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	470				830	465
tC, single (s)	4.2				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.3				3.5	3.3
p0 queue free %	99				100	98
cM capacity (veh/h)	1066				339	602

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	10	345	470	10
Volume Left	10	0	0	0
Volume Right	0	0	10	10
cSH	1066	1700	1700	602
Volume to Capacity	0.01	0.20	0.28	0.02
Queue Length 95th (ft)	1	0	0	1
Control Delay (s)	8.4	0.0	0.0	11.1
Lane LOS	A			B
Approach Delay (s)	0.2		0.0	11.1
Approach LOS				B

Intersection Summary			
Average Delay	0.2		
Intersection Capacity Utilization	36.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	160	5	110	10	5	0	115	195	0	0	275	235
Future Volume (vph)	160	5	110	10	5	0	115	195	0	0	275	235
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)		5.0	5.0		5.0		4.5	5.0			5.0	
Lane Util. Factor		1.00	1.00		1.00		1.00	1.00			1.00	
Frpb, ped/bikes		1.00	1.00		1.00		1.00	1.00			0.99	
Flpb, ped/bikes		1.00	1.00		1.00		1.00	1.00			1.00	
Frt		1.00	0.85		1.00		1.00	1.00			0.93	
Flt Protected		0.95	1.00		0.97		0.95	1.00			1.00	
Satd. Flow (prot)		1560	1390		1694		1484	1562			1521	
Flt Permitted		0.72	1.00		0.83		0.31	1.00			1.00	
Satd. Flow (perm)		1181	1390		1452		491	1562			1521	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	160	5	110	10	5	0	115	195	0	0	275	235
RTOR Reduction (vph)	0	0	83	0	0	0	0	0	0	0	34	0
Lane Group Flow (vph)	0	165	27	0	15	0	115	195	0	0	476	0
Confl. Peds. (#/hr)							2		1	1		2
Heavy Vehicles (%)	7%	7%	7%	0%	0%	0%	12%	12%	12%	6%	6%	6%
Turn Type	Perm	NA	Perm	Perm	NA		D.P+P	NA		D.P+P	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8			6			2		
Actuated Green, G (s)		15.6	15.6		15.6		33.3	37.8			27.3	
Effective Green, g (s)		15.6	15.6		15.6		33.3	37.8			27.3	
Actuated g/C Ratio		0.25	0.25		0.25		0.53	0.60			0.43	
Clearance Time (s)		5.0	5.0		5.0		4.5	5.0			5.0	
Vehicle Extension (s)		3.0	3.0		3.0		3.0	3.0			3.0	
Lane Grp Cap (vph)		290	342		357		351	931			654	
v/s Ratio Prot							c0.03	0.12			c0.31	
v/s Ratio Perm		c0.14	0.02		0.01		0.14					
v/c Ratio		0.57	0.08		0.04		0.33	0.21			0.73	
Uniform Delay, d1		21.0	18.4		18.2		8.5	5.9			15.0	
Progression Factor		1.00	1.00		1.00		1.00	1.00			1.00	
Incremental Delay, d2		2.6	0.1		0.0		0.5	0.1			4.0	
Delay (s)		23.5	18.5		18.3		9.1	6.0			19.0	
Level of Service		C	B		B		A	A			B	
Approach Delay (s)		21.5			18.3			7.2			19.0	
Approach LOS		C			B			A			B	

Intersection Summary			
HCM 2000 Control Delay	16.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	63.4	Sum of lost time (s)	14.5
Intersection Capacity Utilization	63.7%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	10	470	20	265	470	115	30	25	180	150	40	10
Future Volume (vph)	10	470	20	265	470	115	30	25	180	150	40	10
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	4.0	4.5		4.0	4.5			4.0	4.0		4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00	1.00		1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	0.99		1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00		1.00	
Frt	1.00	0.99		1.00	0.97			1.00	0.85		0.99	
Flt Protected	0.95	1.00		0.95	1.00			0.97	1.00		0.96	
Satd. Flow (prot)	1433	2846		1458	2818			1654	1423		1395	
Flt Permitted	0.95	1.00		0.95	1.00			0.97	1.00		0.96	
Satd. Flow (perm)	1433	2846		1458	2818			1654	1423		1395	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	10	470	20	265	470	115	30	25	180	150	40	10
RTOR Reduction (vph)	0	1	0	0	11	0	0	0	0	0	1	0
Lane Group Flow (vph)	10	489	0	265	574	0	0	55	180	0	199	0
Confl. Peds. (#/hr)	1					1			8	8		
Confl. Bikes (#/hr)			1						1			1
Heavy Vehicles (%)	16%	16%	16%	14%	14%	14%	3%	3%	3%	20%	20%	20%
Turn Type	Prot	NA		Prot	NA		Split	NA	Free	Split	NA	
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases									Free			
Actuated Green, G (s)	1.7	28.6		32.2	59.1			9.2	110.6		24.1	
Effective Green, g (s)	1.7	28.6		32.2	59.1			9.2	110.6		24.1	
Actuated g/C Ratio	0.02	0.26		0.29	0.53			0.08	1.00		0.22	
Clearance Time (s)	4.0	4.5		4.0	4.5			4.0			4.0	
Vehicle Extension (s)	3.0	3.5		3.0	3.5			3.0			3.0	
Lane Grp Cap (vph)	22	735		424	1505			137	1423		303	
v/s Ratio Prot	0.01	c0.17		c0.18	0.20			c0.03			c0.14	
v/s Ratio Perm									0.13			
v/c Ratio	0.45	0.66		0.62	0.38			0.40	0.13		0.66	
Uniform Delay, d1	54.0	36.7		34.0	15.1			48.1	0.0		39.5	
Progression Factor	1.00	1.00		1.00	1.00			1.00	1.00		1.00	
Incremental Delay, d2	14.2	2.4		2.9	0.2			1.9	0.2		5.1	
Delay (s)	68.2	39.1		36.8	15.2			50.0	0.2		44.6	
Level of Service	E	D		D	B			D	A		D	
Approach Delay (s)		39.7			22.0			11.8			44.6	
Approach LOS		D			C			B			D	

Intersection Summary			
HCM 2000 Control Delay	28.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	110.6	Sum of lost time (s)	16.5
Intersection Capacity Utilization	59.8%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	40	760	30	80	830	235	10	20	55	300	35	15
Future Volume (vph)	40	760	30	80	830	235	10	20	55	300	35	15
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	4.5	5.0		4.5	5.0			4.5	4.5	4.5	4.5	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00	1.00	0.95	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	0.99			1.00	1.00	1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00	1.00	1.00	
Frt	1.00	0.99		1.00	0.97			1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00			0.98	1.00	0.95	0.97	
Satd. Flow (prot)	1484	2950		1539	2961			1721	1488	1564	1566	
Flt Permitted	0.95	1.00		0.28	1.00			0.98	1.00	0.95	0.97	
Satd. Flow (perm)	1484	2950		456	2961			1721	1488	1564	1566	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	40	760	30	80	830	235	10	20	55	300	35	15
RTOR Reduction (vph)	0	2	0	0	22	0	0	0	53	0	4	0
Lane Group Flow (vph)	40	788	0	80	1043	0	0	30	2	174	172	0
Confl. Peds. (#/hr)	1					1	10					10
Confl. Bikes (#/hr)			1			2						
Heavy Vehicles (%)	12%	12%	12%	8%	8%	8%	0%	0%	0%	1%	1%	1%
Turn Type	Prot	NA		pm+pt	NA		Split	NA	Perm	Split	NA	
Protected Phases	1	6		5	2		4	4		8	8	
Permitted Phases				2					4			
Actuated Green, G (s)	3.3	48.8		56.1	50.8			4.1	4.1	16.3	16.3	
Effective Green, g (s)	3.3	48.8		56.1	50.8			4.1	4.1	16.3	16.3	
Actuated g/C Ratio	0.04	0.52		0.60	0.55			0.04	0.04	0.18	0.18	
Clearance Time (s)	4.5	5.0		4.5	5.0			4.5	4.5	4.5	4.5	
Vehicle Extension (s)	3.0	3.5		3.0	3.5			3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	52	1547		336	1617			75	65	274	274	
v/s Ratio Prot	c0.03	0.27		0.01	c0.35			c0.02		c0.11	0.11	
v/s Ratio Perm				0.13					0.00			
v/c Ratio	0.77	0.51		0.24	0.65			0.40	0.04	0.64	0.63	
Uniform Delay, d1	44.5	14.3		8.4	14.8			43.3	42.6	35.6	35.5	
Progression Factor	1.00	1.00		0.36	0.32			1.00	1.00	1.00	1.00	
Incremental Delay, d2	48.9	1.2		0.3	1.9			3.5	0.2	4.8	4.4	
Delay (s)	93.4	15.5		3.4	6.6			46.7	42.8	40.3	40.0	
Level of Service	F	B		A	A			D	D	D	D	
Approach Delay (s)		19.3			6.4			44.2			40.2	
Approach LOS		B			A			D			D	

Intersection Summary			
HCM 2000 Control Delay	17.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	93.0	Sum of lost time (s)	18.5
Intersection Capacity Utilization	67.2%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	590	510	70	885	0	0	0	0	230	155	360
Future Volume (vph)	0	590	510	70	885	0	0	0	0	230	155	360
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)		5.0	5.0	4.5	5.0					4.5	4.5	4.5
Lane Util. Factor		0.95	1.00	0.97	0.95					0.95	0.95	0.88
Frpb, ped/bikes		1.00	0.98	1.00	1.00					1.00	1.00	1.00
Flpb, ped/bikes		1.00	1.00	1.00	1.00					1.00	1.00	1.00
Frt		1.00	0.85	1.00	1.00					1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95	0.99	1.00
Satd. Flow (prot)		3050	1344	2986	3079					1504	1567	2493
Flt Permitted		1.00	1.00	0.95	1.00					0.95	0.99	1.00
Satd. Flow (perm)		3050	1344	2986	3079					1504	1567	2493
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	590	510	70	885	0	0	0	0	230	155	360
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	151
Lane Group Flow (vph)	0	590	510	70	885	0	0	0	0	189	196	209
Confl. Peds. (#/hr)	4		2	2		4						
Confl. Bikes (#/hr)			3			2						
Heavy Vehicles (%)	9%	9%	9%	8%	8%	8%	0%	0%	0%	5%	5%	5%
Turn Type		NA	Perm	Prot	NA					Split	NA	Perm
Protected Phases		2		1	6					4	4	
Permitted Phases			2									4
Actuated Green, G (s)		55.8	55.8	4.0	64.3					19.2	19.2	19.2
Effective Green, g (s)		55.8	55.8	4.0	64.3					19.2	19.2	19.2
Actuated g/C Ratio		0.60	0.60	0.04	0.69					0.21	0.21	0.21
Clearance Time (s)		5.0	5.0	4.5	5.0					4.5	4.5	4.5
Vehicle Extension (s)		3.5	3.5	3.0	3.5					3.5	3.5	3.5
Lane Grp Cap (vph)		1830	806	128	2128					310	323	514
v/s Ratio Prot		0.19		0.02	c0.29					c0.13	0.13	
v/s Ratio Perm			c0.38									0.08
v/c Ratio		0.32	0.63	0.55	0.42					0.61	0.61	0.41
Uniform Delay, d1		9.2	12.0	43.6	6.2					33.5	33.5	32.0
Progression Factor		0.62	0.60	1.24	0.89					1.00	1.00	1.00
Incremental Delay, d2		0.4	3.4	4.3	0.5					3.6	3.4	0.6
Delay (s)		6.1	10.6	58.2	6.1					37.1	36.9	32.6
Level of Service		A	B	E	A					D	D	C
Approach Delay (s)		8.2			9.9			0.0			34.8	
Approach LOS		A			A			A			C	

Intersection Summary			
HCM 2000 Control Delay	15.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	93.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	62.4%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰↰	↑↑			↑↑	↱	↰↰	↑	↱			
Traffic Volume (vph)	255	565	0	0	340	260	615	165	115	0	0	0
Future Volume (vph)	255	565	0	0	340	260	615	165	115	0	0	0
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	4.5	5.0			5.0	5.0	6.0	6.0	4.0			
Lane Util. Factor	0.97	0.95			0.95	1.00	0.97	1.00	1.00			
Frpb, ped/bikes	1.00	1.00			1.00	0.98	1.00	1.00	0.99			
Flpb, ped/bikes	1.00	1.00			1.00	1.00	1.00	1.00	1.00			
Frt	1.00	1.00			1.00	0.85	1.00	1.00	0.85			
Flt Protected	0.95	1.00			1.00	1.00	0.95	1.00	1.00			
Satd. Flow (prot)	3072	3167			3228	1415	3014	1636	1372			
Flt Permitted	0.95	1.00			1.00	1.00	0.95	1.00	1.00			
Satd. Flow (perm)	3072	3167			3228	1415	3014	1636	1372			
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	255	565	0	0	340	260	615	165	115	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	150	0	0	0	0	0	0
Lane Group Flow (vph)	255	565	0	0	340	110	615	165	115	0	0	0
Confl. Peds. (#/hr)	7		4	4		7			3	3		
Confl. Bikes (#/hr)			3			2						
Heavy Vehicles (%)	5%	5%	5%	3%	3%	3%	7%	7%	7%	0%	0%	0%
Turn Type	Prot	NA			NA	Perm	Split	NA	Free			
Protected Phases	5	2			6		8	8				
Permitted Phases						6			Free			
Actuated Green, G (s)	12.5	56.2			39.2	39.2	25.8	25.8	93.0			
Effective Green, g (s)	12.5	56.2			39.2	39.2	25.8	25.8	93.0			
Actuated g/C Ratio	0.13	0.60			0.42	0.42	0.28	0.28	1.00			
Clearance Time (s)	4.5	5.0			5.0	5.0	6.0	6.0				
Vehicle Extension (s)	3.0	3.5			3.5	3.5	3.0	3.0				
Lane Grp Cap (vph)	412	1913			1360	596	836	453	1372			
v/s Ratio Prot	c0.08	c0.18			0.11		c0.20	0.10				
v/s Ratio Perm						0.08			0.08			
v/c Ratio	0.62	0.30			0.25	0.18	0.74	0.36	0.08			
Uniform Delay, d1	38.0	8.9			17.4	16.9	30.5	27.0	0.0			
Progression Factor	0.81	0.74			1.00	1.00	1.00	1.00	1.00			
Incremental Delay, d2	2.7	0.4			0.4	0.7	3.4	0.5	0.1			
Delay (s)	33.5	6.9			17.8	17.5	33.9	27.5	0.1			
Level of Service	C	A			B	B	C	C	A			
Approach Delay (s)		15.2			17.7			28.4			0.0	
Approach LOS		B			B			C			A	

Intersection Summary			
HCM 2000 Control Delay	20.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	93.0	Sum of lost time (s)	15.5
Intersection Capacity Utilization	62.4%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	25	470	75	390	540	165	85	80	525	300	110	45
v/c Ratio	0.30	0.56	0.15	0.69	0.74	0.24	0.28	0.41	1.00	0.72	0.38	0.13
Control Delay	62.0	33.5	0.7	47.8	31.4	6.1	39.0	52.2	68.7	48.4	47.7	0.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	62.0	33.5	0.7	47.8	31.4	6.1	39.0	52.2	68.7	48.4	47.7	0.8
Queue Length 50th (ft)	17	136	0	129	306	12	47	52	292	190	71	0
Queue Length 95th (ft)	49	194	0	#226	476	54	103	107	#562	#377	135	0
Internal Link Dist (ft)		868			1020			559			326	
Turn Bay Length (ft)	560		50	825			350		390	280		50
Base Capacity (vph)	82	1287	666	567	877	805	347	719	523	419	909	827
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.30	0.37	0.11	0.69	0.62	0.20	0.24	0.11	1.00	0.72	0.12	0.05

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBT	EBR	WBL	WBT	SBT	SBR
Lane Group Flow (vph)	745	550	405	595	145	500
v/c Ratio	0.71	0.71	0.83	0.27	0.59	0.62
Control Delay	34.5	11.8	48.5	5.4	53.4	7.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	34.5	11.8	48.5	5.4	53.4	7.8
Queue Length 50th (ft)	228	44	252	67	90	0
Queue Length 95th (ft)	333	190	400	87	178	52
Internal Link Dist (ft)	1020			607	372	
Turn Bay Length (ft)		310	200			180
Base Capacity (vph)	1349	862	685	2675	297	864
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.55	0.64	0.59	0.22	0.49	0.58

Intersection Summary

Lane Group	EBL	EBT	WBT	NBL	NBT	NBR
Lane Group Flow (vph)	660	210	830	162	163	145
v/c Ratio	0.97	0.09	0.97	0.74	0.74	0.44
Control Delay	67.0	4.9	72.5	75.4	75.8	11.9
Queue Delay	8.7	0.0	0.0	0.0	0.0	0.0
Total Delay	75.7	4.9	72.5	75.4	75.8	11.9
Queue Length 50th (ft)	580	23	385	147	148	0
Queue Length 95th (ft)	#882	38	#548	232	234	62
Internal Link Dist (ft)		607	306		404	
Turn Bay Length (ft)	300			240		
Base Capacity (vph)	678	2331	856	271	271	371
Starvation Cap Reductn	26	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	1.01	0.09	0.97	0.60	0.60	0.39

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	45	65	175	40	65	95	165	325	65	290
v/c Ratio	0.30	0.26	0.49	0.25	0.24	0.31	0.98	0.66	0.41	0.58
Control Delay	31.0	23.8	9.7	29.6	23.4	8.1	101.2	22.1	36.0	20.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	31.0	23.8	9.7	29.6	23.4	8.1	101.2	22.1	36.0	20.0
Queue Length 50th (ft)	13	18	0	12	18	0	~61	84	20	74
Queue Length 95th (ft)	#48	53	46	43	53	31	#195	172	#77	150
Internal Link Dist (ft)		1222			378			2383		291
Turn Bay Length (ft)	100		200	150		150	135		150	
Base Capacity (vph)	152	1254	1094	161	1322	1117	168	1193	159	1244
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.30	0.05	0.16	0.25	0.05	0.09	0.98	0.27	0.41	0.23

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBT	EBR	WBT	NBL	NBT	SBT
Lane Group Flow (vph)	165	110	15	115	195	510
v/c Ratio	0.57	0.26	0.04	0.29	0.22	0.75
Control Delay	34.3	7.5	24.0	8.2	7.2	22.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	34.3	7.5	24.0	8.2	7.2	22.4
Queue Length 50th (ft)	56	0	4	16	29	141
Queue Length 95th (ft)	154	40	23	48	79	324
Internal Link Dist (ft)	5421		175		763	967
Turn Bay Length (ft)		120		120		
Base Capacity (vph)	577	735	710	439	1348	1260
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.29	0.15	0.02	0.26	0.14	0.40

Intersection Summary

Lane Group	EBL	EBT	WBL	WBT	NBT	NBR	SBT
Lane Group Flow (vph)	10	490	265	585	55	180	200
v/c Ratio	0.11	0.65	0.69	0.38	0.31	0.13	0.65
Control Delay	71.1	44.4	51.2	17.5	59.6	0.2	55.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	71.1	44.4	51.2	17.5	59.6	0.2	55.0
Queue Length 50th (ft)	6	147	154	98	34	0	118
Queue Length 95th (ft)	36	338	384	265	104	0	305
Internal Link Dist (ft)		457		542	390		318
Turn Bay Length (ft)	90		150			90	
Base Capacity (vph)	93	1510	810	2342	468	1423	623
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.11	0.32	0.33	0.25	0.12	0.13	0.32

Intersection Summary

Lane Group	EBL	EBT	WBL	WBT	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	40	790	80	1065	30	55	174	176
v/c Ratio	0.46	0.49	0.22	0.62	0.32	0.27	0.64	0.64
Control Delay	59.8	17.1	4.5	7.1	51.6	3.3	45.3	44.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	59.8	17.1	4.5	7.1	51.6	3.3	45.3	44.0
Queue Length 50th (ft)	23	156	3	73	17	0	102	100
Queue Length 95th (ft)	#63	258	25	120	46	0	153	152
Internal Link Dist (ft)		542		515	105			290
Turn Bay Length (ft)	200		330			150	185	
Base Capacity (vph)	87	1607	362	1725	94	203	422	426
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.46	0.49	0.22	0.62	0.32	0.27	0.41	0.41

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBT	EBR	WBL	WBT	SBL	SBT	SBR
Lane Group Flow (vph)	590	510	70	885	189	196	360
v/c Ratio	0.32	0.62	0.44	0.42	0.61	0.60	0.54
Control Delay	6.9	12.4	61.0	7.0	40.7	40.3	17.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	6.9	12.4	61.0	7.0	40.7	40.3	17.1
Queue Length 50th (ft)	62	103	22	96	107	110	48
Queue Length 95th (ft)	80	137	m42	129	161	165	85
Internal Link Dist (ft)	515			447		580	
Turn Bay Length (ft)		275	160				450
Base Capacity (vph)	1858	817	160	2127	582	606	1081
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.32	0.62	0.44	0.42	0.32	0.32	0.33

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	EBL	EBT	WBT	WBR	NBL	NBT	NBR
Lane Group Flow (vph)	255	565	340	260	615	165	115
v/c Ratio	0.62	0.30	0.25	0.35	0.74	0.36	0.08
Control Delay	37.2	7.6	19.8	4.5	35.6	28.1	0.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	37.2	7.6	19.8	4.5	35.6	28.1	0.1
Queue Length 50th (ft)	64	69	67	0	168	78	0
Queue Length 95th (ft)	103	105	116	53	204	119	0
Internal Link Dist (ft)		447	460			581	
Turn Bay Length (ft)	180			240			400
Base Capacity (vph)	478	1913	1359	746	1101	598	1372
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.53	0.30	0.25	0.35	0.56	0.28	0.08

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑	↱	↰↰	↑	↱	↰	↑	↱	↰	↑	↱
Traffic Volume (vph)	25	425	100	620	415	270	85	175	605	275	190	30
Future Volume (vph)	25	425	100	620	415	270	85	175	605	275	190	30
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	4.5	4.9	4.9	4.5	4.9	4.9	4.5	4.9	4.5	4.5	4.9	4.9
Lane Util. Factor	1.00	0.95	1.00	0.97	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1599	3197	1430	3101	1683	1430	1614	1699	1444	1630	1716	1458
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1599	3197	1430	3101	1683	1430	1614	1699	1444	1630	1716	1458
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	25	425	100	620	415	270	85	175	605	275	190	30
RTOR Reduction (vph)	0	0	52	0	0	116	0	0	104	0	0	25
Lane Group Flow (vph)	25	425	48	620	415	154	85	175	501	275	190	5
Heavy Vehicles (%)	4%	4%	4%	4%	4%	4%	3%	3%	3%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8	1	7	4	
Permitted Phases			2			6			8			4
Actuated Green, G (s)	4.0	62.7	62.7	15.5	74.2	74.2	13.1	19.5	35.0	13.5	19.9	19.9
Effective Green, g (s)	4.0	62.7	62.7	15.5	74.2	74.2	13.1	19.5	35.0	13.5	19.9	19.9
Actuated g/C Ratio	0.03	0.48	0.48	0.12	0.57	0.57	0.10	0.15	0.27	0.10	0.15	0.15
Clearance Time (s)	4.5	4.9	4.9	4.5	4.9	4.9	4.5	4.9	4.5	4.5	4.9	4.9
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	49	1541	689	369	960	816	162	254	388	169	262	223
v/s Ratio Prot	0.02	0.13		c0.20	c0.25		0.05	0.10	c0.15	c0.17	0.11	
v/s Ratio Perm			0.03			0.11			0.19			0.00
v/c Ratio	0.51	0.28	0.07	1.68	0.43	0.19	0.52	0.69	1.29	1.63	0.73	0.02
Uniform Delay, d1	62.0	20.1	18.0	57.2	15.9	13.4	55.5	52.4	47.5	58.2	52.4	46.8
Progression Factor	1.00	1.00	1.00	0.98	1.27	2.75	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	8.7	0.4	0.2	316.6	1.3	0.5	3.0	7.6	149.4	307.6	9.6	0.0
Delay (s)	70.7	20.5	18.2	372.6	21.4	37.4	58.5	59.9	196.9	365.9	62.0	46.8
Level of Service	E	C	B	F	C	D	E	E	F	F	E	D
Approach Delay (s)		22.4			191.6			155.6			229.9	
Approach LOS		C			F			F			F	

Intersection Summary			
HCM 2000 Control Delay	158.9	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	18.8
Intersection Capacity Utilization	81.6%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	650	655	245	790	0	0	0	0	75	0	515
Future Volume (vph)	0	650	655	245	790	0	0	0	0	75	0	515
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)		5.9	5.9	5.5	5.9						5.9	5.9
Lane Util. Factor		0.95	1.00	1.00	0.95						1.00	0.88
Frt		1.00	0.85	1.00	1.00						1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00						0.95	1.00
Satd. Flow (prot)		3197	1430	1583	3167						1599	2517
Flt Permitted		1.00	1.00	0.95	1.00						0.95	1.00
Satd. Flow (perm)		3197	1430	1583	3167						1599	2517
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	650	655	245	790	0	0	0	0	75	0	515
RTOR Reduction (vph)	0	0	273	0	0	0	0	0	0	0	0	464
Lane Group Flow (vph)	0	650	382	245	790	0	0	0	0	0	75	51
Heavy Vehicles (%)	4%	4%	4%	5%	5%	5%	0%	0%	0%	4%	4%	4%
Turn Type		NA	Perm	Prot	NA					Perm	NA	Perm
Protected Phases		2		1	6						4	
Permitted Phases			2							4		4
Actuated Green, G (s)		75.9	75.9	23.9	105.3						12.9	12.9
Effective Green, g (s)		75.9	75.9	23.9	105.3						12.9	12.9
Actuated g/C Ratio		0.58	0.58	0.18	0.81						0.10	0.10
Clearance Time (s)		5.9	5.9	5.5	5.9						5.9	5.9
Vehicle Extension (s)		3.0	3.0	3.5	5.0						4.0	4.0
Lane Grp Cap (vph)		1866	834	291	2565						158	249
v/s Ratio Prot		0.20		c0.15	0.25							
v/s Ratio Perm			c0.27								0.05	0.02
v/c Ratio		0.35	0.46	0.84	0.31						0.47	0.21
Uniform Delay, d1		14.1	15.4	51.2	3.1						55.3	53.8
Progression Factor		1.09	2.74	1.00	1.00						1.00	1.00
Incremental Delay, d2		0.2	0.6	19.7	0.3						3.0	0.6
Delay (s)		15.6	42.7	70.9	3.4						58.4	54.4
Level of Service		B	D	E	A						E	D
Approach Delay (s)		29.2			19.4			0.0			54.9	
Approach LOS		C			B			A			D	

Intersection Summary			
HCM 2000 Control Delay	30.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	19.3
Intersection Capacity Utilization	81.5%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	485	240	0	0	435	80	600	0	375	0	0	0
Future Volume (vph)	485	240	0	0	435	80	600	0	375	0	0	0
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	5.5	5.9			5.9		5.9	5.9	5.9			
Lane Util. Factor	1.00	0.95			0.95		0.95	0.95	1.00			
Frt	1.00	1.00			0.98		1.00	1.00	0.85			
Flt Protected	0.95	1.00			1.00		0.95	0.95	1.00			
Satd. Flow (prot)	1614	3228			3064		1504	1504	1417			
Flt Permitted	0.95	1.00			1.00		0.95	0.95	1.00			
Satd. Flow (perm)	1614	3228			3064		1504	1504	1417			
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	485	240	0	0	435	80	600	0	375	0	0	0
RTOR Reduction (vph)	0	0	0	0	11	0	0	0	272	0	0	0
Lane Group Flow (vph)	485	240	0	0	504	0	300	300	103	0	0	0
Heavy Vehicles (%)	3%	3%	3%	6%	6%	6%	5%	5%	5%	0%	0%	0%
Turn Type	Prot	NA			NA		Perm	NA	Perm			
Protected Phases	5	2			6			8				
Permitted Phases							8		8			
Actuated Green, G (s)	41.4	72.8			25.9		32.1	32.1	32.1			
Effective Green, g (s)	41.4	72.8			25.9		32.1	32.1	32.1			
Actuated g/C Ratio	0.35	0.62			0.22		0.28	0.28	0.28			
Clearance Time (s)	5.5	5.9			5.9		5.9	5.9	5.9			
Vehicle Extension (s)	4.0	3.0			3.5		4.0	4.0	4.0			
Lane Grp Cap (vph)	572	2013			680		413	413	389			
v/s Ratio Prot	c0.30	0.07			c0.16							
v/s Ratio Perm							c0.20	0.20	0.07			
v/c Ratio	0.85	0.12			0.74		0.73	0.73	0.27			
Uniform Delay, d1	34.7	8.9			42.3		38.3	38.3	33.1			
Progression Factor	1.00	1.00			1.00		1.00	1.00	1.00			
Incremental Delay, d2	11.6	0.0			4.5		6.7	6.7	0.5			
Delay (s)	46.4	8.9			46.8		45.0	45.0	33.6			
Level of Service	D	A			D		D	D	C			
Approach Delay (s)		34.0			46.8			40.6			0.0	
Approach LOS		C			D			D			A	

Intersection Summary			
HCM 2000 Control Delay	39.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	116.7	Sum of lost time (s)	17.3
Intersection Capacity Utilization	81.5%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	0	20	0	485	15	25	500	0
Future Volume (Veh/h)	0	0	0	0	0	20	0	485	15	25	500	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	0	0	20	0	485	15	25	500	0
Pedestrians					1							
Lane Width (ft)					12.0							
Walking Speed (ft/s)					3.5							
Percent Blockage					0							
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1062	1051	500	1044	1044	494	500			501		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1062	1051	500	1044	1044	494	500			501		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	97	100			98		
cM capacity (veh/h)	192	223	575	205	225	579	1059			1052		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	0	20	500	525
Volume Left	0	0	0	25
Volume Right	0	20	15	0
cSH	1700	579	1059	1052
Volume to Capacity	0.00	0.03	0.00	0.02
Queue Length 95th (ft)	0	3	0	2
Control Delay (s)	0.0	11.4	0.0	0.7
Lane LOS	A	B		A
Approach Delay (s)	0.0	11.4	0.0	0.7
Approach LOS	A	B		

Intersection Summary			
Average Delay	0.6		
Intersection Capacity Utilization	60.7%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	30	0	45	0	0	5	60	445	0	10	435	40
Future Volume (Veh/h)	30	0	45	0	0	5	60	445	0	10	435	40
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	30	0	45	0	0	5	60	445	0	10	435	40
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1045	1040	455	1085	1060	445	475			445		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1045	1040	455	1085	1060	445	475			445		
tC, single (s)	7.1	6.5	6.2	7.3	6.7	6.4	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.7	4.2	3.5	2.2			2.2		
p0 queue free %	84	100	93	100	100	99	94			99		
cM capacity (veh/h)	193	214	601	158	195	577	1077			1099		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1
Volume Total	75	5	60	445	485
Volume Left	30	0	60	0	10
Volume Right	45	5	0	0	40
cSH	326	577	1077	1700	1099
Volume to Capacity	0.23	0.01	0.06	0.26	0.01
Queue Length 95th (ft)	22	1	4	0	1
Control Delay (s)	19.3	11.3	8.5	0.0	0.3
Lane LOS	C	B	A		A
Approach Delay (s)	19.3	11.3	1.0		0.3
Approach LOS	C	B			

Intersection Summary			
Average Delay	2.0		
Intersection Capacity Utilization	59.5%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	0	15	20	0	40	15	475	20	15	480	10
Future Volume (Veh/h)	10	0	15	20	0	40	15	475	20	15	480	10
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	10	0	15	20	0	40	15	475	20	15	480	10
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1060	1040	485	1030	1025	475	490			495		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1060	1040	485	1030	1025	475	490			495		
tC, single (s)	7.2	6.6	6.3	7.2	6.6	6.3	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.1	3.4	3.6	4.1	3.4	2.2			2.2		
p0 queue free %	94	100	97	90	100	93	99			99		
cM capacity (veh/h)	180	220	574	192	219	568	1068			1053		

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2	NB 3	SB 1	SB 2
Volume Total	25	20	40	15	475	20	15	490
Volume Left	10	20	0	15	0	0	15	0
Volume Right	15	0	40	0	0	20	0	10
cSH	307	192	568	1068	1700	1700	1053	1700
Volume to Capacity	0.08	0.10	0.07	0.01	0.28	0.01	0.01	0.29
Queue Length 95th (ft)	7	9	6	1	0	0	1	0
Control Delay (s)	17.8	25.9	11.8	8.4	0.0	0.0	8.5	0.0
Lane LOS	C	D	B	A			A	
Approach Delay (s)	17.8	16.5		0.2			0.3	
Approach LOS	C	C						

Intersection Summary			
Average Delay	1.5		
Intersection Capacity Utilization	43.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	90	10	495	85	0	485
Future Volume (Veh/h)	90	10	495	85	0	485
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	90	10	495	85	0	485
Pedestrians	1					
Lane Width (ft)	12.0					
Walking Speed (ft/s)	3.5					
Percent Blockage	0					
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1024	538			581	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1024	538			581	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	66	98			100	
cM capacity (veh/h)	263	546			987	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	100	580	485
Volume Left	90	0	0
Volume Right	10	85	0
cSH	277	1700	987
Volume to Capacity	0.36	0.34	0.00
Queue Length 95th (ft)	39	0	0
Control Delay (s)	25.1	0.0	0.0
Lane LOS	D		
Approach Delay (s)	25.1	0.0	0.0
Approach LOS	D		

Intersection Summary			
Average Delay	2.2		
Intersection Capacity Utilization	46.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	60	110	235	65	90	145	155	395	90	135	420	35
Future Volume (vph)	60	110	235	65	90	145	155	395	90	135	420	35
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5		4.5	4.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	0.98	1.00	0.99		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97		1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1554	1636	1358	1630	1716	1428	1568	1596		1614	1676	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1554	1636	1358	1630	1716	1428	1568	1596		1614	1676	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	60	110	235	65	90	145	155	395	90	135	420	35
RTOR Reduction (vph)	0	0	197	0	0	122	0	7	0	0	2	0
Lane Group Flow (vph)	60	110	38	65	90	23	155	478	0	135	453	0
Confl. Peds. (#/hr)	1		4	4		1	7		8	8		7
Confl. Bikes (#/hr)									3			1
Heavy Vehicles (%)	7%	7%	7%	2%	2%	2%	6%	6%	6%	3%	3%	3%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8						
Actuated Green, G (s)	5.1	10.5	10.5	5.1	10.5	10.5	5.6	25.8		5.6	25.8	
Effective Green, g (s)	5.1	10.5	10.5	5.1	10.5	10.5	5.6	25.8		5.6	25.8	
Actuated g/C Ratio	0.08	0.16	0.16	0.08	0.16	0.16	0.09	0.40		0.09	0.40	
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5		4.5	4.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	121	264	219	127	277	230	135	633		139	665	
v/s Ratio Prot	0.04	c0.07		c0.04	0.05		c0.10	c0.30		0.08	0.27	
v/s Ratio Perm			0.03			0.02						
v/c Ratio	0.50	0.42	0.17	0.51	0.32	0.10	1.15	0.75		0.97	0.68	
Uniform Delay, d1	28.7	24.5	23.5	28.8	24.1	23.2	29.7	16.9		29.6	16.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	3.2	1.1	0.4	3.5	0.7	0.2	122.8	5.1		67.2	2.9	
Delay (s)	31.9	25.6	23.9	32.2	24.8	23.4	152.5	22.0		96.8	19.1	
Level of Service	C	C	C	C	C	C	F	C		F	B	
Approach Delay (s)		25.5			25.7			53.6			36.9	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM 2000 Control Delay	38.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	62.3%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	15	285	55	55	225	5	45	20	90	20	25	15
Future Volume (Veh/h)	15	285	55	55	225	5	45	20	90	20	25	15
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	15	285	55	55	225	5	45	20	90	20	25	15
Pedestrians					1						3	
Lane Width (ft)					12.0						12.0	
Walking Speed (ft/s)					3.5						3.5	
Percent Blockage					0						0	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	233			340			708	686	314	784	710	230
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	233			340			708	686	314	784	710	230
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			95			85	94	88	92	93	98
cM capacity (veh/h)	1325			1208			309	349	726	248	337	806

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	355	285	155	60
Volume Left	15	55	45	20
Volume Right	55	5	90	15
cSH	1325	1208	474	346
Volume to Capacity	0.01	0.05	0.33	0.17
Queue Length 95th (ft)	1	4	35	15
Control Delay (s)	0.4	1.9	16.2	17.6
Lane LOS	A	A	C	C
Approach Delay (s)	0.4	1.9	16.2	17.6
Approach LOS			C	C

Intersection Summary			
Average Delay	5.0		
Intersection Capacity Utilization	57.4%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	360	45	180	295	20	230
Future Volume (Veh/h)	360	45	180	295	20	230
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	360	45	180	295	20	230
Pedestrians					2	
Lane Width (ft)					12.0	
Walking Speed (ft/s)					3.5	
Percent Blockage					0	
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			407		1040	384
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			407		1040	384
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			84		91	65
cM capacity (veh/h)			1150		216	664

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2
Volume Total	405	180	295	20	230
Volume Left	0	180	0	20	0
Volume Right	45	0	0	0	230
cSH	1700	1150	1700	216	664
Volume to Capacity	0.24	0.16	0.17	0.09	0.35
Queue Length 95th (ft)	0	14	0	8	39
Control Delay (s)	0.0	8.7	0.0	23.4	13.3
Lane LOS		A		C	B
Approach Delay (s)	0.0	3.3		14.1	
Approach LOS				B	

Intersection Summary			
Average Delay	4.5		
Intersection Capacity Utilization	47.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	10	580	450	10	10	25
Future Volume (Veh/h)	10	580	450	10	10	25
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	10	580	450	10	10	25
Pedestrians					1	
Lane Width (ft)					12.0	
Walking Speed (ft/s)					3.5	
Percent Blockage					0	
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	461				1056	456
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	461				1056	456
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				96	96
cM capacity (veh/h)	1104				249	608

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	10	580	460	35
Volume Left	10	0	0	10
Volume Right	0	0	10	25
cSH	1104	1700	1700	431
Volume to Capacity	0.01	0.34	0.27	0.08
Queue Length 95th (ft)	1	0	0	7
Control Delay (s)	8.3	0.0	0.0	14.1
Lane LOS	A			B
Approach Delay (s)	0.1		0.0	14.1
Approach LOS				B

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	43.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	305	10	290	10	10	0	190	400	15	0	380	225
Future Volume (vph)	305	10	290	10	10	0	190	400	15	0	380	225
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)		5.0	5.0		5.0		4.5	5.0			5.0	
Lane Util. Factor		1.00	1.00		1.00		1.00	1.00			1.00	
Frpb, ped/bikes		1.00	0.98		1.00		1.00	1.00			0.99	
Flpb, ped/bikes		1.00	1.00		1.00		1.00	1.00			1.00	
Frt		1.00	0.85		1.00		1.00	0.99			0.94	
Flt Protected		0.95	1.00		0.98		0.95	1.00			1.00	
Satd. Flow (prot)		1621	1412		1707		1599	1672			1607	
Flt Permitted		0.72	1.00		0.85		0.19	1.00			1.00	
Satd. Flow (perm)		1220	1412		1486		317	1672			1607	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	305	10	290	10	10	0	190	400	15	0	380	225
RTOR Reduction (vph)	0	0	186	0	0	0	0	1	0	0	21	0
Lane Group Flow (vph)	0	315	104	0	20	0	190	414	0	0	584	0
Confl. Peds. (#/hr)									1	1		
Confl. Bikes (#/hr)			2			1			1			2
Heavy Vehicles (%)	3%	3%	3%	0%	0%	0%	4%	4%	4%	2%	2%	2%
Turn Type	Perm	NA	Perm	Perm	NA		D.P+P	NA		D.P+P	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8			6			2		
Actuated Green, G (s)		27.7	27.7		27.7		47.4	51.9			37.6	
Effective Green, g (s)		27.7	27.7		27.7		47.4	51.9			37.6	
Actuated g/C Ratio		0.31	0.31		0.31		0.53	0.58			0.42	
Clearance Time (s)		5.0	5.0		5.0		4.5	5.0			5.0	
Vehicle Extension (s)		3.0	3.0		3.0		3.0	3.0			3.0	
Lane Grp Cap (vph)		377	436		459		307	968			674	
v/s Ratio Prot							c0.07	0.25			c0.36	
v/s Ratio Perm		c0.26	0.07		0.01		0.26					
v/c Ratio		0.84	0.24		0.04		0.62	0.43			0.87	
Uniform Delay, d1		28.8	23.1		21.7		14.7	10.5			23.7	
Progression Factor		1.00	1.00		1.00		1.00	1.00			1.00	
Incremental Delay, d2		14.7	0.3		0.0		3.7	0.3			11.3	
Delay (s)		43.6	23.4		21.7		18.4	10.8			35.0	
Level of Service		D	C		C		B	B			C	
Approach Delay (s)		33.9			21.7			13.2			35.0	
Approach LOS		C			C			B			C	

Intersection Summary			
HCM 2000 Control Delay	27.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	89.6	Sum of lost time (s)	14.5
Intersection Capacity Utilization	85.7%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	25	690	40	290	580	140	75	65	305	155	45	15
Future Volume (vph)	25	690	40	290	580	140	75	65	305	155	45	15
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	4.0	4.5		4.0	4.5			4.0	4.0		4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00	1.00		1.00	
Frpb, ped/bikes	1.00	1.00		1.00	0.99			1.00	0.99		1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00		1.00	
Frt	1.00	0.99		1.00	0.97			1.00	0.85		0.99	
Flt Protected	0.95	1.00		0.95	1.00			0.97	1.00		0.97	
Satd. Flow (prot)	1599	3165		1599	3079			1687	1453		1621	
Flt Permitted	0.95	1.00		0.95	1.00			0.97	1.00		0.97	
Satd. Flow (perm)	1599	3165		1599	3079			1687	1453		1621	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	25	690	40	290	580	140	75	65	305	155	45	15
RTOR Reduction (vph)	0	3	0	0	14	0	0	0	0	0	2	0
Lane Group Flow (vph)	25	727	0	290	706	0	0	140	305	0	213	0
Confl. Peds. (#/hr)	8		4	4		8	3		4	4		3
Confl. Bikes (#/hr)			1			3						
Heavy Vehicles (%)	4%	4%	4%	4%	4%	4%	1%	1%	1%	3%	3%	3%
Turn Type	Prot	NA		Prot	NA		Split	NA	Free	Split	NA	
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases									Free			
Actuated Green, G (s)	3.6	40.5		22.6	59.5			15.9	115.0		19.5	
Effective Green, g (s)	3.6	40.5		22.6	59.5			15.9	115.0		19.5	
Actuated g/C Ratio	0.03	0.35		0.20	0.52			0.14	1.00		0.17	
Clearance Time (s)	4.0	4.5		4.0	4.5			4.0			4.0	
Vehicle Extension (s)	3.0	3.5		3.0	3.5			3.0			3.0	
Lane Grp Cap (vph)	50	1114		314	1593			233	1453		274	
v/s Ratio Prot	0.02	c0.23		c0.18	0.23			c0.08			c0.13	
v/s Ratio Perm									0.21			
v/c Ratio	0.50	0.65		0.92	0.44			0.60	0.21		0.78	
Uniform Delay, d1	54.8	31.3		45.4	17.4			46.6	0.0		45.7	
Progression Factor	1.00	1.00		0.65	0.23			1.00	1.00		1.00	
Incremental Delay, d2	7.7	3.0		18.5	0.4			4.3	0.3		12.8	
Delay (s)	62.5	34.3		47.8	4.4			50.9	0.3		58.5	
Level of Service	E	C		D	A			D	A		E	
Approach Delay (s)		35.2			16.9			16.2			58.5	
Approach LOS		D			B			B			E	

Intersection Summary			
HCM 2000 Control Delay	26.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	115.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	69.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	65	1060	35	235	980	435	20	30	215	500	65	20
Future Volume (vph)	65	1060	35	235	980	435	20	30	215	500	65	20
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	4.5	5.0		4.5	5.0			4.5	4.5	4.5	4.5	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00	1.00	0.95	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	0.98			1.00	1.00	1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00	1.00	1.00	
Frt	1.00	1.00		1.00	0.95			1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00			0.98	1.00	0.95	0.97	
Satd. Flow (prot)	1599	3179		1614	3028			1716	1488	1564	1570	
Flt Permitted	0.95	1.00		0.12	1.00			0.98	1.00	0.95	0.97	
Satd. Flow (perm)	1599	3179		197	3028			1716	1488	1564	1570	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	65	1060	35	235	980	435	20	30	215	500	65	20
RTOR Reduction (vph)	0	2	0	0	41	0	0	0	163	0	2	0
Lane Group Flow (vph)	65	1093	0	235	1374	0	0	50	52	290	293	0
Confl. Peds. (#/hr)	10		6	6		10	15					15
Confl. Bikes (#/hr)			2			1						1
Heavy Vehicles (%)	4%	4%	4%	3%	3%	3%	0%	0%	0%	1%	1%	1%
Turn Type	Prot	NA		pm+pt	NA		Split	NA	Perm	Split	NA	
Protected Phases	1	6		5	2		4	4		8	8	
Permitted Phases				2					4			
Actuated Green, G (s)	5.2	49.9		68.4	58.7			8.4	8.4	24.2	24.2	
Effective Green, g (s)	5.2	49.9		68.4	58.7			8.4	8.4	24.2	24.2	
Actuated g/C Ratio	0.05	0.43		0.59	0.51			0.07	0.07	0.21	0.21	
Clearance Time (s)	4.5	5.0		4.5	5.0			4.5	4.5	4.5	4.5	
Vehicle Extension (s)	3.0	3.5		3.0	3.5			3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	72	1379		289	1545			125	108	329	330	
v/s Ratio Prot	0.04	0.34		c0.10	c0.45			0.03		0.19	c0.19	
v/s Ratio Perm				0.38					c0.03			
v/c Ratio	0.90	0.79		0.81	0.89			0.40	0.48	0.88	0.89	
Uniform Delay, d1	54.6	28.1		23.3	25.2			50.9	51.2	44.0	44.1	
Progression Factor	1.03	0.63		1.58	0.49			1.00	1.00	1.00	1.00	
Incremental Delay, d2	67.0	4.2		13.2	6.7			2.1	3.3	23.0	23.6	
Delay (s)	123.1	21.8		49.9	19.0			53.0	54.5	67.0	67.7	
Level of Service	F	C		D	B			D	D	E	E	
Approach Delay (s)		27.5			23.4			54.2			67.3	
Approach LOS		C			C			D			E	

Intersection Summary			
HCM 2000 Control Delay	34.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	115.0	Sum of lost time (s)	18.5
Intersection Capacity Utilization	84.9%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	1025	850	225	1360	0	0	0	0	445	150	390
Future Volume (vph)	0	1025	850	225	1360	0	0	0	0	445	150	390
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)		5.0	5.0	4.5	5.0					4.5	4.5	4.5
Lane Util. Factor		0.95	1.00	0.97	0.95					0.95	0.95	0.88
Frpb, ped/bikes		1.00	0.98	1.00	1.00					1.00	1.00	0.98
Flpb, ped/bikes		1.00	1.00	1.00	1.00					1.00	1.00	1.00
Frt		1.00	0.85	1.00	1.00					1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95	0.98	1.00
Satd. Flow (prot)		3260	1429	3162	3260					1548	1590	2511
Flt Permitted		1.00	1.00	0.95	1.00					0.95	0.98	1.00
Satd. Flow (perm)		3260	1429	3162	3260					1548	1590	2511
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	1025	850	225	1360	0	0	0	0	445	150	390
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	67
Lane Group Flow (vph)	0	1025	850	225	1360	0	0	0	0	294	301	323
Confl. Peds. (#/hr)	10		5	5		10	1					1
Confl. Bikes (#/hr)			5			8						
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	0%	0%	0%	2%	2%	2%
Turn Type		NA	Perm	Prot	NA					Split	NA	Perm
Protected Phases		2		1	6					4	4	
Permitted Phases			2									4
Actuated Green, G (s)		64.3	64.3	7.5	76.3					29.2	29.2	29.2
Effective Green, g (s)		64.3	64.3	7.5	76.3					29.2	29.2	29.2
Actuated g/C Ratio		0.56	0.56	0.07	0.66					0.25	0.25	0.25
Clearance Time (s)		5.0	5.0	4.5	5.0					4.5	4.5	4.5
Vehicle Extension (s)		3.5	3.5	3.0	3.5					3.5	3.5	3.5
Lane Grp Cap (vph)		1822	798	206	2162					393	403	637
v/s Ratio Prot		0.31		c0.07	0.42					c0.19	0.19	
v/s Ratio Perm			c0.59									0.13
v/c Ratio		0.56	1.07	1.09	0.63					0.75	0.75	0.51
Uniform Delay, d1		16.3	25.4	53.8	11.2					39.5	39.5	36.7
Progression Factor		0.80	0.70	0.93	0.64					1.00	1.00	1.00
Incremental Delay, d2		0.8	44.6	79.1	1.0					7.8	7.6	0.8
Delay (s)		13.8	62.4	129.4	8.2					47.3	47.1	37.5
Level of Service		B	E	F	A					D	D	D
Approach Delay (s)		35.8			25.4			0.0			43.4	
Approach LOS		D			C			A			D	

Intersection Summary			
HCM 2000 Control Delay	33.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	115.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	94.4%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	455	1015	0	0	815	425	770	270	225	0	0	0
Future Volume (vph)	455	1015	0	0	815	425	770	270	225	0	0	0
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	4.5	5.0			5.0	5.0	6.0	6.0	4.0			
Lane Util. Factor	0.97	0.95			0.95	1.00	0.97	1.00	1.00			
Frpb, ped/bikes	1.00	1.00			1.00	0.97	1.00	1.00	0.99			
Flpb, ped/bikes	1.00	1.00			1.00	1.00	1.00	1.00	1.00			
Frt	1.00	1.00			1.00	0.85	1.00	1.00	0.85			
Flt Protected	0.95	1.00			1.00	1.00	0.95	1.00	1.00			
Satd. Flow (prot)	3162	3260			3292	1427	3131	1699	1427			
Flt Permitted	0.95	1.00			1.00	1.00	0.95	1.00	1.00			
Satd. Flow (perm)	3162	3260			3292	1427	3131	1699	1427			
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	455	1015	0	0	815	425	770	270	225	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	145	0	0	0	0	0	0
Lane Group Flow (vph)	455	1015	0	0	815	280	770	270	225	0	0	0
Confl. Peds. (#/hr)	12		7	7		12						
Confl. Bikes (#/hr)			6			7			1			
Heavy Vehicles (%)	2%	2%	2%	1%	1%	1%	3%	3%	3%	0%	0%	0%
Turn Type	Prot	NA			NA	Perm	Split	NA	Free			
Protected Phases	5	2			6		8	8				
Permitted Phases						6			Free			
Actuated Green, G (s)	21.0	70.5			45.0	45.0	33.5	33.5	115.0			
Effective Green, g (s)	21.0	70.5			45.0	45.0	33.5	33.5	115.0			
Actuated g/C Ratio	0.18	0.61			0.39	0.39	0.29	0.29	1.00			
Clearance Time (s)	4.5	5.0			5.0	5.0	6.0	6.0				
Vehicle Extension (s)	3.0	3.5			3.5	3.5	3.0	3.0				
Lane Grp Cap (vph)	577	1998			1288	558	912	494	1427			
v/s Ratio Prot	c0.14	0.31			c0.25		c0.25	0.16				
v/s Ratio Perm						0.20			0.16			
v/c Ratio	0.79	0.51			0.63	0.50	0.84	0.55	0.16			
Uniform Delay, d1	44.9	12.5			28.3	26.5	38.3	34.3	0.0			
Progression Factor	0.90	1.08			1.00	1.00	1.00	1.00	1.00			
Incremental Delay, d2	5.9	0.8			2.4	3.2	7.2	1.2	0.2			
Delay (s)	46.5	14.3			30.7	29.7	45.5	35.6	0.2			
Level of Service	D	B			C	C	D	D	A			
Approach Delay (s)		24.2			30.4			35.3			0.0	
Approach LOS		C			C			D			A	

Intersection Summary			
HCM 2000 Control Delay	29.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	115.0	Sum of lost time (s)	15.5
Intersection Capacity Utilization	94.4%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	25	425	100	620	415	270	85	175	605	275	190	30
v/c Ratio	0.32	0.28	0.13	1.68	0.42	0.28	0.52	0.69	1.12	1.63	0.73	0.09
Control Delay	70.9	21.7	0.3	350.9	23.2	6.3	67.5	65.4	107.4	343.8	67.8	0.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	70.9	21.7	0.3	350.9	23.2	6.3	67.5	65.4	107.4	343.8	67.8	0.5
Queue Length 50th (ft)	21	108	0	~396	256	28	70	142	~503	~333	155	0
Queue Length 95th (ft)	52	165	0	#518	340	58	126	207	#667	#512	224	0
Internal Link Dist (ft)		868			1020			559			326	
Turn Bay Length (ft)	560		50	825			350		390	280		50
Base Capacity (vph)	81	1541	777	369	984	948	172	548	541	169	549	557
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.31	0.28	0.13	1.68	0.42	0.28	0.49	0.32	1.12	1.63	0.35	0.05

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBT	EBR	WBL	WBT	SBT	SBR
Lane Group Flow (vph)	650	655	245	790	75	515
v/c Ratio	0.35	0.59	0.84	0.31	0.47	0.72
Control Delay	16.5	4.0	75.7	3.6	65.3	10.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	16.5	4.0	75.7	3.6	65.3	10.9
Queue Length 50th (ft)	132	77	197	77	60	0
Queue Length 95th (ft)	m143	m62	#316	96	112	56
Internal Link Dist (ft)	1020			607	372	
Turn Bay Length (ft)		310	200			180
Base Capacity (vph)	1867	1107	322	2566	175	735
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.35	0.59	0.76	0.31	0.43	0.70

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	EBL	EBT	WBT	NBL	NBT	NBR
Lane Group Flow (vph)	485	240	515	300	300	375
v/c Ratio	0.85	0.12	0.76	0.73	0.73	0.57
Control Delay	51.8	9.5	51.8	53.0	53.0	7.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	51.8	9.5	51.8	53.0	53.0	7.6
Queue Length 50th (ft)	365	40	203	226	226	0
Queue Length 95th (ft)	543	59	295	389	389	87
Internal Link Dist (ft)		607	306		404	
Turn Bay Length (ft)	300			240		
Base Capacity (vph)	791	2547	903	516	516	732
Starvation Cap Reductn	2	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.61	0.09	0.57	0.58	0.58	0.51

Intersection Summary

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	60	110	235	65	90	145	155	485	135	455
v/c Ratio	0.50	0.42	0.57	0.51	0.33	0.42	1.15	0.76	0.98	0.69
Control Delay	49.6	32.2	10.4	49.8	30.0	9.6	159.2	25.5	109.7	22.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	49.6	32.2	10.4	49.8	30.0	9.6	159.2	25.5	109.7	22.3
Queue Length 50th (ft)	23	40	0	25	32	0	~75	155	55	142
Queue Length 95th (ft)	#91	98	60	#97	82	47	#228	285	#198	256
Internal Link Dist (ft)		1222			378			2383		291
Turn Bay Length (ft)	100		200	150		150	135		150	
Base Capacity (vph)	121	1076	971	127	1128	988	135	991	138	1037
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.50	0.10	0.24	0.51	0.08	0.15	1.15	0.49	0.98	0.44

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBT	EBR	WBT	NBL	NBT	SBT
Lane Group Flow (vph)	315	290	20	190	415	605
v/c Ratio	0.84	0.47	0.04	0.62	0.43	0.88
Control Delay	52.1	7.2	24.8	19.3	12.8	39.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	52.1	7.2	24.8	19.3	12.8	39.2
Queue Length 50th (ft)	182	9	9	54	140	326
Queue Length 95th (ft)	#341	74	27	91	210	#533
Internal Link Dist (ft)	5421		175		763	967
Turn Bay Length (ft)		120		120		
Base Capacity (vph)	469	708	571	333	1095	884
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.67	0.41	0.04	0.57	0.38	0.68

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBL	EBT	WBL	WBT	NBT	NBR	SBT
Lane Group Flow (vph)	25	730	290	720	140	305	215
v/c Ratio	0.30	0.63	1.00	0.44	0.60	0.21	0.78
Control Delay	62.6	35.0	68.7	4.8	56.1	0.3	63.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	62.6	35.0	68.7	4.8	56.1	0.3	63.5
Queue Length 50th (ft)	18	228	227	11	100	0	151
Queue Length 95th (ft)	48	#406	m#294	m200	149	0	229
Internal Link Dist (ft)		457		542	390		318
Turn Bay Length (ft)	90		150			90	
Base Capacity (vph)	83	1162	291	1649	381	1453	340
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.30	0.63	1.00	0.44	0.37	0.21	0.63

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	EBL	EBT	WBL	WBT	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	65	1095	235	1415	50	215	290	295
v/c Ratio	0.72	0.79	0.81	0.88	0.40	0.79	0.88	0.89
Control Delay	90.9	22.9	49.1	19.1	60.2	33.7	71.9	71.9
Queue Delay	0.0	1.7	0.0	0.3	0.0	0.7	0.0	0.0
Total Delay	90.9	24.6	49.1	19.4	60.2	34.5	71.9	71.9
Queue Length 50th (ft)	48	172	91	114	36	28	217	218
Queue Length 95th (ft)	m#101	328	#220	#659	77	#138	#371	#377
Internal Link Dist (ft)		542		515	105			290
Turn Bay Length (ft)	200		330			150	185	
Base Capacity (vph)	90	1382	306	1611	141	284	346	350
Starvation Cap Reductn	0	0	0	22	0	0	0	0
Spillback Cap Reductn	0	143	0	0	0	7	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.72	0.88	0.77	0.89	0.35	0.78	0.84	0.84

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	EBT	EBR	WBL	WBT	SBL	SBT	SBR
Lane Group Flow (vph)	1025	850	225	1360	294	301	390
v/c Ratio	0.56	1.06	1.09	0.63	0.75	0.75	0.55
Control Delay	14.8	65.5	126.6	9.0	51.2	50.6	30.4
Queue Delay	0.2	0.0	0.0	0.6	0.0	0.0	0.0
Total Delay	15.0	65.5	126.6	9.6	51.2	50.6	30.4
Queue Length 50th (ft)	181	~685	~93	272	209	214	108
Queue Length 95th (ft)	258	#998	m#160	330	294	300	151
Internal Link Dist (ft)	515			447		580	
Turn Bay Length (ft)		275	160				450
Base Capacity (vph)	1823	799	206	2164	484	498	847
Starvation Cap Reductn	215	0	0	409	0	0	0
Spillback Cap Reductn	0	0	0	74	0	0	2
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.64	1.06	1.09	0.77	0.61	0.60	0.46

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	EBL	EBT	WBT	WBR	NBL	NBT	NBR
Lane Group Flow (vph)	455	1015	815	425	770	270	225
v/c Ratio	0.79	0.51	0.63	0.60	0.85	0.55	0.16
Control Delay	49.1	14.9	32.2	16.8	47.8	38.5	0.2
Queue Delay	0.0	0.5	0.0	0.0	0.3	0.0	0.0
Total Delay	49.1	15.4	32.2	16.8	48.1	38.5	0.2
Queue Length 50th (ft)	157	232	266	111	269	164	0
Queue Length 95th (ft)	218	315	346	231	342	247	0
Internal Link Dist (ft)		447	460			581	
Turn Bay Length (ft)	180			240			400
Base Capacity (vph)	646	1999	1288	703	980	531	1427
Starvation Cap Reductn	0	517	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	24	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.70	0.68	0.63	0.60	0.81	0.51	0.16

Intersection Summary

APPENDIX B.1 STAKEHOLDER MEETING SUMMARIES

North Lewis County Industrial Access Transportation Study
Stakeholder Kickoff Meeting Summary
Thursday, November 3, 2022

Meeting Attendees

Stakeholders	Project Team	WSDOT Representatives
Gary Martindale, FHWA	Kelly Smith, WSDOT	Scott Langer
Bill Fashing, CWCOG / SWRTPO	Richard Warren, WSDOT	Devin Reck
Robert Stevens, CWCOG / SWRTPO	Laurie Lebowsky-Young, WSDOT	Colin Newell
Marc Daily, TRPC	Nick Roach, WSP	Paul Mason
Patty Page, City of Centralia	Logan Cullums, WSP	Jason Beloso
Christina Chaput, Thurston County	Scott Keillor, WSP	Celeste Dimichina
Kyle Heaton, Port of Centralia	Scott Bucklin, WSP	Jennette Queen
Maggie McCarthy, Twin Transit		Courtney Sell
Todd Chaput, Lewis County Alliance		Jason Gibbens
Bob Mohrbacher, Centralia College		Dylan Bass
Leslie Fountain-Williams, Centralia College		

Presentation

- Kelly Smith opened the meeting by welcoming stakeholders and WSDOT staff.
- Scott Keillor provided an overview of the meeting agenda and introduced the project team, WSDOT attendees and the stakeholder team. He also provided an overview of the draft stakeholder team charter.
- Nick Roach discussed the history and background of this project, including prior studies that many of the current stakeholders contributed to. He also reviewed the draft purpose and goals and high-level schedule.

2040 Visioning Exercise

- Gary Martindale envisions a growing and bustling corridor that is busy with distribution centers and robust transit.
- Marc Daily thinks that growth will keep moving south on the I-5 corridor, and that the economies of Thurston and Lewis Counties will be more intertwined. He hopes that the region will be well-integrated from both an economic and transportation standpoint. He doesn’t want to be overly constrained by jurisdictional boundaries.
- Bill Fashing agrees with Marc. He also thinks that by 2040, autonomous freight vehicles will start to be the norm. He envisions more trucks traveling at night and more efficiently during all hours, leading to less congestion during the daytime hours.
- Robert Stevens echoed prior statements. He sees higher traffic volumes overall and he also thinks this area will be better integrated and connected with the rest of the Vancouver-Olympia corridor in a well-integrated I-5 corridor.
- Maggie McCarthy noted that as infrastructure investments are made, more people move to the area and there’s more traffic but the volumes will not worsen congestion due to the planning done

today. She would like to see a clover interchange near Harrison. She envisions more electric vehicles, more bikes, and less noise.

- Todd Chaput envisions investments in infrastructure that allow for more housing and more development. He would like to see a connector between SR 6 and US 12, as well as capacity for increased flood mitigation and local rivers treated as amenities. He envisions the river being used for more economic activities.
- Kyle Heaton noted that Washington is transitioning away from manufacturing and toward distribution centers and last mile delivery systems. He sees increased autonomous vehicle use in 2040, but the scale is hard to picture. How many changes will we see, and how fast?
- Patty Page has lived and worked in this area for most of her life. She recently reviewed a prior study that analyzed 2020 as the future year and the recommended improvements weren't made. Her goal for 2040 is to have a transportation system that works for everyone, not just industrial and commercial users. She sees a need for a westside connector bridge over the Chehalis River, and she noted that a North Lewis County interchange has been called for since the 1990s.
- Bob Mohrbacher said that although we are all thinking about North-South development because of the I-5 corridor, we need to also think about East-West movements and the growth that will accompany future development in Winlock and at the TransAlta site.

Discussion

- Scott asked the group for feedback on the draft study area boundary.
  - Patty suggested extending the southern study area boundary south to Cooks Hill Road.
    - Kelly responded that the study area map shows the focus area for future improvements, but the project team will also be considering the larger context of the surrounding area.
- Scott Keillor asked the group for their thoughts on the draft charter.
  - Colin Newell asked if Providence Hospital can be included in this stakeholder group.
    - Kelly responded that this committee is focused on folks with a technical transportation background, but that during the outreach phase, the project team will be sure to include important community stakeholders such as the hospital.
    - Nick added that if any stakeholders have other ideas of community stakeholders to contact during the outreach phase, to please let the project team know.
  - Laurie asked a clarifying question about reaching decision points and the decision-making process. Is it voting? Consensus? Once a decision is made, do we move on or circle back?
    - Scott responded that the project team is recommending a non-voting, consensus-based decision-making process.
- Bill Fashing said that it's always good to have a set of operating protocols in place. He also asked if the project team can pull together a resource document with links to prior studies.
  - Scott responded that this shouldn't be a problem.

Next Steps

- Scott Keillor noted that homework is due in a few weeks. Stakeholders should watch their inboxes the week of November 7 for this homework.

- The next stakeholder meeting will take place in December, and the project team will send out a poll to schedule that meeting.

Action Items

- WSDOT project team to deliver the draft homework documents to the stakeholder team the week of 11/8-11/11 for their review. The materials will include the Draft Charter, Study Area, Purpose and Goals, and access to the prior studies so the stakeholder team can review.

North Lewis County Industrial Access Transportation Study
Stakeholder Meeting #2 Summary
December 8, 2022

The project team made the following updates based on your comments at the Stakeholder Team (ST) Meeting #1:

- Slide 4: Charter Revisions
    - The project team clarified the number of industrial sites in North Lewis County and the number of ST meetings.
    - Defined the “Core Team” and the “Project Team”.
    - Added a signature line for WSDOT.
- Slide 5: Purpose, Need, and Goals Revisions
    - Clarified that “viable” solutions for improved traffic and multimodal operations will be identified at the end of the study.
- Slide 6: Study Area - the analysis area will include:
    - Cooks Hill Road, 216th Ave, 222nd Ave, and the BNSF Rail Line
    - Port Parks 1 & 2
    - Harrison and W. 1st Street intersection may be included in the analysis. The Project Team is looking into the logistics of adding this intersection to the analysis.
- Slide 7: Vision 2040
    - The draft vision is shown in the attached PowerPoint (PPT) and the project team would like to hear your feedback on the draft.

The project team also outlined the baseline conditions in the area (maps are included in the attached PPT).

- Slide 9: Baseline Conditions overview
    - Summary of baseline conditions that are being covered at today’s meeting.
    - The list of topics discussed today doesn’t cover the entirety of topics that will be addressed in the upcoming Existing and Future Baseline Conditions Report.
- Slide 10: Demographics (2010-2020)
    - The team looked at a broader area than the study area to better reflect how the US Census data is presented for northern portion of Lewis County.
    - The analysis area grew in population by over 9 percent over the 2010-2020 period.
    - Median household income grew from $38,000 per year to over $52,000 per year for the 10-year period.
    - Low-income population grew by 16%. Minority population grew by 53%.
    - Analysis area has a higher proportion of children and seniors than the national average.
    - The area is in the 81st percentile nationally for air toxins and 83rd percentile for overall cancer risk.
- Slide 11: Environmental constraints
    - In our assessment, there were a high number of environmental constraints.

    - The team looked at geologic hazards, endangered and sensitive species, historic resources, flood hazards, wetlands, and riparian habitat areas.
    - The constraints potentially limit feasible locations for a new interchange.
- Slide 12: Freight
    - The team looked at freight rail and road corridors.
    - Based on previous Stakeholder feedback, and due to its importance for the region, the team will be looking closely at BNSF operations and activity during the study.
    - Classifications for railroads and freight corridors were provided and are described on the slide.
- Slide 13: Land use and circulation
    - Analysis focused on zoning and comprehensive plans for both Lewis County and the City of Centralia.
    - Throughout the study area, zoning is largely commercial and industrial, but with scattered pockets of residential zones. Some land may be zoned for commercial or industrial use but has pre-existing residential on it.
    - Recent development includes new distribution center at just south of Galvin Road and east of the Chehalis River.
    - Regarding circulation, there are frequent and redundant driveways along Harrison in the vicinity of Belmont Ave., which leads to stop-and-go traffic.
- Slide 14: Pedestrian and bike network
    - Slide showed the map with locations of existing sidewalks and bike lanes. There are still noticeable gaps in the sidewalk/bike network and between schools and commercial areas.
    - Existing sidewalks and bike lanes largely lack separation from traffic lanes, which adds to the level of traffic stress for these modes, with sidewalks also lacking ADA-compliant facilities.
- Slide 15: Transit network
    - Existing transit service in the study area include the Twin Transit Orange and Yellow Lines, Dial-a-Ride Twin Transit, LIFTT paratransit and Grays Harbor Transit
    - Future service includes the SW Washington e-Transit corridor
- Slide 16: Safety
    - Areas with the highest volume of crashes are along the I-5 interchange areas.
    - Within the study area the locations with the highest volume of crashes include the Harrison/I-5 interchange area, the intersection at Harrison and Reynolds, and Lacey junction at Lum Road.
- Slide 17-20: Traffic
    - 15 intersection levels of service were assessed for 2022 and the 2045 horizon year
    - General traffic growth is expected to lead to longer delays at many of the intersections studied but most will maintain LOS D, which meets local and county standards.
    - Land use and network changes are still being tested
    - Closer examination of the interchange area will be conducted in the future

The project team outlined the study timeline and the evaluation criteria.

- Slide 22: Study overview (timeline)
    - The graphic shows the project timeline and key milestones.
- Slide 24: Evaluation Criteria
    - 7 evaluation criteria have been selected. Each one is comprised of approx. 2-3 measures of success. See the attached PPT for the evaluation criteria.
- Slide 25: Measures of Effectiveness
    - The 16 measures of success will inform the preferred alternative selection process. See the attached PPT for each measure.
- Slide 26: Next Steps and Schedule
    - Stakeholder Team Meeting #3 is expected to occur in February 2023
    - Stakeholders will rate the alternatives using the evaluation criteria at Meeting #3

SUMMARY

North Lewis County Industrial Access Transportation Study Stakeholder Team Meeting #3 Summary

DATE: Thursday, February 16, 2023

TIME: 10 a.m. to 12 noon.

LOCATION: WSDOT Chehalis Field Office, 1411 Rush Rd, Chehalis, WA 98532
Conference Rooms 1 & 2
Virtual: Microsoft Teams

1. Attendance

Stakeholder Team		**Core Team/Project Team**	
Name	**Organization**	**Name**	**Organization**
Bill Fashing	CWCOG	Scott Langer	WSDOT
Robert Stevens	CWCOG	Richard Warren	WSDOT
Kyle Heaton	Port of Centralia	Laurie Lebowsky-Young	WSDOT
Kyle Markstrum	Port of Centralia	Celeste Dimichina	WSDOT
Maggie McCarthy	Twin Transit	Jason Gibbens	WSDOT
Josh Metcalf	Lewis County	Dylan Bass	WSDOT
Patty Page	City of Centralia	Jason Beloso	WSDOT
		Paul Mason	WSDOT
		Hunter Henderson	WSDOT
		Jennette Queen	WSDOT
		Courtney Sell	WSDOT
		LisaRene Schilperoort	WSDOT
		Colin Newell	WSDOT
		Nick Roach	WSP
		Scott Keillor	WSP
		Logan Cullums	WSP
		Tony Lo	WSP
		Scott Bucklin	WSP
		Jodi Mescher	WSP

2. Welcome

Richard Warren opened the meeting and welcomed the meeting participants. He introduced Scott Keillor, who facilitated a round of self-introductions, provided an overview of the meeting agenda and meeting objectives, and described the project schedule.

3. Proposed Alternatives

Richard introduced Nick Roach and asked him to describe the proposed alternatives. Nick reviewed the existing and future conditions in the study area, including environmental constraints, demographics, bike and pedestrian needs, and traffic and safety conditions. Each of these topics influenced the alternatives development process. He noted the project is working in parallel with the County's Reynolds Ave/Harrison Ave Corridor Improvement Project, which is preparing for their first open house in April 2023.

Nick discussed the framework used to evaluate the proposed alternatives. Each alternative was evaluated based on meeting the six elements of the purpose and need statement established by the Stakeholder Team. Next, Nick presented an overview of each alternative. Comments made about each alternative by the meeting attendees are summarized below.

1. Westside Connector
   - The connector should be above the flood elevation to improve access to the hospital during flood events.
2. Lum Road
   - No questions or comments from the committee.
3. County Line I-5 Interchange
   - The biggest benefit of the 216th Ave option is that there is an existing overcrossing. The other proposed locations would require new construction.
   - The 216th Ave interchange option would be approximately three miles from Harrison Ave, which is significantly out-of-direction travel for freight traffic.
   - The overcrossing at 216th Ave was recently seismically retrofitted. The bridge at 216th Ave would potentially need to be rebuilt as part of this alternative; however, the design details have not yet been determined.
   - The 216th Ave interchange option would open the east side of I-5 to future development. There is new proposed development on Davis Hill.
   - Existing rail crossings would need to be navigated at 222nd Ave and at Kuper Rd.
4. Bike and Pedestrian Improvements
   - WSDOT must consider complete streets policies for all areas of study per recent legislative direction.
5. Access Management
   - The Reynolds Ave/Harrison Ave Corridor Improvements Project is considering improvements to the Blakeslee Junction area in their project.

- The City has construction funding for repaving local streets east of I-5, installing a concrete barrier median, and a two-way left turn lane.
- It was suggested that roundabouts should be considered on Harrison Ave to mitigate speed and safety concerns.
- Consider closing north/south crosswalks on the west side of I-5.
- Meter ramps will be installed at the Harrison Ave/I-5 on-ramps as part of a separate WSDOT project.

6. Other Alternatives

- Scott Langer mentioned that before FHWA will consider new freeway access, they typically look for proof the local jurisdictions have implemented all possible improvements to the local system.
- Future analysis should consider the potential impacts to both local and regional traffic.

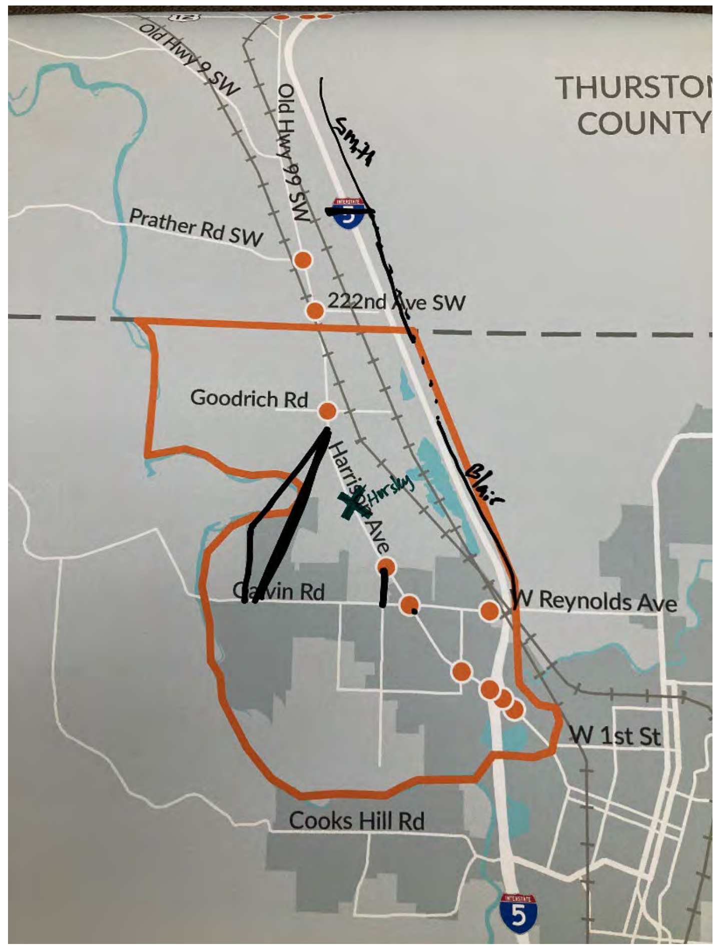
4. Alternatives Workshop

Scott Keillor asked the Stakeholder Committee members to provide additional feedback on the proposed alternatives, or to propose new alternatives, via a workshop activity using a map of the study area to identify priority projects. Key findings from the workshop discussion are summarized below.

- Roundabout at Ives Rd and Harrison Ave are being analyzed through the Reynolds Ave/Harrison Ave Improvements Project.
- By connecting to S Scheuber Rd, the Westside Connector would connect Centralia to Highway 6 south of the Chehalis River.
- The Gallagher Road extension is included in the County TIP but is not funded. This will tie the industrial area to Harrison Ave without access to Gallagher Rd. One committee member suggested as an alternative to the Gallagher Rd extension to consider Sandra Ave as a viable existing alternative route.
- Consider eliminating the Horsley Ave/Harrison Ave intersection for access control.
- The City has encountered challenges with adjacent property owners in getting positive support for closing access on other projects.
- The project team should consider and identify what the key local connections are in the project area to increase the potential for economic development.
- The City and County should not promote the Westside Connector for commercial or industrial traffic. Some funding applications are under consideration for pre-planning the Chehalis River bridge crossing with the intent to separate the local traffic and improve the disaster management secondary route.

- An additional interchange at Kuper Rd could be a good option as it is closest to the existing Harrison Ave interchange to divert traffic away from it (Exit 82).
- An issue on Harrison Ave north of Centralia is the maintenance cost as non-concrete surfaces get torn up as industrial traffic navigates tight angles.
- The Chehalis Tribe owns a sizable portion of land along Old Highway 99.
- Tie in Blair Rd connection at Harrison Ave and Smith Rd/Old Highway 99 connection.

The meeting participants added key points to the study area map to identify priority projects.



5. Next steps and action items

Action items for the project team:

- Updated draft list of alternatives based on today's workshop.
- Send draft baseline conditions memo to stakeholders.
- Send poll of proposed alternatives to stakeholders.

Action items for the stakeholder committee members:

- Review baseline conditions memo.
- Rate the proposed alternatives (note: Project Team will send a poll to collect input once the list of alternatives is revised to incorporate the workshop suggestions).

An online open house is scheduled in March to obtain public input on the proposed alternatives. The next stakeholder team meeting will be held in late April 2023 to review the preferred alternative(s).

6. Closing

Richard thanked the stakeholder committee members for their participation in the meeting. He also noted that the study website is now live.

One Stakeholder Team member commented the best way to move forward is to consider the project wholistically by packaging the Westside Connector, north interchange, and capacity increases to the south, with pedestrian and bicycle improvements from the city.

WSDOT

SUMMARY

North Lewis County Industrial Access Transportation Study Stakeholder Team Meeting #4 Summary

DATE: Thursday, June 22, 2023

TIME: 10 a.m. to 12 p.m. (noon)

LOCATION: WSDOT Chehalis Field Office, 1411 Rush Rd, Chehalis, WA 98532
Conference Rooms 1 & 2
Virtual: Microsoft Teams

1. Attendance

Stakeholder Team		Project Team	
Name	**Organization**	**Name**	**Organization**
Josh Metcalf	Lewis County	Scott Langer	WSDOT
Patty Page	City of Centralia	Richard Warren	WSDOT
Bill Fashing	CWCOG	Laurie Lebowsky-Young	WSDOT
Robert Stevens	CWCOG	Kelly Smith	WSDOT
Kyle Heaton	Port of Centralia	Hunter Henderson	WSDOT
Kyle Markstrom	Port of Centralia	Jennette Queen	WSDOT
Todd Chaput	Economic Alliance of Lewis County	Courtney Sell	WSDOT
Jason Beloso	WSDOT (virtual)	LisaRene Schilperoort	WSDOT
Joel Barnett	FHWA (virtual)	Angie Haffie	WSDOT
Andrew Bohn	Thurston County	Colin Newell	WSDOT
		Chelsey Martin	WSDOT
		Dylan Bass	WSDOT
		Nick Roach	WSP
		Scott Keillor	WSP
		Logan Cullums	WSP
		Tony Lo	WSP
		Scott Bucklin	WSP

In addition to the stakeholder team and project team, four guests attended the meeting. These guests included Lewis County Commissioner Sean Swope, State Representative Ed Orcutt, State Representative Peter Abbarno and State Senate Minority Leader John Braun. The meeting also had one observer who did not participate, Port of Centralia Commissioner Peter Lahmann.

2. Welcome

Richard Warren opened the meeting and welcomed the meeting participants. He introduced Scott Keillor, who facilitated a round of self-introductions and provided an overview of the meeting agenda and meeting objectives. Scott also gave an overview of the legislative proviso that initiated this study and reminded attendees of the study's purpose and need, which is to identify potential solutions that enhance industrial access and safety using a wholistic view of transportation in North Lewis County.

3. Schedule and Public Outreach

Scott summarized the study's schedule to date and described key milestones where the project team pursued public input to support the study's findings. He noted that most recently, the project team held an online survey from May 31 to June 14 to hear public comments about the potential improvements being considered. He also mentioned that members of the stakeholder team were invited to participate as well. This survey asked respondents to note their preferred improvement, and the team received 280 responses, which is considered a high level of public participation for the area and demonstrated clear public interest in the study. Survey results showed:

- 54% of respondents chose a new I-5 interchange
- 22% chose the Westside Connector
- 12% chose bike and pedestrian improvements
- 8% chose traffic flow improvements on Harrison Avenue; and
- 4% chose connecting existing local roads.

Richard Warren added that the NLCIA project team also attended the Harrison Avenue/Reynolds Avenue Improvement Project in-person open house on April 20, 2023 to answer questions and build awareness. The NLCIA team spoke with around 100 individuals at this open house.

4. Evaluation

Scott Keillor introduced Nick Roach and asked him to describe the study improvements and how they were evaluated.

Nick provided an overview of the evaluation process and criteria, including a summary of the feasibility assessment. He noted that team did not apply any weights to the scoring criteria.

Nick then summarized how the team conducted traffic analysis, using the Thurston Regional Planning Council's regional model as the basis for this analysis. The team analyzed three potential improvements: a new I-5 interchange at 222nd Ave SW, the Westside Connector, and the Gallagher Road Extension.

New I-5 interchange at 222nd Ave SW:

- This location was chosen for analysis because it was in the geographic center of all three locations under consideration. The modeling results would be very similar at the other two locations due to the capabilities of the TRPC demand model.
- A new I-5 interchange in North Lewis County or South Thurston County would result in lower traffic volumes on Harrison Avenue and Old Highway 99, with a modest increase in volumes on I-5 between Harrison Avenue and Grand Mound.

Westside Connector:

- This project would result in lower traffic volumes on Harrison Avenue near the I-5 interchange, as well as lower traffic volumes on the I-5 connector-distributor lanes south of Harrison Avenue. Traffic volumes would also decrease at the Mellen Street / I-5 interchange.
- Scheuber Road and Oakland Avenue would see an increase in traffic volumes due to the new bridge.

Gallagher Road Extension:

- This was analyzed on its own, not in combination with a new interchange.
- If extended north, Gallagher Road would see a modest increase in traffic volumes. Galvin Road and Sandra Avenue would see a decrease in traffic volumes. Harrison Avenue would also see a modest decrease in traffic volumes near the intersection with Galvin Road.

Comments from meeting attendees are noted below.

- A stakeholder asked if the team analyzed traffic impacts caused by the Westside Connector on the Mellen Street / I-5 interchange, and if so, could the graphic extent be expanded to show these projected impacts?
  - Nick responded that the project team did analyze the impacts of the Westside Connector on the Mellen Street interchange, and the team will update the graphic to reflect this.
- Commissioner Slope, a guest at the meeting, asked if the bundled projects were analyzed to determine their impact on industrial access travel.
  - Nick said that this level of analysis was not performed and would not be feasible as part of this study. However, it could be undertaken in a follow-up study.
- Multiple stakeholders and guests were interested in the scoring of the improvements and asked if there was a spreadsheet that provided the scores.
  - Nick confirmed that the team did prepare a scoring spreadsheet and can provide a copy of it to meeting attendees.

5. Potential Improvements

Nick then presented an overview of each potential improvement. Comments from meeting attendees are noted under each improvement. For a summary of each improvement, please see the meeting presentation.

1. Traffic flow improvements to Harrison Ave
   - A stakeholder asked how expensive it is to upgrade existing traffic signals to the adaptive signal control systems.
     - Another stakeholder responded that this would depend on the signal cabinets. Cabinets in this area are already upgraded to facilitate the transition to adaptive signals, but some modifications would be needed.
     - Scott Langer added that detection is key. If there is good lane detection, then it's easy to transition. A stakeholder noted that the signals have been upgraded to the Wavetronix platform. Tony Lo confirmed these comments.
   - Another stakeholder asked if the team could provide information about the cost for ongoing maintenance of adaptive signal control systems that would be appropriate for this area. This stakeholder also asked if the adaptive signal cost estimate included other improvements such as ADA curb ramps.
     - Tony responded that the provided cost estimates just include the costs for upgrading the signal network to adaptive control capabilities.

2. Blair Rd to Hobson Rd connection
   - Several stakeholders noted the high estimated cost.
     - Tony noted that this high cost is largely due to the need for several structures, such as retaining walls, and the need to move a large amount of earth.

3. Gallagher Rd extension
   - No comments.

4. Bike and pedestrian improvements
   - A stakeholder noted the connection between the County-led Harrison/Reynolds Improvements Project, which is at 30% design, and the NLCIATS recommendation to extend the pedestrian and bike improvements from the Kuper and Harrison intersection north to the Lewis/Thurston County line.

5. Westside Connector
   - Representative Orcutt asked if the Westside Connector would have adverse impacts on Providence Hospital.
     - A stakeholder responded that the Westside Connector would provide an important alternate route to the hospital in the event of major flooding.
   - Colin Newell noted that this project could have significant cultural impacts.

6. I-5 interchange option at Kuper Rd
   - No comments.

7. I-5 interchange option at 222nd Ave
   - A stakeholder mentioned that Thurston County has been contacted about developing property in the vicinity of 222nd Avenue, and the County would like to review the information on the two potential freeway interchange locations in Thurston County.

  - Richard suggested that when Thurston County reviews the draft report, it would be helpful for County staff to note their interests in potential land use changes as WSDOT is interested in capturing those issues in the final report.
- Another stakeholder asked if the cost estimate includes the replacement cost of the existing elevated structure.
  - Tony responded that the estimated cost does not include replacing it.

8. I-5 interchange option at 216^{th} Ave (recommended interchange option)
   - A stakeholder noted that this location is the farthest away from Port properties, which would make it least useful for trucks accessing them. This option might be the most feasible to build, but there's a question about its utility for freight access.
     - Another stakeholder responded that the difference in a couple of miles is negligible for a freight trip. A truck driver will often choose a longer route if it is more suitable for trucks.
     - Another stakeholder concurred, and said that he often uses the Grand Mound interchange over the Harrison interchange because it is less congested.

Nick then summarized the project's teams recommendations. The team recommends that all potential improvements are carried forward, other than the Blair Rd – Hobson Rd connection and interchange options at Kuper Rd and 222^{nd} Ave.

Scott Keillor asked the stakeholders if they felt that consensus had been reached around the list of projects to carry forward.

- Joel noted that at this early stage, the Federal Highway Administration is remaining neutral while local stakeholders and WSDOT develop their recommendations. He recommended the stakeholder group continue working through WSDOT and follow the federal processes that are in place.
- Commissioner Swope stated that he would like to see freight improvements prioritized and active transportation improvements de-emphasized in the final list of recommendations. Representative Orcutt concurred with Commissioner Swope.
  - A member of the stakeholder group noted that separated bike and pedestrian facilities do benefit freight users. Two other stakeholders concurred.
  - Scott Langer reiterated that the study tried to take a holistic approach and that it isn't strictly focused on freight movement projects.
  - Another stakeholder suggested that the report should separate out industrial access projects and safety-focused projects such as bike and pedestrian improvements.
- Scott Langer noted that none of these projects are currently funded for implementation. Policy officials need to look at these improvements as options and determine what should move forward based on their funding priorities.

6. Next Steps and Action Items

Action items for the project team:

- Circulate draft scoring matrix for stakeholder review (*note: complete*).
- Circulate draft report for stakeholder review on Friday, July 14.

Action items for the stakeholder committee members:

- Review scoring matrix and provide comments by Friday, June 30.
- Review the draft report and provide comments between Friday, July 14 and Friday, August 4.

7. Closing

Scott Keillor noted that the project team will be sure to incorporate feedback heard from stakeholders and guests at today's meeting.

Richard asked the stakeholders to take another look at the legislative proviso and the project purpose and need to assess whether the recommendations met their expectations. He thanked meeting attendees for their participation and input.

APPENDIX B.2 PUBLIC ENGAGEMENT SUMMARIES

APPENDIX B-2 PUBLIC ENGAGEMENT SUMMARIES

Online Open House 1 Summary
March 17 through March 31, 2023

North Lewis County Industrial Access Transportation Study Online Open House 1 Summary

DATES: March 17 through March 31, 2023

LOCATION: Online at [WSDOT | Online Open House]

1. Overview

WSDOT hosted an online open house for two weeks at the end of March 2023 to gather community input on the North Lewis County Industrial Access Transportation Study (NLCIATS). The objectives of the open house were to inform the local community about the study, share the existing conditions assessment, and solicit input on the improvements being considered.

2. Community Engagement

The project team used two approaches to invite the public to attend and engage with the online open house. The first was through a project website, which was prepared to provide background on the project and is updated periodically during the study. Additionally, prior to the online open house, the project team mailed a postcard to businesses and residents within a 5-mile radius of the study area, which included approximately 15,000 properties. The postcards gave a brief overview of the project, invited participants to provide comment at the online open house, and directed them to the project website for more information.

3. Content Presented

The online open house included seven partitions on the website to orient the public to the project and solicit feedback. The first partition shared an overview of the project, the study area, project purpose and need, the funding source for the study, and introduced the need for public input. The second partition highlighted the work done by the Stakeholder Team to make recommendations about the suggested improvements and ensure support from local agencies. The third partition included more details about the scope of the project and highlighted that the project is studying walking, biking, rolling, and driving counts through 16 intersections in the study area. This partition also described the existing conditions and congestion in the area and included graphics showing the study intersections, crash results from 2017 – 2021 in the area, and environmental constraints which could limit improvements in the area.

The fourth partition contained the bulk of the information about the proposed improvements. The partition highlighted seven alternatives under consideration by the project team including a Westside Connector, a new I-5 interchange near the Lewis County and Thurston County line, a roundabout at Lum Road and Harrison Avenue, local road network extensions, bike and pedestrian improvements, adaptive signal controls on the Harrison Avenue corridor, and access consolidation on Harrison Avenue.

The fifth partition encouraged input from participants, asking: *What projects or changes to the current alternatives would you recommend to improve freight and industrial access in North Lewis County?* The sixth partition shared an overall project schedule. Finally, the seventh partition shared project contact information and encouraged participants to attend the next open house, tentatively scheduled for May 2023.

4. Summary of Feedback Received

The project received 82 unique emails in response to the online open house. A summary of the feedback received from the open house is provided below.

Many participants shared their support of the Westside Connector, commenting that it would relieve some congestion from Harrison Avenue, improve access to the hospital, and improve conditions during flood events.

Several participants responded to the proposed I-5 interchange improvements. Some respondents commented generally on the need for a new interchange while others shared support for or specific concerns at 216th, 222nd, and Kuper Road. Respondents seemed split on their preferred location for a new interchange between the 216th and Kuper Road alternatives. A few respondents suggested a new interchange connecting to Blair Road.

Some participants commented that the proposed roundabout at Lum Road and Harrison Avenue would not improve congestion or questioned why a roundabout was under consideration.

A few participants commented in support of the Gallagher Road to Harrison Avenue extensions, saying that project would relieve congestion on Harrison Avenue.

Some participants commented in support of the proposed bicycle and pedestrian improvements in the study corridor, with a few commented that those improvements were overdue. A few respondents also commented in support of improved signals in the Harrison Avenue corridor to better manage congestion.

Some participants commented in support of access consolidation on Harrison Avenue to eliminate congestion, while one participant shared concern about the possible negative impacts to local businesses.

Many participants commented on other needs or suggested improvements in the study area that were not initially proposed by the project team. Common suggestions included:

- Add a third lane in the study area
- Expand capacity on I-5, and suggested improvements on I-5 interchanges
- Improve signals and signage at existing on/off ramps

Additionally, some participants commented on the public engagement process and stakeholder team, such as asking for details the logistics and invite list for the open house, as well as suggestions to include FHWA and the Lewis County Community Trails Association as stakeholders.

SUMMARY (DRAFT)

North Lewis County Industrial Access Transportation Study Public Survey Summary (DRAFT)

SURVEY DATE: May 31 through June 14, 2023

LOCATION: Online via SurveyMonkey

1. Overview

WSDOT opened an online public survey to learn more about community goals for the potential improvements being studied in the North Lewis County Industrial Access Transportation Study (the study). The survey was launched in May and was open to public comment for two weeks.

2. Community Engagement

WSDOT mailed postcards to approximately 15,000 households near the study area and people or organizations identified on the project stakeholder list. Each postcard gave a brief overview of the study, shared details of how to access the survey, and invited participation.

3. Content Presented

A presentation included with the survey linked participants to additional background information and draft-conceptual graphics of the potential improvements. As part of the survey, participants were asked to indicate their preferred potential improvement from the following options:

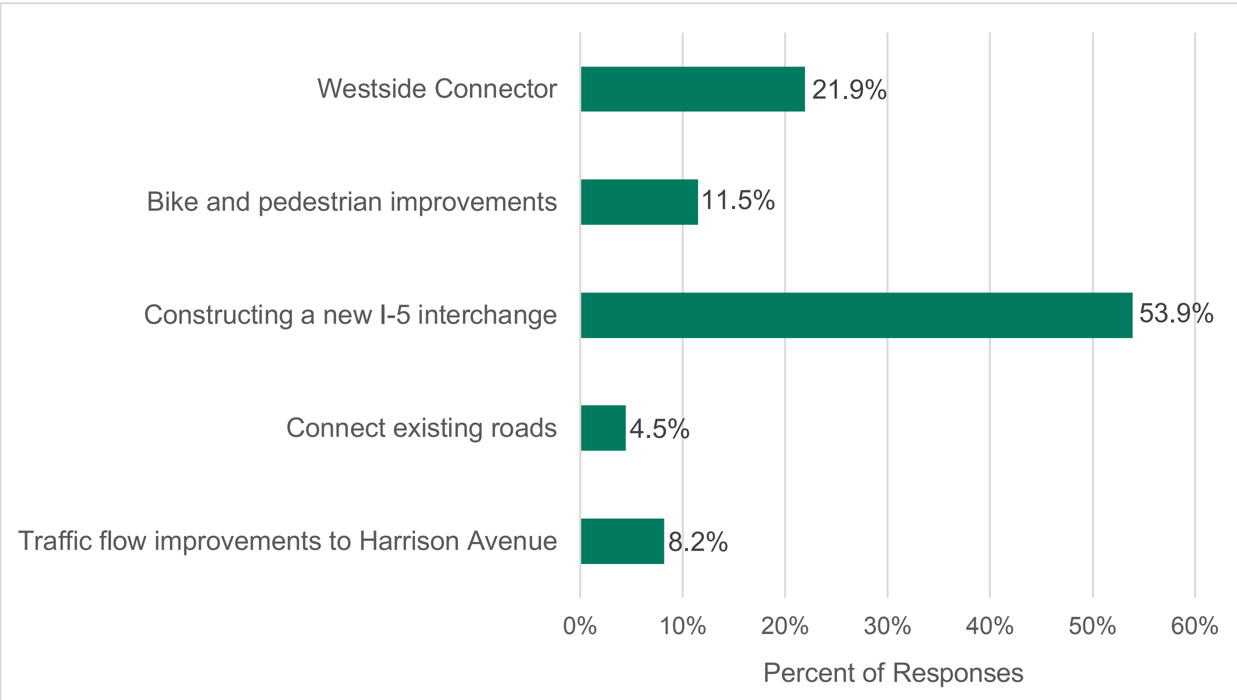
- Traffic flow improvements to Harrison Avenue: closing extra driveways and installing adaptive signals
- Connect existing roads: Blair Road to Hobson Road; extend Gallagher Road north to Harrison Avenue
- Constructing a new I-5 interchange at one of the following locations: 216th Avenue Southwest, 222nd Avenue Southwest, or Kuper Road
- Bike and pedestrian improvements: fill in sidewalk gaps on Galvin Roads; constructing a new shared-use path on Harrison Avenue north of Kuper Roads; enhancing pedestrian signals near schools
- Westside Connector: constructing a new bridge to connect Oakland Avenue and South Scheuber Road

The survey also provided an open-ended comment box for participants to share additional feedback and suggestions they would like WSDOT to consider.

4. Summary of Feedback Received

The survey received 280 unique responses to the two questions asked. A summary of the feedback received from the survey is provided below.

Survey Participants Preferred Potential Improvements



269 participants responded to the first survey question, which asked them to select one preferred improvement. Approximately half (145 responses) indicated that their preferred potential improvement was a new I-5 interchange. The second-most popular option was the Westside Connector (59 responses). Fewer respondents indicated that their preferred options were the bike and pedestrian improvements (31 responses), traffic flow improvements to Harrison Avenue (22 responses), or connecting existing roads (12 responses).

Other Suggestions for WSDOT to Consider

The second survey question gave participants the opportunity to share additional comments and suggestions for WSDOT to consider. 111 participants provided additional comments.

- Several respondents said that I-5 should be expanded to three lanes in both directions.
- Several respondents reiterated their support for the new I-5 interchange option because it would help divert freight traffic from Harrison Avenue to other corridors. A few commenters said that the interchange should be at Kuper Road, a few said that the

interchange should be at 216th Avenue or 222nd Avenue, and a few suggested alternate locations not being considered by the study (i.e., 183rd Avenue and Harrison Avenue).

- Several respondents commented that they would like to see multiple, or all, projects completed.
  - "You only allow one choice, all of the above are needed. My choice is in my mind the most important, but they all need to be done."
- Some respondents stated their support of bicycle and pedestrian improvements, and suggested specific improvements at Eshom Road, Market Road, and Borst Park.
- Some commented on the importance of the Westside Connector to improve access to services and help direct traffic away from Harrison Avenue.
- A few respondents shared their support for traffic flow improvements on Harrison Avenue, including the need for coordinated signal timing.
- A few respondents commented on the need for improvements at the rail crossing to mitigate significant delays caused by trains. Respondents suggested closing Foron Road, installing an overpass, or installing signage to indicate when to expect delays.
- A few respondents said that the benefits from the Hobson/Blair Road connection were not clear or would be challenging to realize.

Attachments

- Survey Questions

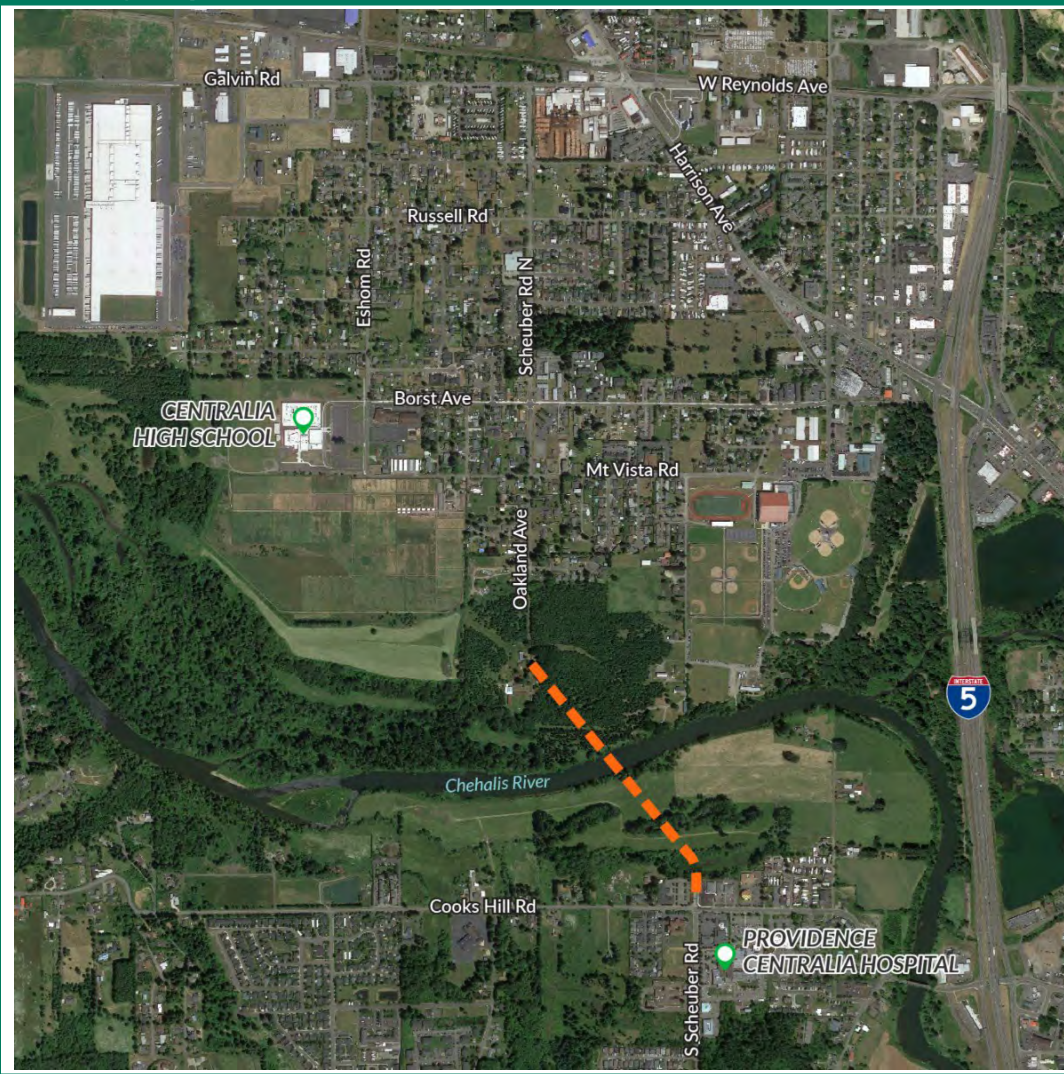
Attachment: Survey Questions

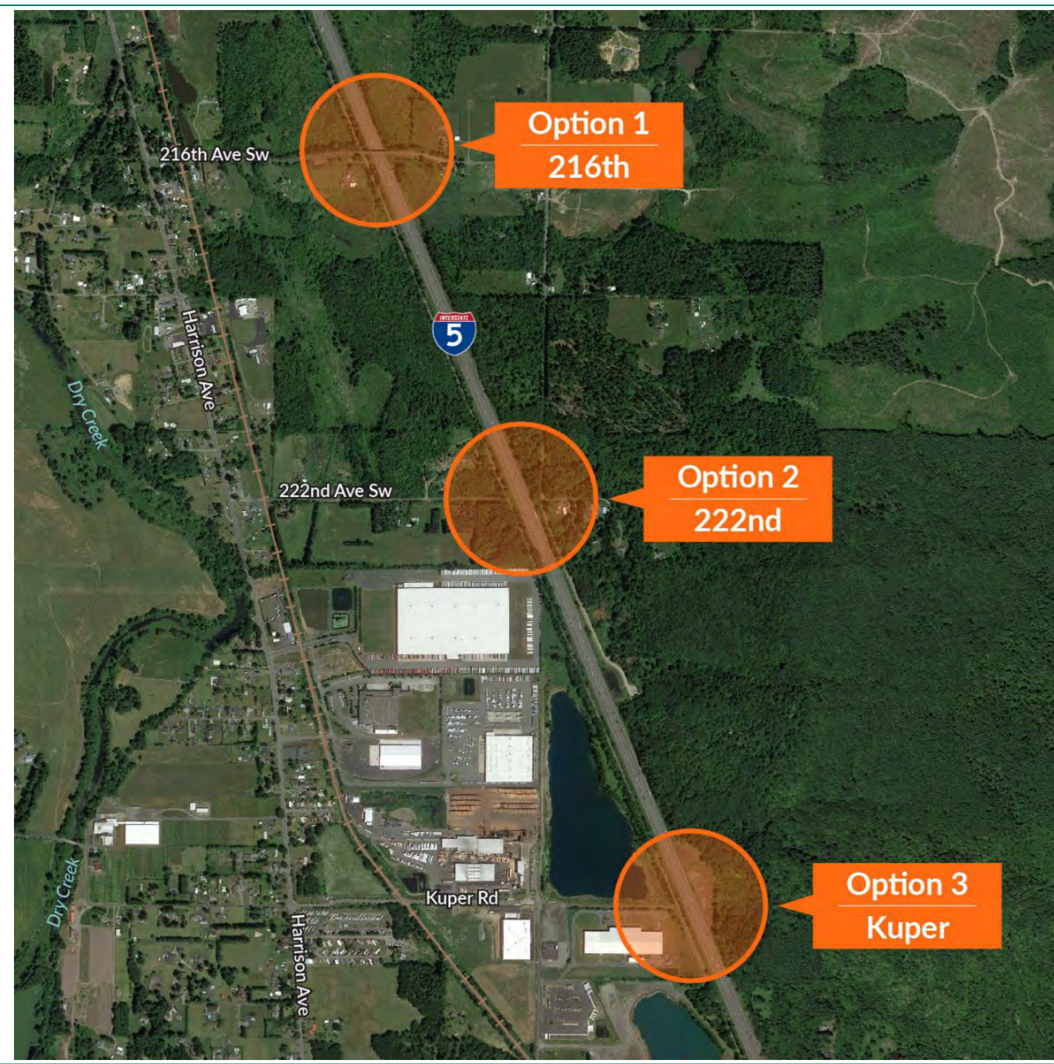
1. Please indicate your preferred potential improvement.
    - Traffic flow improvements to Harrison Avenue: closing extra driveways and installing adaptive signals
    - Connect existing roads: Blair Road to Hobson Road; extend Gallagher Road north to Harrison Avenue
    - Constructing a new I-5 interchange at one of the following locations: 216th Avenue Southwest, 222nd Ave Southwest, or Kuper Road
    - Bike and pedestrian improvements: fill in sidewalk gaps on Galvin Road; constructing a new shared-use path on Harrison Avenue north of Kuper Road; enhancing pedestrian signals near schools
    - Westside Connector: constructing a new bridge to connect Oakland Avenue and South Scheuber Road
2. Is there anything else you would like WSDOT to consider? Your additional comments and suggestions are welcome.

APPENDIX C.1 ALTERNATIVES DEVELOPMENT MATRICES

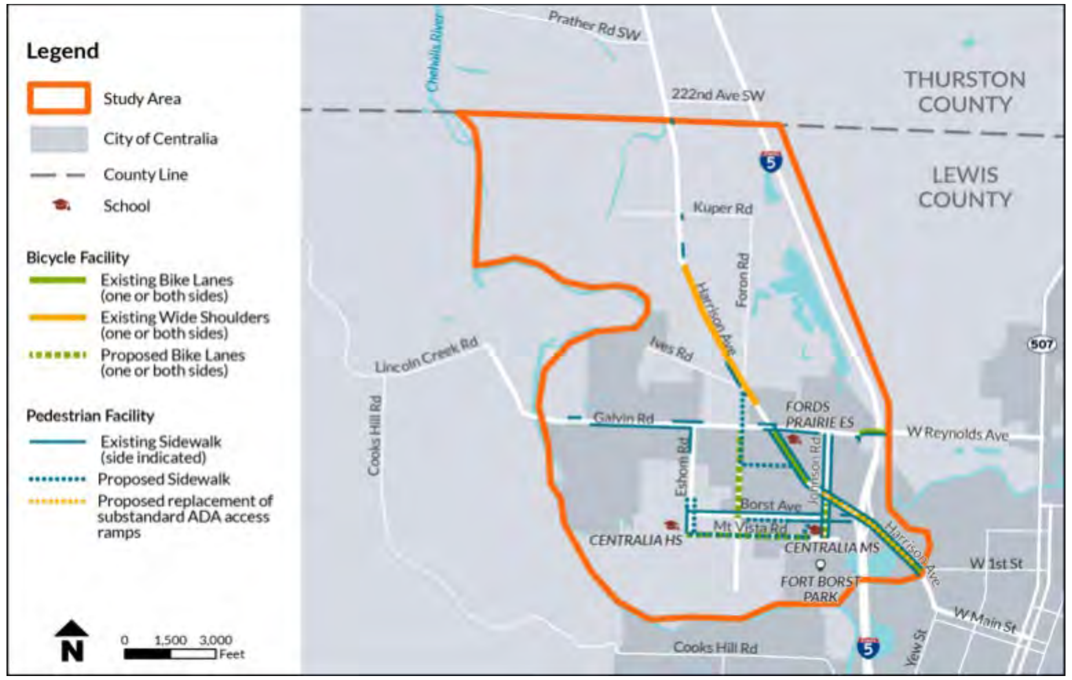
NLCIA ALTERNATIVES DEVELOPMENT MATRIX – MAR. 20, 2023

I-5 Access Improvements

Description	Summary Map	Benefits	Challenges	Additional Notes
Westside Connector: new bridge over Chehalis River, connecting Fords Prairie area to Mellen St interchange via Cooks Hill Rd • **Preferred bridge alignment:** Connect Oakland Ave to N Scheuber Rd		• Improves connectivity to Fords Prairie, Centralia High School for residences south of the Chehalis River. • Provides another north-south route for local traffic, which could reduce congestion around the Harrison Ave / I-5 interchange. • Provides a multimodal connection across the Chehalis River west of I-5. Would need to provide proper separation from truck traffic. • Minimal property impacts – S Scheuber Rd is already stubbed out, and the City has acquired right-of-way north of the river. • Provides a local emergency route to Providence Hospital in the event of flooding – potential for FEMA grants.	• Would not be intended as a freight route • Relatively high cost • Environmental clearance for new structure over waterway could be lengthy process – shoreline substantial development permit and/or variance likely required.	• Westside Connector concept has been referenced in local plans for decades and benefits appear to have been already examined.

Description	Summary Map	Benefits	Challenges	Additional Notes
Connect Lum Rd to I-5 • Extend Lum Rd south to Harrison, connect to SB ramp with roundabout (similar concept to Exit 22 in Woodland) or other traffic control type.		• Provides a direct connection from Harrison Ave to Reynolds Ave.	• Would likely impact commercial properties adjacent to I-5 R/W (Dress Barn, Denny's, Chevron). Though feasible, an RB is not a preferred intersection design for trucks and would require quite a large diameter.	• Would be most effective coupled with access consolidation on Harrison Ave. • City of Centralia expressed that current freight route is preferable
New I-5 interchange near Lewis/ Thurston county line • **Option 1:** Connect 216th to I-5 (Thurston County) • **Option 2:** Connect 222nd to I-5 (Thurston County) • **Option 3:** Connect Kuper Rd to I-5 (Lewis County)		• May relieve pressure on existing interchanges • **All options** would meet FHWA spacing standards • **Option 1** utilizes an existing overpass over I-5. This is also an existing, permitted railroad overcrossing.	• **All options** primarily serve industrial lands, with relatively limited benefit to other road users. Diversion traffic on Harrison is likely. • **All options** would have to cross the railroad that runs parallel and to the west of I-5 • **All options** will have property impacts • **Options 1 and 2** are in Thurston County – language of legislative proviso is specific to improvements in Lewis County • **Option 3** is very close to recent landslide area. • **All options** would result in out of direction travel for trucks accessing the Port of Centralia to/from the south.	• Each interchange option will be screened independently • These are the only potentially feasible locations for a new I-5 connection near the study area • Half diamond configurations may be needed for **Options 2 and 3** – connection over/under I-5 may be problematic

Bike and Pedestrian Improvements

<table>
<tr><th>Description</th><th>Summary Map</th><th>Benefits</th><th>Challenges</th><th>Additional Notes</th></tr>
<tr><td>New multi-use path along Harrison north of Kuper Rd (beyond the scope of Harrison/ Reynolds project)</td><td rowspan="3">
</td><td>Simpler and cheaper to implement than sidewalk, curb, gutter (stormwater)
Provides physical separation between vehicles and bikes/ peds</td><td>Potential for minor property impacts</td><td rowspan="3">Harrison/Reynolds project design includes three lanes - one lane each direction + two-way left turn lane. Typical cross-section includes curb, sidewalk and gutter. Project is currently funded for full design but is still seeking construction funding.
Coordination with Harrison/ Reynolds project will ensure best implementation of active transportation improvements.</td></tr>
<tr><td>Complete missing sidewalks on Galvin Rd near distribution center</td><td>Will connect existing isolated sidewalk segments and remove pedestrians from shoulder of roadway</td><td>More costly than a shared-use path
Potential for minor property impacts</td></tr>
<tr><td>Pedestrian signal improvements (such as leading pedestrian interval) at key intersections, including:
Harrison and Reynolds
Near Harrison/I-5 interchange
Lum and Reynolds
Intersections near high school, middle school</td><td>Improved safety for pedestrians</td><td>Causes a slight reduction in green time for traffic movements</td></tr>
</table>

Local Road Connections

Description	Summary Map	Benefits	Challenges	Additional Notes
Connect Blair Rd to Hobson Rd		• Would complete a loop route from Blair > Smith > 216th > Harrison > Reynolds • City of Centralia noted that this would be particularly helpful for trips to/from local landfill	• Very significant environmental constraints – steep/unstable slopes – could be very costly	• Suggested by multiple stakeholders at February workshop
Extend Gallagher Rd north to Harrison Ave		• Would decrease NB trips to Grand Mound interchange by 1 mile – could lead to some freight trips diverting away from Harrison interchange	• N/A	• Suggested by Port Commissioners at February workshop • Currently in County TIP – not funded

Access Management

<table>
<tr><th>Description</th><th>Summary Map</th><th>Benefits</th><th>Challenges</th><th>Additional Notes</th></tr>
<tr><td>WSDOT purchases access rights on Harrison Ave between I-5 SB ramps and Belmont Ave
• Close off driveway to Chevron, Denny’s, and Country Cousin
• Close south leg of Belmont Ave</td><td rowspan="2">
</td><td rowspan="2">• Simpler than local govt attempting to negotiate closing access connection voluntarily
• Smoother traffic flow
• Fewer conflicts between vehicles and bikes/peds (right hooks, etc.)</td><td rowspan="2">• Will likely be expensive to purchase access control in this location
• Perceived impact to commercial properties is likely significant</td><td rowspan="2">• WSDOT currently controls signals at Belmont/Harrison and Johnson/Harrison but does not have access control
• Attempts to negotiate driveway closures at the local level have not been successful</td></tr>
<tr><td>WSDOT purchases access rights on Harrison Ave between I-5 NB ramps and Lowe St
• Close off redundant driveways to Arco, Jiffy Lube, Burgerville, Wendy’s, Alibertos, Dairy Queen, and Auto Zone</td></tr>
</table>

Intersection and Signal Improvements

Description	Summary Map	Benefits	Challenges	Additional Notes
Adaptive signal controller installation near retail along Harrison/Reynolds corridors	N/A	• Likely improvements to traffic flow, particularly for less predictable traffic conditions associated with retail and services as opposed to commute trips.	• Likely requires vendor-led installation with substantial upfront cost. Could also result in long term reliance on outside management and maintenance of hardware/ software. • Long term operations and maintenance are another consideration – increased cost if SWR, City or County are not able to manage the system.	• May be easier to implement at signals already controlled by WSDOT

APPENDIX C.2 ALTERNATIVES SCREENING MATRIX

North Lewis County Industrial Access Transportation Study--Level I Screening Matrix

Candidate Alternatives / ***Project Purpose & Need Statements***	Westside Connector	Connect Lum Road to I-5	Interchange near County line	Harrison multi-use path n/o Kuper	Galvin Rd missing sidewalks	Ped Signal improvements at key intersections	Connect Blair Rd to Hobson Rd	Extend Gallagher Rd north to Harrison Ave	Optimize access management on Harrison btwn View and Lowe St.	Adaptive traffic signal control along Harrison Ave betw Reynolds and Lowe St.	**TOTAL**
Enhance connectivity between South Thurston County and North Lewis County	2	1	3	3	2	2	3	3	2	2	23
Acknowledge the value of working across jurisdictional boundaries to accomplish common safety, operations, and economic development goals.	3	1	3	3	3	3	3	3	2	3	27
Identify solutions by reaching consensus with support from stakeholders, recognizing that there will be give and take to achieve our vision.	2	1	2	3	3	3	3	3	2	2	24
Coordinate successfully with the County-led project on Reynolds Avenue to identify a suite of solutions that enhance safety and mobility for all users.	2	2	2	3	3	3	3	2	2	3	25
Improve safety for all road users through viable solutions, with a focus on vulnerable users such as school children, pedestrians, and cyclists.	2	1	2	3	3	3	2	3	3	2	24
Prioritize community needs adjacent to Harrison Avenue, including the schools, housing, services, and commercial areas that currently share roadways with freight traffic.	3	1	3	3	2	3	2	3	3	2	25
Provide solutions that enhance mobility, safety, and access for all modes and that support economic development and accommodate future development.	2	1	2	3	3	3	2	3	3	3	25
Identify solutions that are forward compatible with the ultimate vision for the corridor, acknowledging that it cannot all be built at once.	3	1	2	3	3	3	3	3	3	3	27
Consider the county's process of investigating alternatives to improve industrial access to I-5 that began in March 2015.	2	1	3	2	2	2	2	2	3	3	22
Apply "dig once" principles where possible.	2	2	2	2	2	2	2	2	2	2	20
Total	23	12	24	28	26	27	25	27	25	25	

Revised: March 22, 2023

Exceeds Purpose Need Statement-3; Meets Purpose Need Statement-2; Does not meet Purpose Need Statement-1

North Lewis County Industrial Access Transportation Study--Level II Alternatives Evaluation

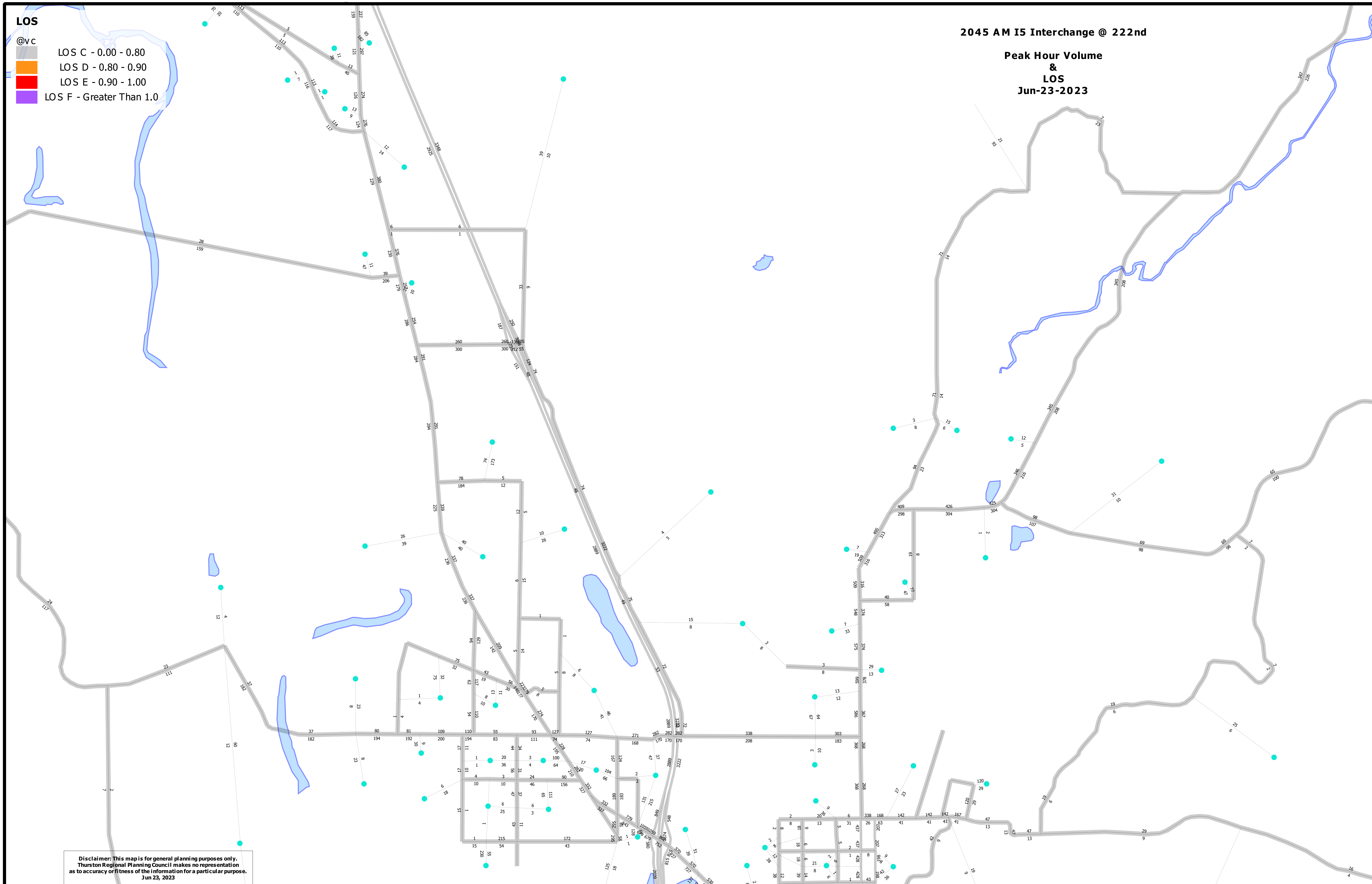
Evaluation Criteria	*Scoring Method*
Mobility	
Travel time reliability	1 = reduced reliability; 2 = no change in reliability; 3 = improved reliability
Intersection LOS (vehicles)	1 = reduced LOS; 2 = no impact; 3 = improved LOS
Ped/bike level of traffic stress (LTS)	1 = reduced LTS; 2 = no impact to LTS; 3 = improved LTS
Transit speed/reliability	1 = reduces transit speed/reliability; 2 = no impact; 3 = improves transit speed/reliability
Roadway design deficiencies (especially for trucks)	1 = increased deficiencies; 2 = no change in deficiencies; 3 = reduced deficiencies
Availability of transit service within 1/2 mile	1 = no access to transit stops; 2 = access to one route; 3 = access to two or more routes
Freight travel times and reliability	1 = reduced reliability; 2 = no change in reliability; 3 = improved reliability
Safety	
Reduction of fatal/serious injury crashes	1 = increased crash potential; 2 = no change in crash potential; 3 = reduced crash potential
Total crash reduction potential	1 = increased crash potential; 2 = no change in crash potential; 3 = reduced crash potential
Ped/bike/vehicle conflict reduction, particularly with large trucks - degree of protected facilities and crossings	1 = increased conflict potential; 2 = no change to conflict potential; 3 = reduced conflict potential
Visibility - lighting and sight distance	1 = reduced visibility; 2 = no change / not applicable; 3 = improved visibility
Complete Streets	
Route directness by mode: freight	1 = reduced route directness; 2 = no change in route directness; 3 = improved route directness
Route directness by mode: all other motor vehicles	1 = reduced route directness; 2 = no change in route directness; 3 = improved route directness
Route directness by mode: active transportation	1 = reduced route directness; 2 = no change in route directness; 3 = improved route directness
Degree to which alternative accommodates active transportation along street or corridor	1 = reduced AT accommodation; 2 = no change to AT facilities; 3 = improved AT accommodation
Connectivity for bikes/peds	1 = reduced connectivity; 2 = no change to connectivity; 3 = improved connectivity
Connectivity for freight	1 = reduced connectivity; 2 = no change to connectivity; 3 = improved connectivity
Connectivity for all other motor vehicles	1 = reduced connectivity; 2 = no change to connectivity; 3 = improved connectivity
Environmental	
Fish passage - whether project avoids impacts to fish passage locations	1 = impacts WSDOT-mapped fish passage locations; 2 = does not impact WSDOT-mapped fish passage locations
Critical areas - degree to which project avoids critical areas that may restrict project development	1 = high impacts; 2 = moderate impacts; 3 = low/no impacts
Air quality - degree to which project is expected to shift diesel particulates from neighborhoods	1 = reduced air quality; 2 = no impacts; 3 = improved air quality

North Lewis County Industrial Access Transportation Study--Level II Alternatives Evaluation

Equity	
Whether alternative avoids adverse impacts to vulnerable populations	1 = adverse impacts to vulnerable populations; 2 = no adverse impacts anticipated
ADA accessibility	1 = reduced accessibility; 2 = no change; 3 = improved accessibility
Equitable distribution of bike/ped facilities, including access to schools	1 = reduced equitable distribution; 2 = no change; 3 = improved equitable distribution
Availability or convenience of transit to vulnerable populations	1 = reduced access to transit; 2 = no change; 3 = improved access to transit
Feasibility	
Opinion of cost	1 = high cost; 2 = moderate cost; 3 = low cost (spell out dollar amount ranges?)
Funding feasibility—ability to leverage additional funding	1 = least likely; 2 = possible; 3 = most likely (includes high-level assessment of applicability of existing grant programs)
Right of way needs including acquisition and stormwater	1 = high ROW impacts; 2 = moderate ROW impacts; 3 = low/no ROW impacts
Constructability	1 = least constructable; 2 = moderately constructable; 3 = most constructable
Barriers to development (e.g., railroad crossings, environmental impacts)	1 = high barriers; 2 = moderate barriers; 3 = low barriers
Long-term maintenance and operations cost	1 = highest cost 2 = medium cost; 3 = lower cost
Community Support	
Level of stakeholder support	1 = low support; 2 = moderate support; 3 = high support
Level of public support (gathered through feedback from outreach activities)	1 = low support; 2 = moderate support; 3 = high support

Candidate Alternatives	Westside Connector	Interchange at 216th	Interchange at 222nd	Interchange at Kuper	Harrison multi-use path n/o Kuper	Galvin Rd missing sidewalks	Ped Signal improvements at key intersections	Connect Blair Rd to Hobson Rd	Extend Gallagher Rd north to Harrison Ave	Optimize access management on Harrison btwn View and Lowe St.	Adaptive traffic signal control along Harrison Ave betw Reynolds and Lowe St.
Evaluation Criteria											
Mobility											
Travel time reliability	3	3	3	3	2	2	2	3	3	3	3
Intersection LOS (vehicles)	2.5	3	3	3	2	2	1	2.5	2.5	3	3
Ped/bike level of traffic stress (LTS)	3	2	2	2	3	3	3	2	3	3	3
Transit speed/reliability	3	3	3	3	2	2	1	2	2	3	3
Roadway design deficiencies (especially for trucks)	2	3	3	3	2	2	2	1	2	3	3
Availability of transit service within 1/2 mile	3	1	1	1	1	2	3	1	2	3	3
Freight travel times and reliability	2	3	3	3	2	2	1	3	3	3	3
Safety											
Potential reduction of fatal/serious injury crashes	2.5	2	2	2	3	3	3	2	2	3	3
Total crash reduction potential	2.5	2	2	2	2.5	2.5	3	2	2	3	3
Ped/bike/vehicle conflict reduction, particularly with large trucks - degree of protected facilities and crossings	3	2	2	2	3	3	3	2	2	3	3
Visibility - lighting, sight distance	2	2	2	2	2	2	3	2	2	3	2
Complete Streets											
Route directness by mode - freight	2	3	3	3	2	2	2	3	3	1	2
Route directness by mode - other motor vehicles	3	3	3	3	2	2	2	3	3	1	2
Route directness by mode - active transportation	3	2	2	2	3	3	3	2	3	2	2
Degree to which alternative accommodates active transportation along street or corridor	3	2	2	2	3	3	3	2	3	3	2
Connectivity for bikes/peds	3	2	2	2	3	3	3	2	3	2	2
Connectivity for freight	2	3	3	3	2	2	2	3	3	2	3
Connectivity for all other motor vehicles	3	3	3	3	2	2	2	3	3	2	2
Environmental											
Fish passage - whether project avoids impacts to fish passage locations	2	1	1	2	2	2	2	2	2	2	2
Critical areas - degree to which project avoids critical areas that may restrict project development	1	2	2	1	2	3	3	1	2	3	3
Air quality - degree to which project is expected to shift diesel particulates from neighborhoods	1	3	3	3	2	2	2	3	3	3	3
Equity											
Whether alternative avoids adverse impacts to vulnerable populations	1	2	1	2	2	2	2	2	2	2	2
ADA accessibility	2	2	2	2	3	3	3	2	3	3	2
Equitable distribution of bike/ped facilities, including access to schools	3	2	2	2	3	3	3	2	3	2	2
Availability or convenience of transit to vulnerable populations	3	2	2	2	3	3	3	2	3	2	2
Feasibility											
Opinion of cost	1.5	1	1	1	3	3	3	2	2	3	2.5
Funding feasibility—ability to leverage additional funding	2	2	2	2	3	3	3	2	2	2	2
Right of way needs including acquisition and stormwater	2	1	1	1	2	2	3	2	2	2	3
Constructability	2	2	1	1	3	3	3	1	3	3	3
Barriers to development (e.g., railroad crossings, environmental impacts)	2	2	1	1	2	2	3	1	2	3	3
Long-term maintenance and operations cost	1	1	1	1	3	3	2	1	1	3	2
Community Support											
Level of stakeholder support	3	3	3	3	2	2	2	2	1	2	2
Level of public support (gathered through feedback from outreach activities)	2	3	3	3	2	2	2	1	1	1	1
Total	**76**	**73**	**70**	**71**	**78.5**	**80.5**	**81**	**66.5**	**78.5**	**82**	**81.5**

APPENDIX C.3 PROJECTED AM/PM PROJECT VOLUMES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Peak Hour Volume
&
LOS
Jun-23-2023
LOS
@vc
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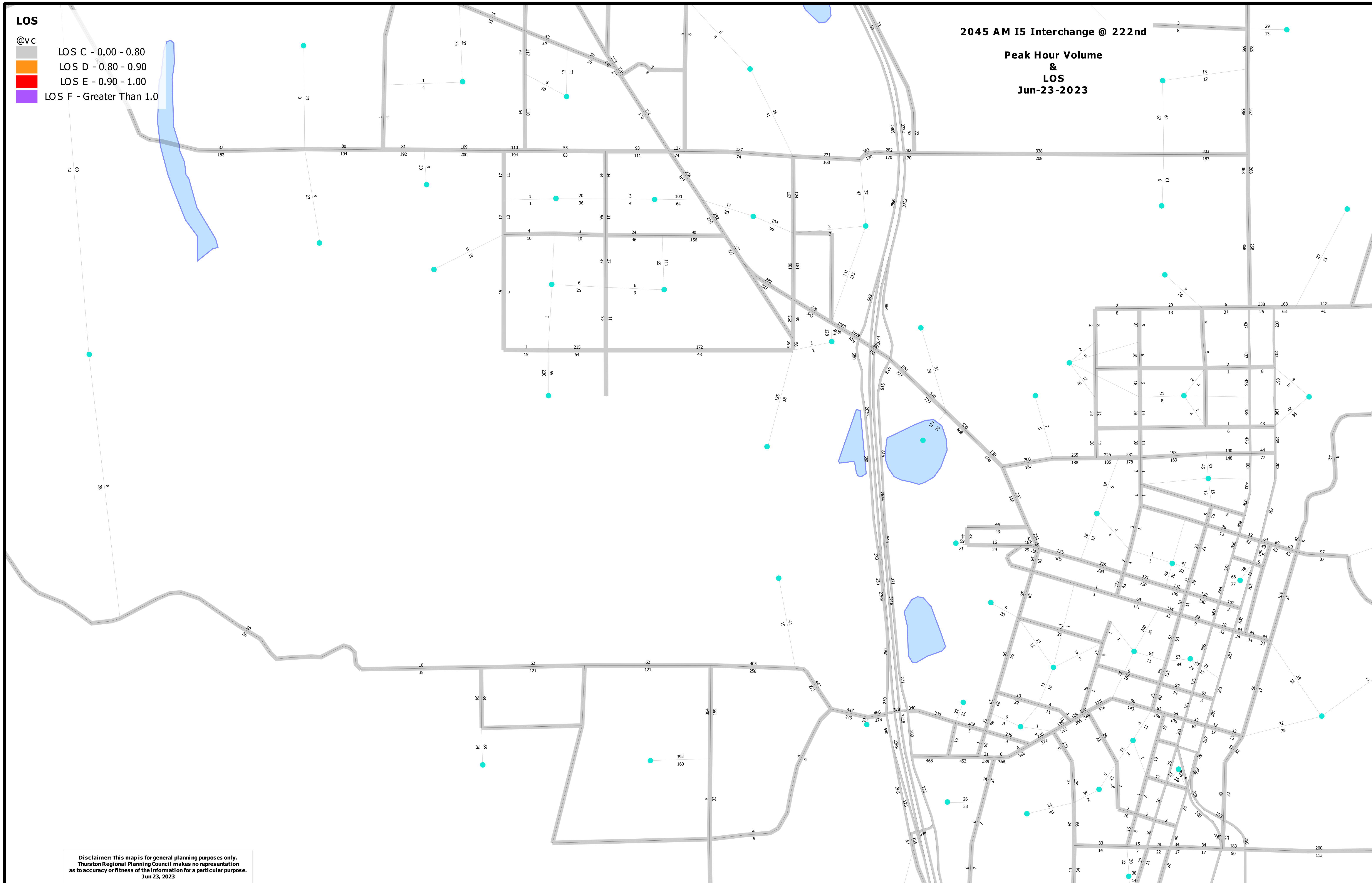
LOS D - 0.80 - 0.90
LOS E - 0.90 - 1.00
LOS F - Greater Than 1.0
Disclaimer: This map is for general planning purposes only. Thurston Regional Planning Council makes no representation as to accuracy or fitness of the information for a particular purpose.
Jun 23, 2023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Peak Hour Volume
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LOS E - 0.90 - 1.00
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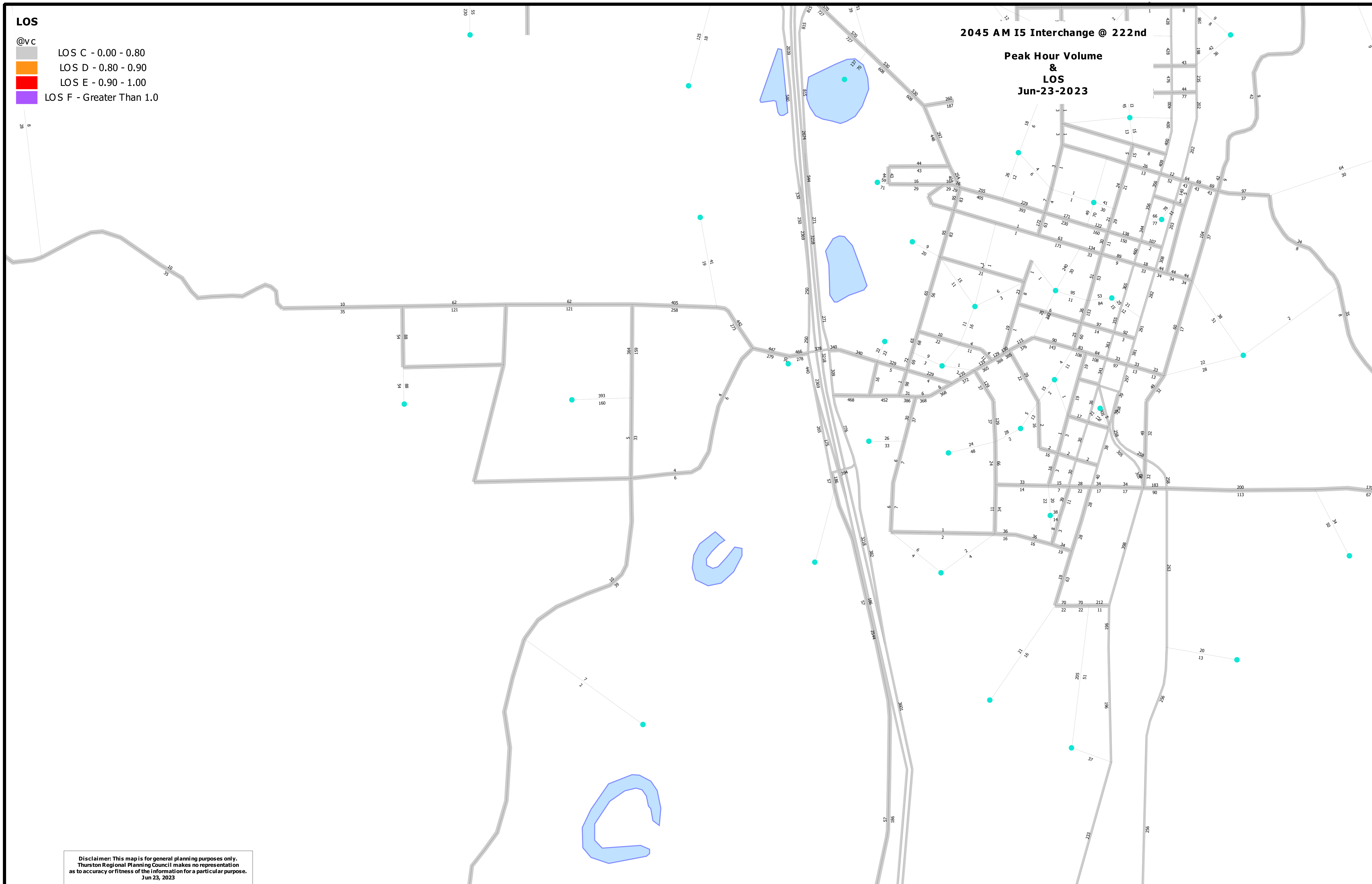
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Peak Hour Volume
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Jun-23-2023
LOS
@vc
LOS C - 0.00 - 0.80
LOS D - 0.80 - 0.90
LOS E - 0.90 - 1.00
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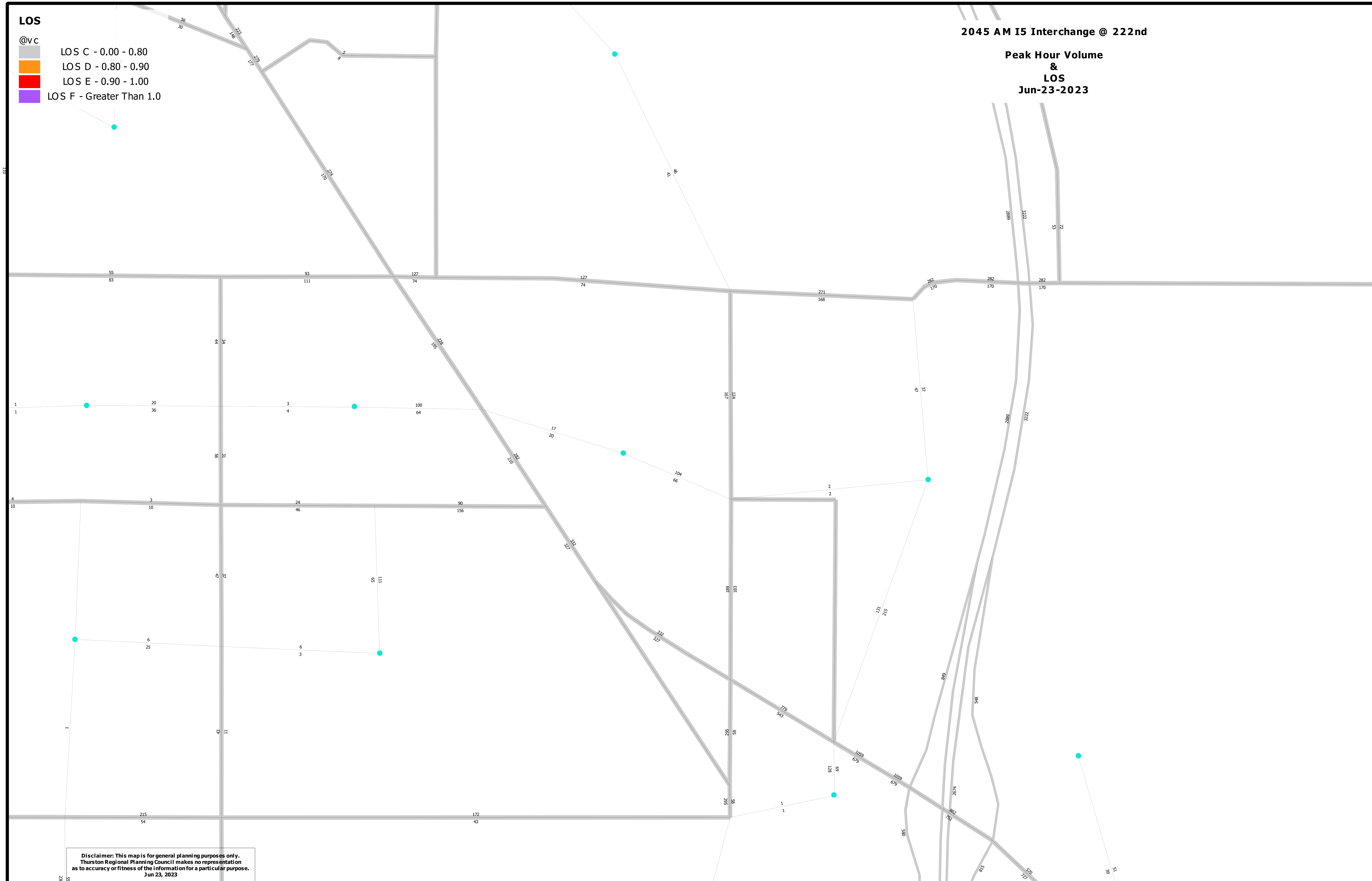
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LOS D - 0.80 - 0.90
LOS E - 0.90 - 1.00
LOS F - Greater Than 1.0
2045 AM I5 Interchange @ 222nd
Peak Hour Volume
&
LOS
Jun-23-2023
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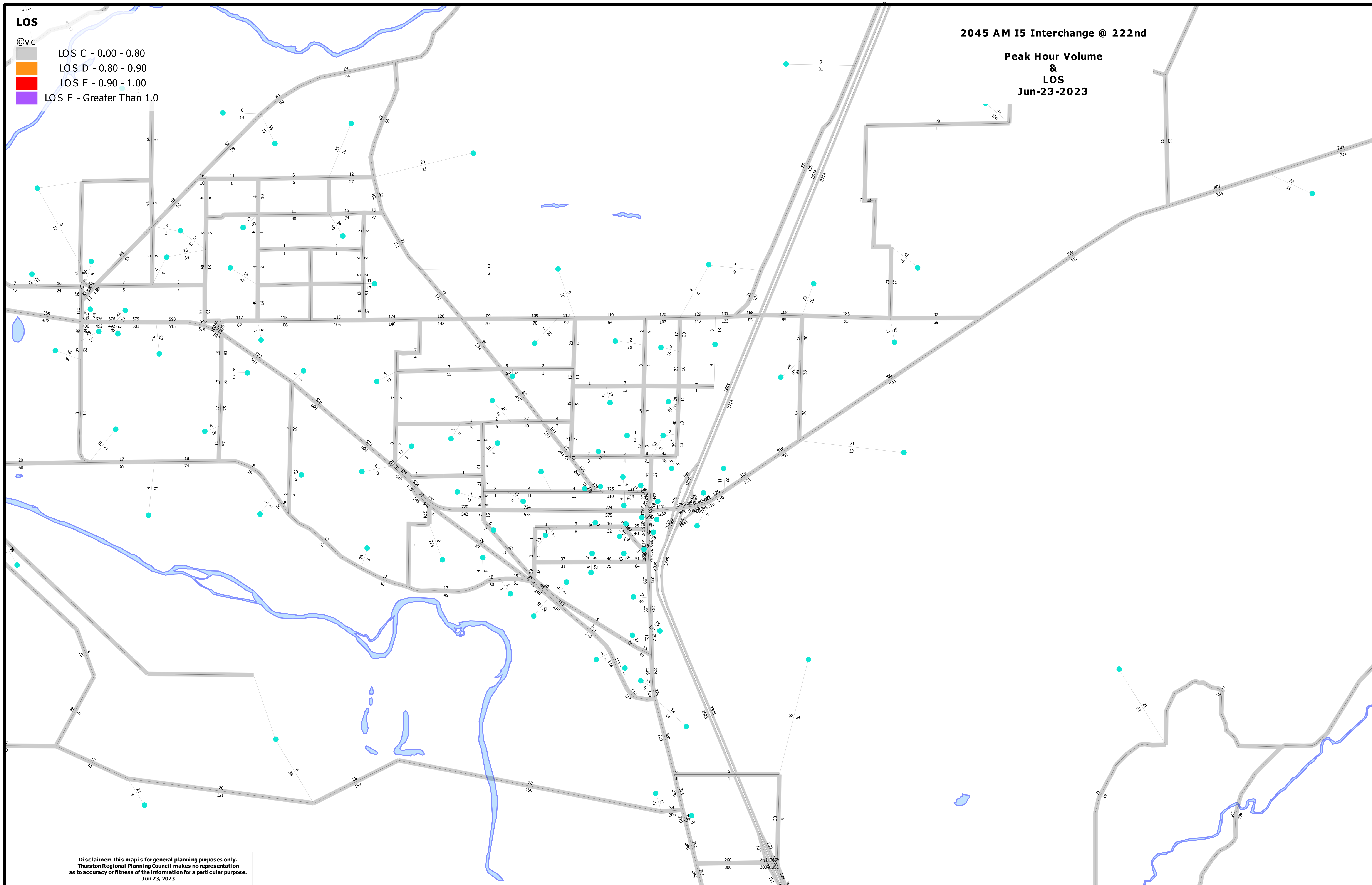
2045 AM I5 Interchange @ 222nd
Peak Hour Volume
&
LOS
Jun-23-2023
LOS
@vc
LOS C - 0.00 - 0.80
LOS D - 0.80 - 0.90
LOS E - 0.90 - 1.00
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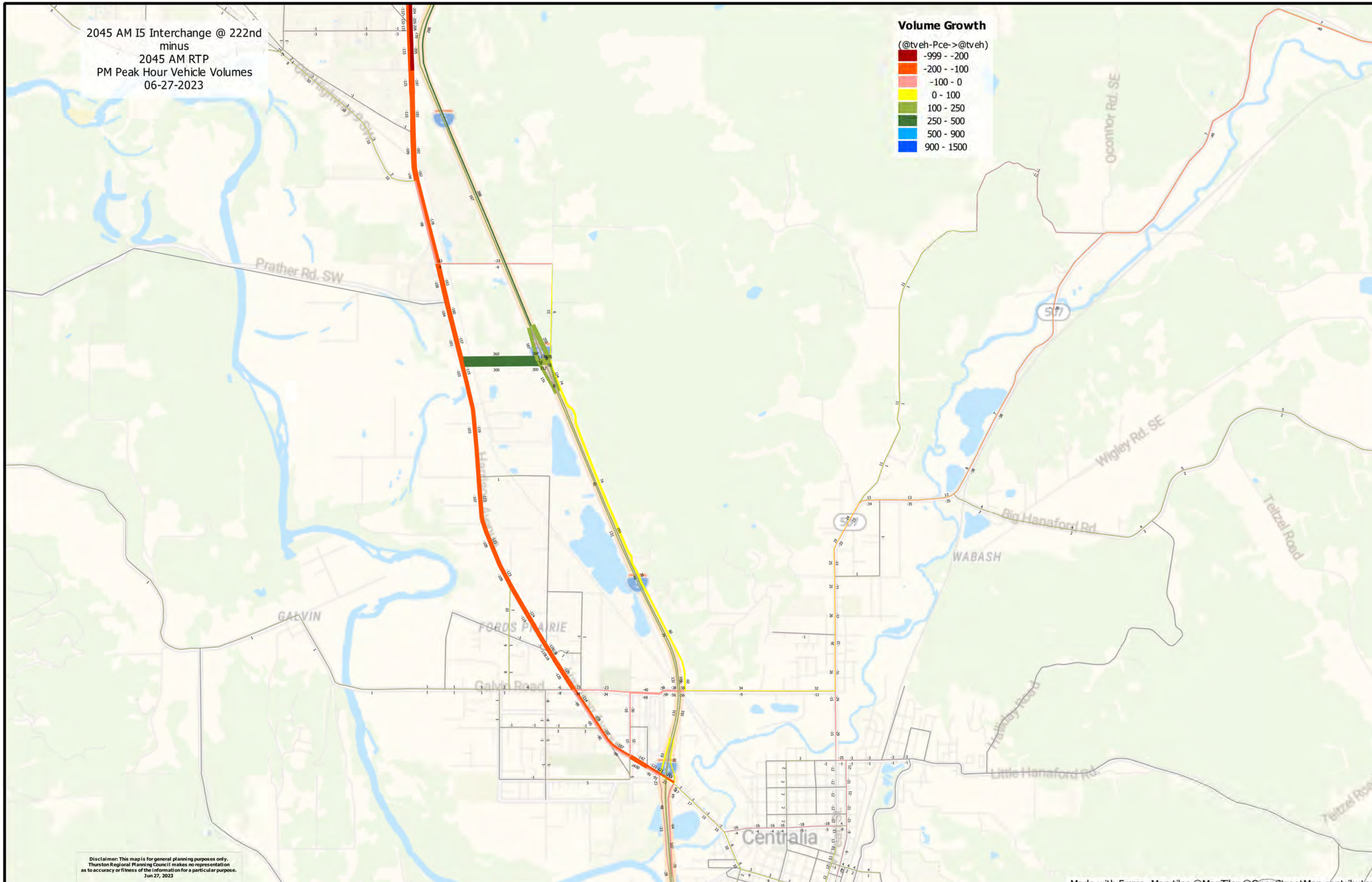

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2045 AM RTP
PM Peak Hour Vehicle Volumes
06-27-2023
Volume Growth
(@tveh-Pce->@tveh)
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-200 - -100
-100 - 0
0 - 100
100 - 250
250 - 500
500 - 900
900 - 1500
Prather Rd. SW
Oconnor Rd. SE
Wigley Rd. SE
Big Hanaford Rd
WABASH
Teitzel Road
GALVIN
FORDS PRAIRIE
Galvin Road
Little Hanaford Rd.
Centralia
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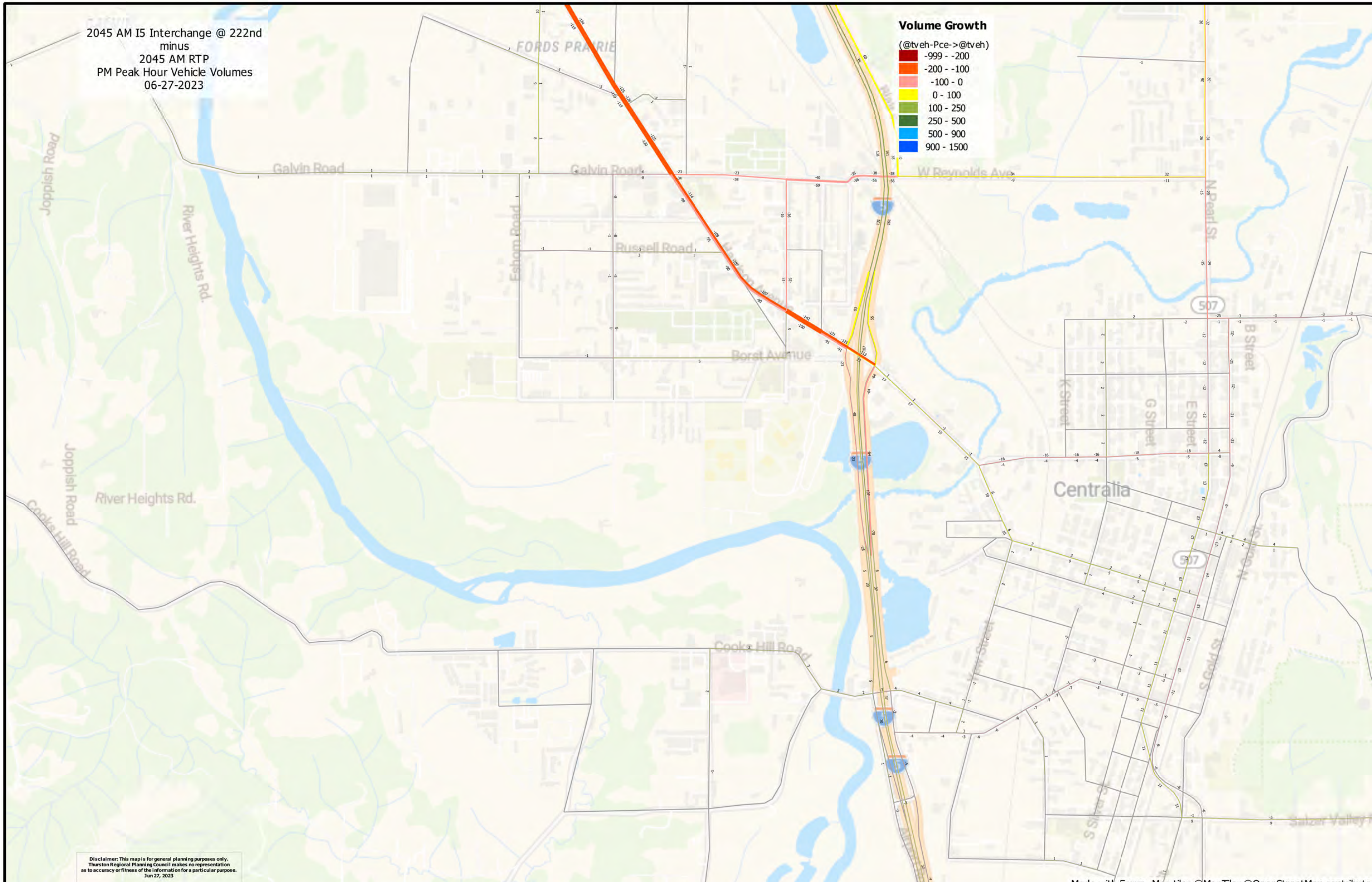

2045 AM I5 Interchange @ 222nd
minus
2045 AM RTP
PM Peak Hour Vehicle Volumes
06-27-2023
Volume Growth
(@tveh-Pce->@tveh)
-999 - -200
-200 - -100
-100 - 0
0 - 100
100 - 250
250 - 500
500 - 900
900 - 1500
FORDS PRAIRIE
Galvin Road
Galvin Road
W Reynolds Ave
Russell Road
Eshom Road
Borst Avenue
Joppish Road
River Heights Rd.
River Heights Rd.
Joppish Road
Cooks Hill Road
Cooks Hill Road
N Pearl St
507
507
B Street
K Street
G Street
E Street
Centralia
S Gold St
S Silver St
Salzer Valley Rd
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Jun 27, 2023
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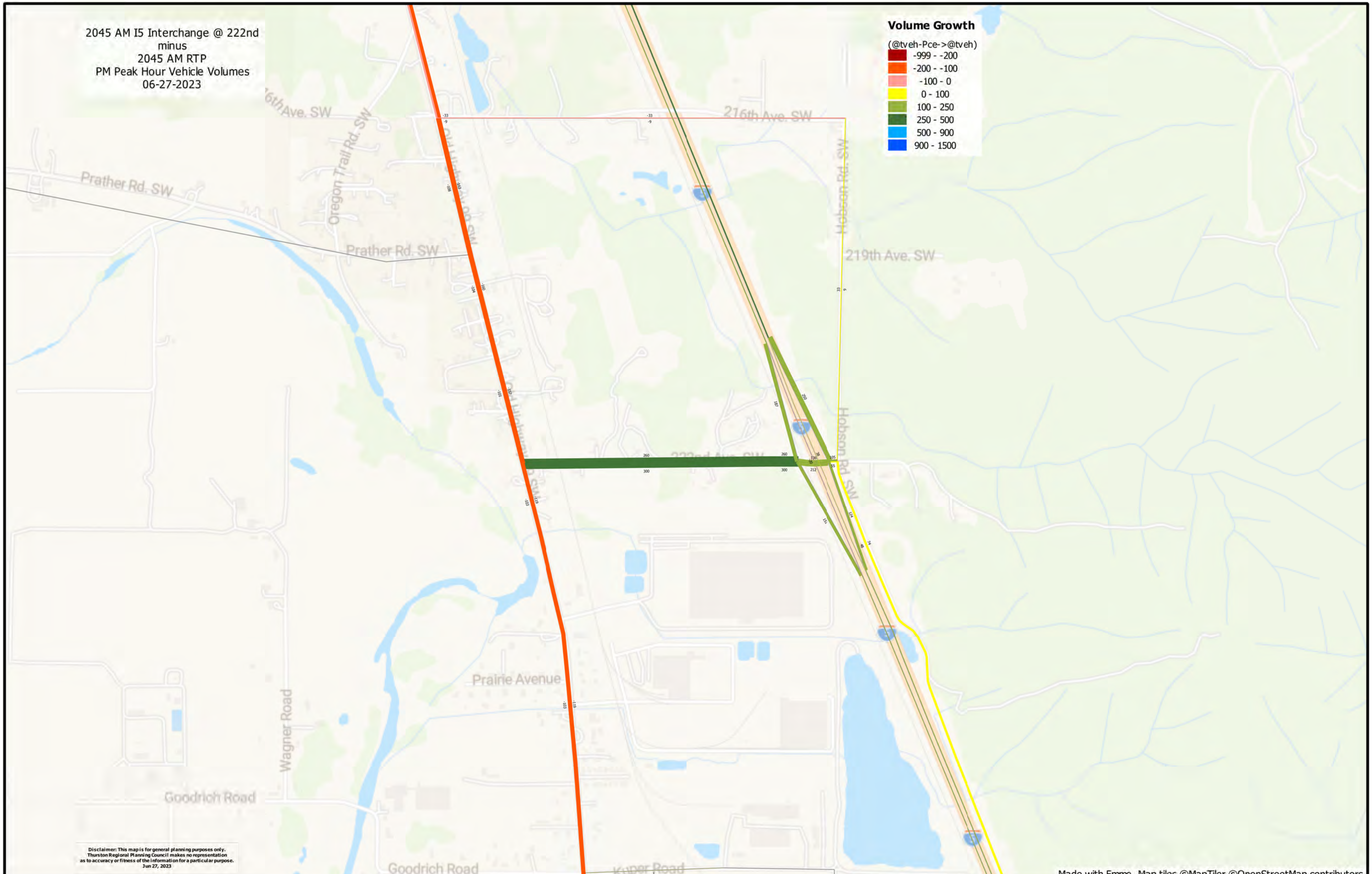

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minus
2045 AM RTP
PM Peak Hour Vehicle Volumes
06-27-2023
Volume Growth
(@tveh-Pce->@tveh)
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-200 - -100
-100 - 0
0 - 100
100 - 250
250 - 500
500 - 900
900 - 1500
216th Ave. SW
Prather Rd. SW
Oregon Trail Rd. SW
Hobson Rd. SW
219th Ave. SW
Prairie Avenue
Wagner Road
Goodrich Road
Kuper Road
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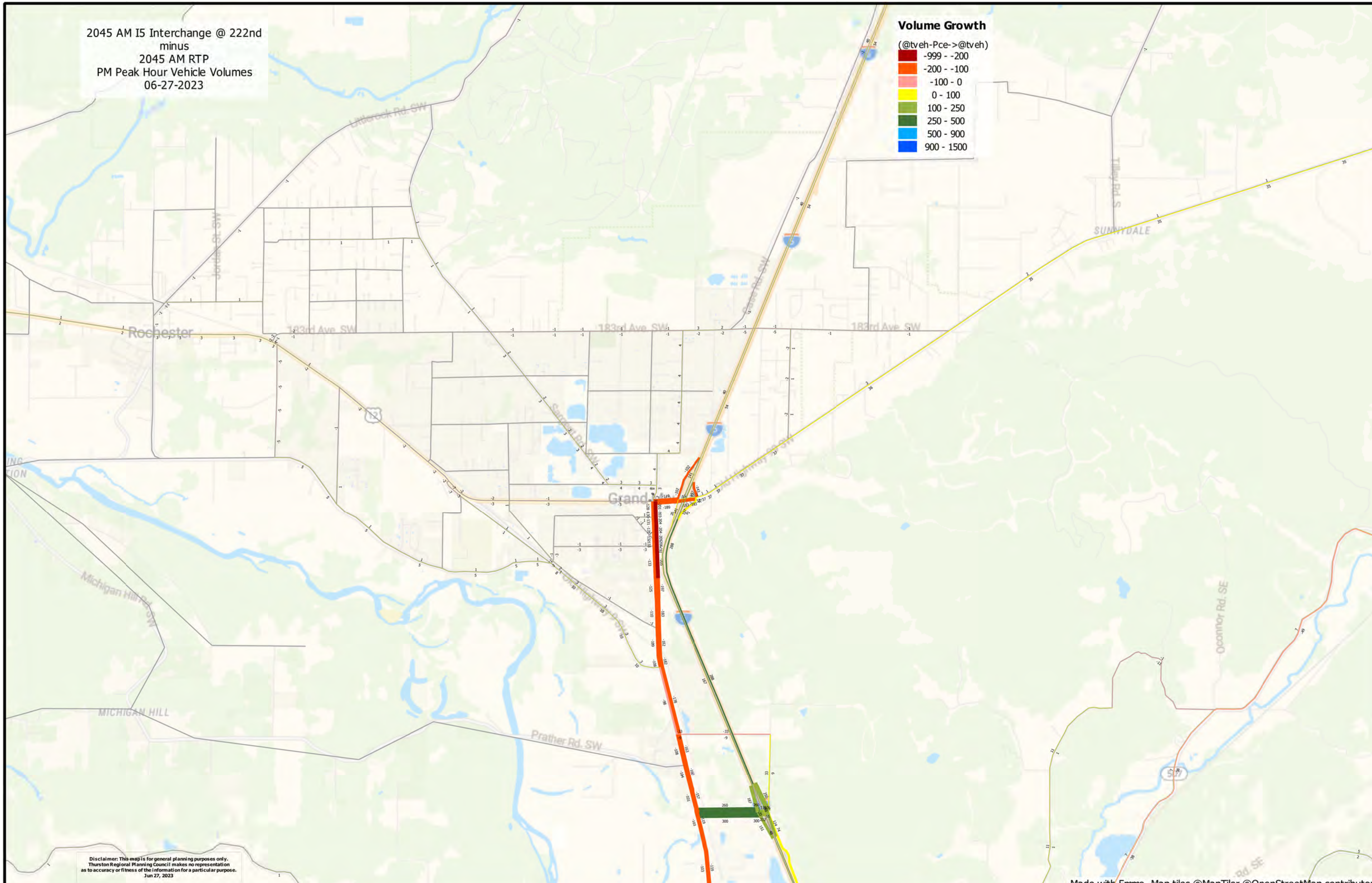
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minus
2045 AM RTP
PM Peak Hour Vehicle Volumes
06-27-2023
Volume Growth
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-200 - -100
-100 - 0
0 - 100
100 - 250
250 - 500
500 - 900
900 - 1500
Rochester
183rd Ave SW
183rd Ave SW
183rd Ave SW
Littlerock Rd SW
Jordan St SW
Sargent Rd SW
Sunnydale
Tilley Rd S
Grand Mound
Old Highway 99 SW
Michigan Hill Rd SW
Michigan Hill
Prather Rd SW
Oconnor Rd SE
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Jun 27, 2023
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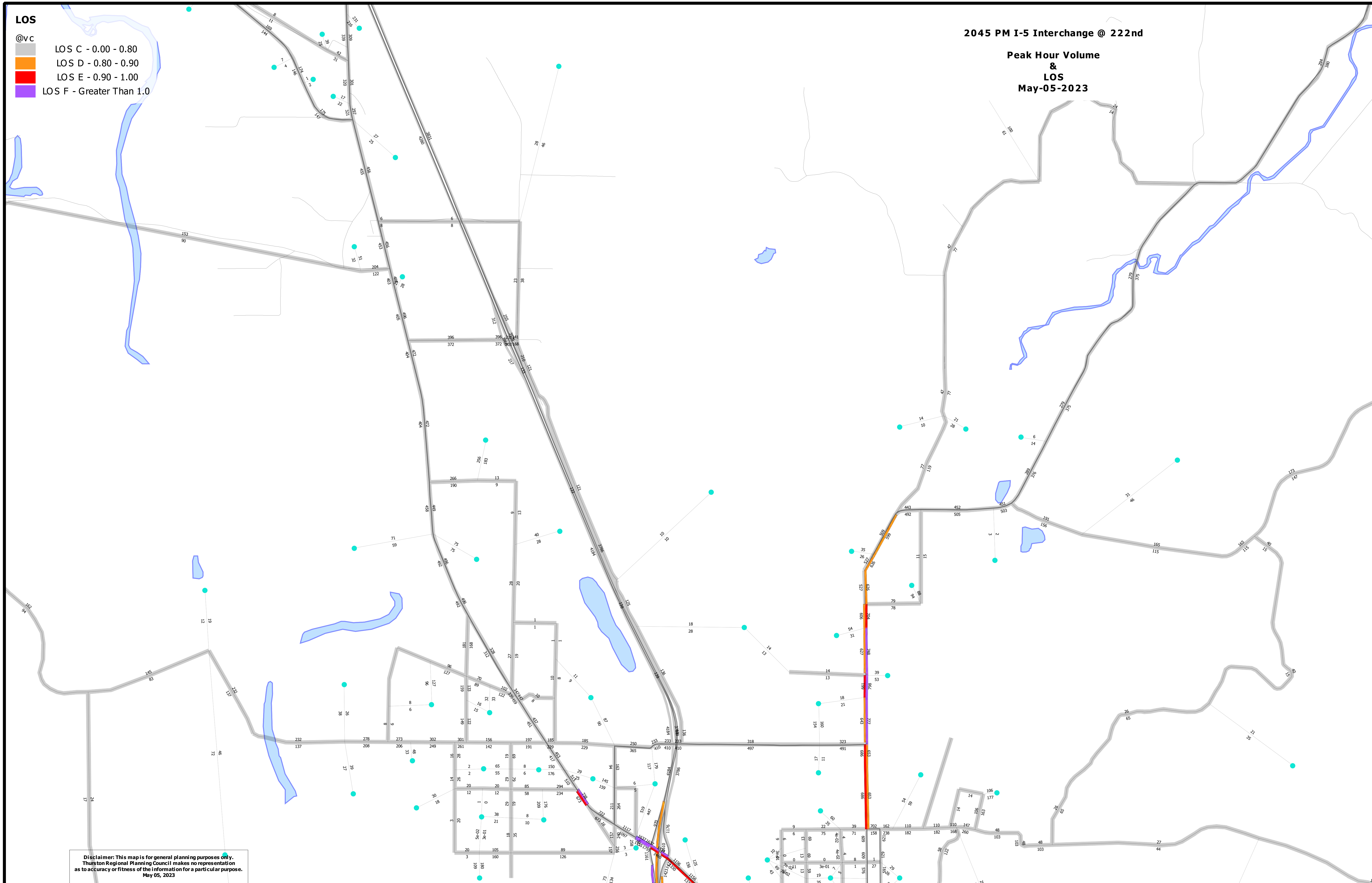
2045 PM I-5 Interchange @ 222nd
Peak Hour Volume
&
LOS
May-05-2023
LOS
@vc
LOS C - 0.00 - 0.80
LOS D - 0.80 - 0.90
LOS E - 0.90 - 1.00
LOS F - Greater Than 1.0
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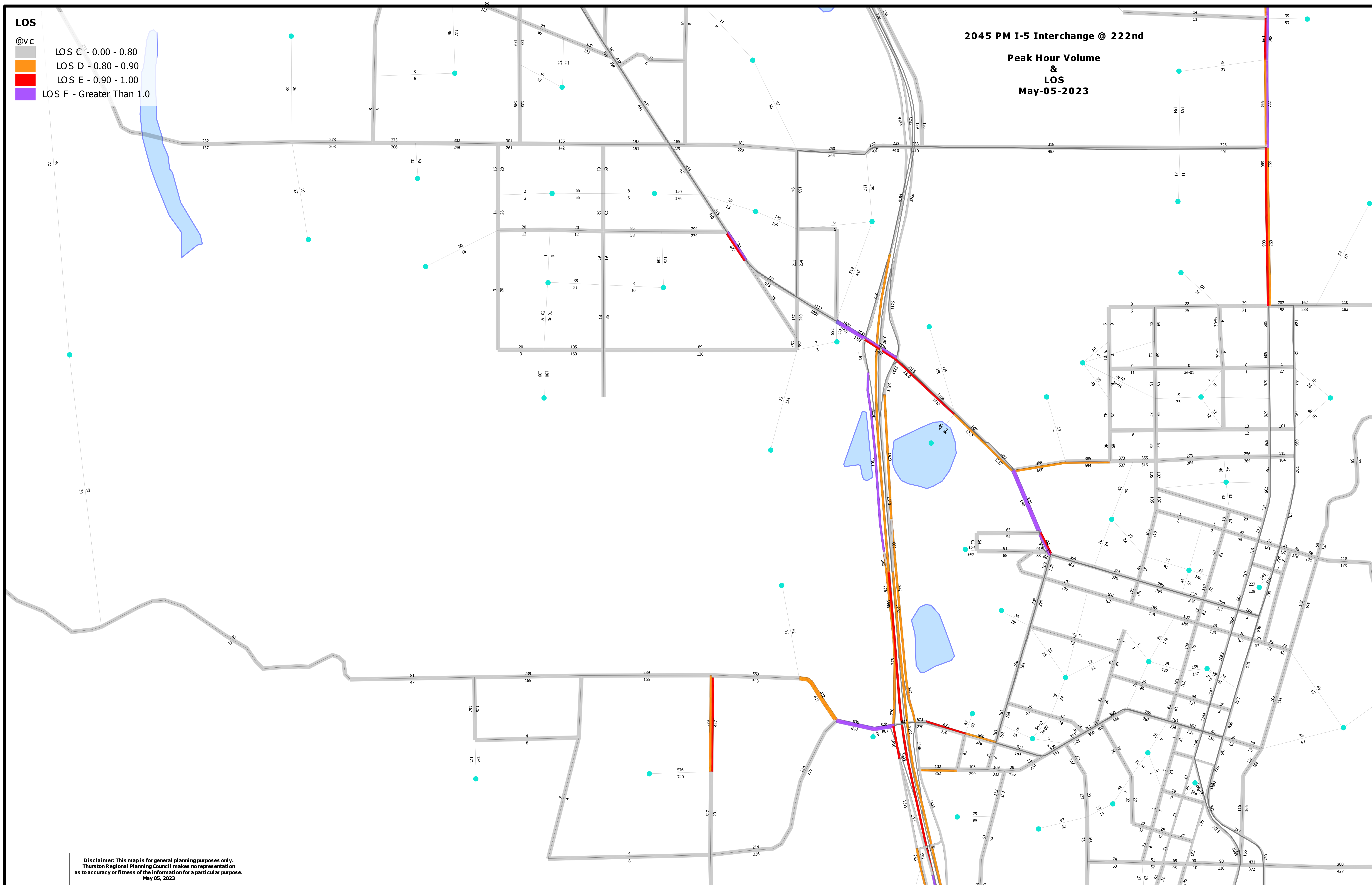
May 05, 2023


2045 PM I-5 Interchange @ 222nd
Peak Hour Volume
&
LOS
May-05-2023
LOS
@vc
LOS C - 0.00 - 0.80
LOS D - 0.80 - 0.90
LOS E - 0.90 - 1.00
LOS F - Greater Than 1.0
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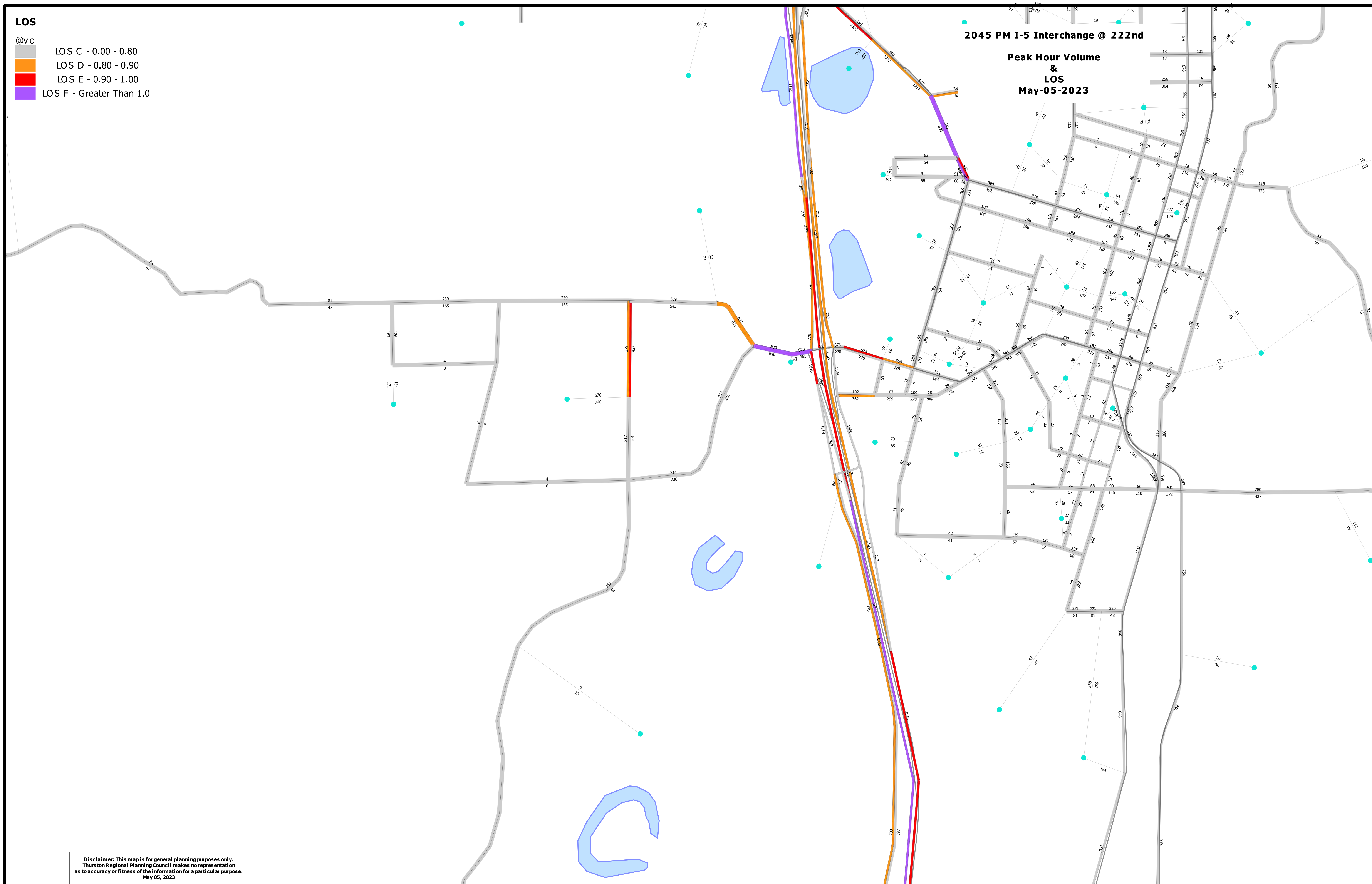
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LOS F - Greater Than 1.0
2045 PM I-5 Interchange @ 222nd
Peak Hour Volume
&
LOS
May-05-2023
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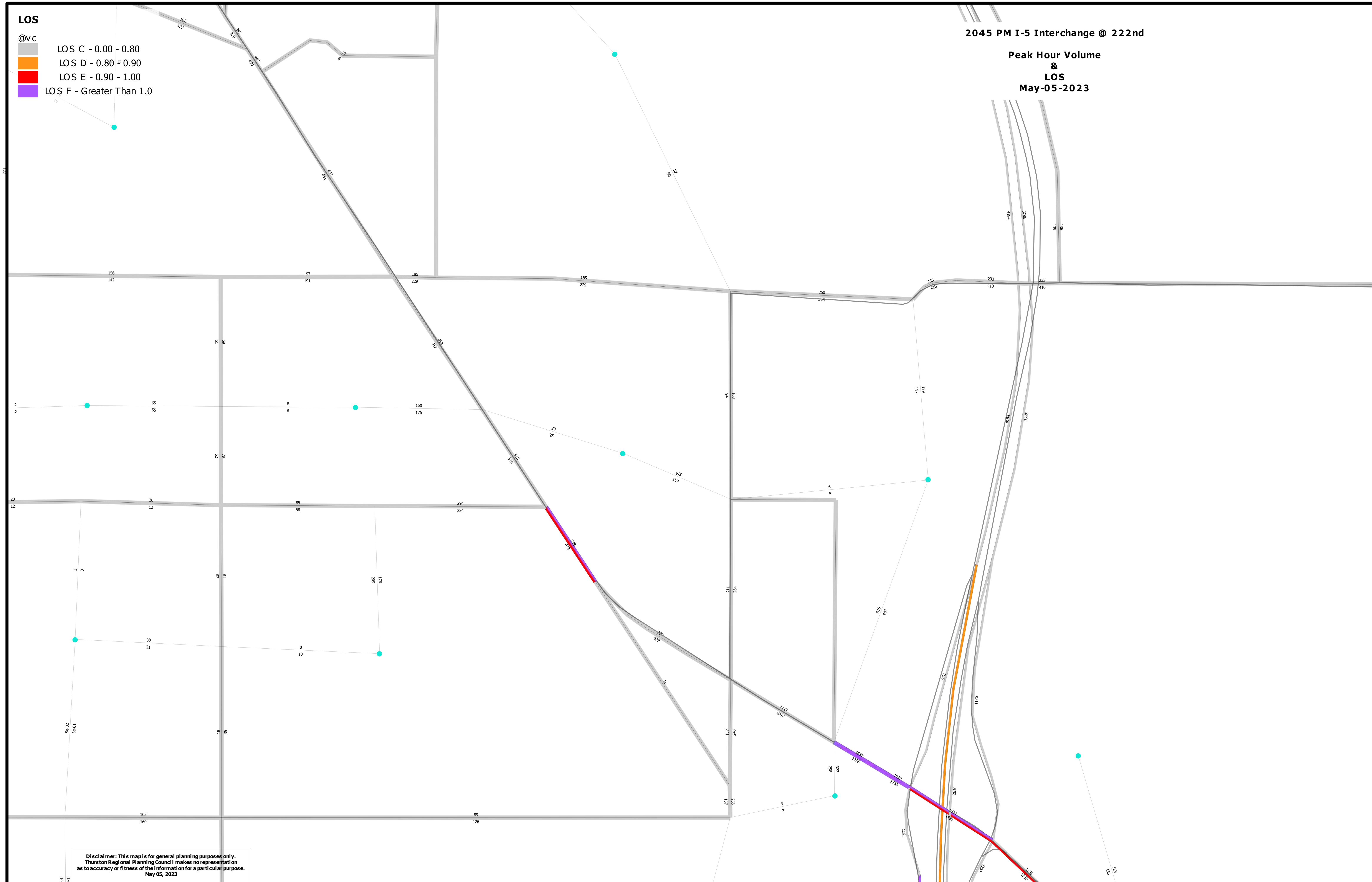
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LOS D - 0.80 - 0.90
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LOS F - Greater Than 1.0
2045 PM I-5 Interchange @ 222nd
Peak Hour Volume
&
LOS
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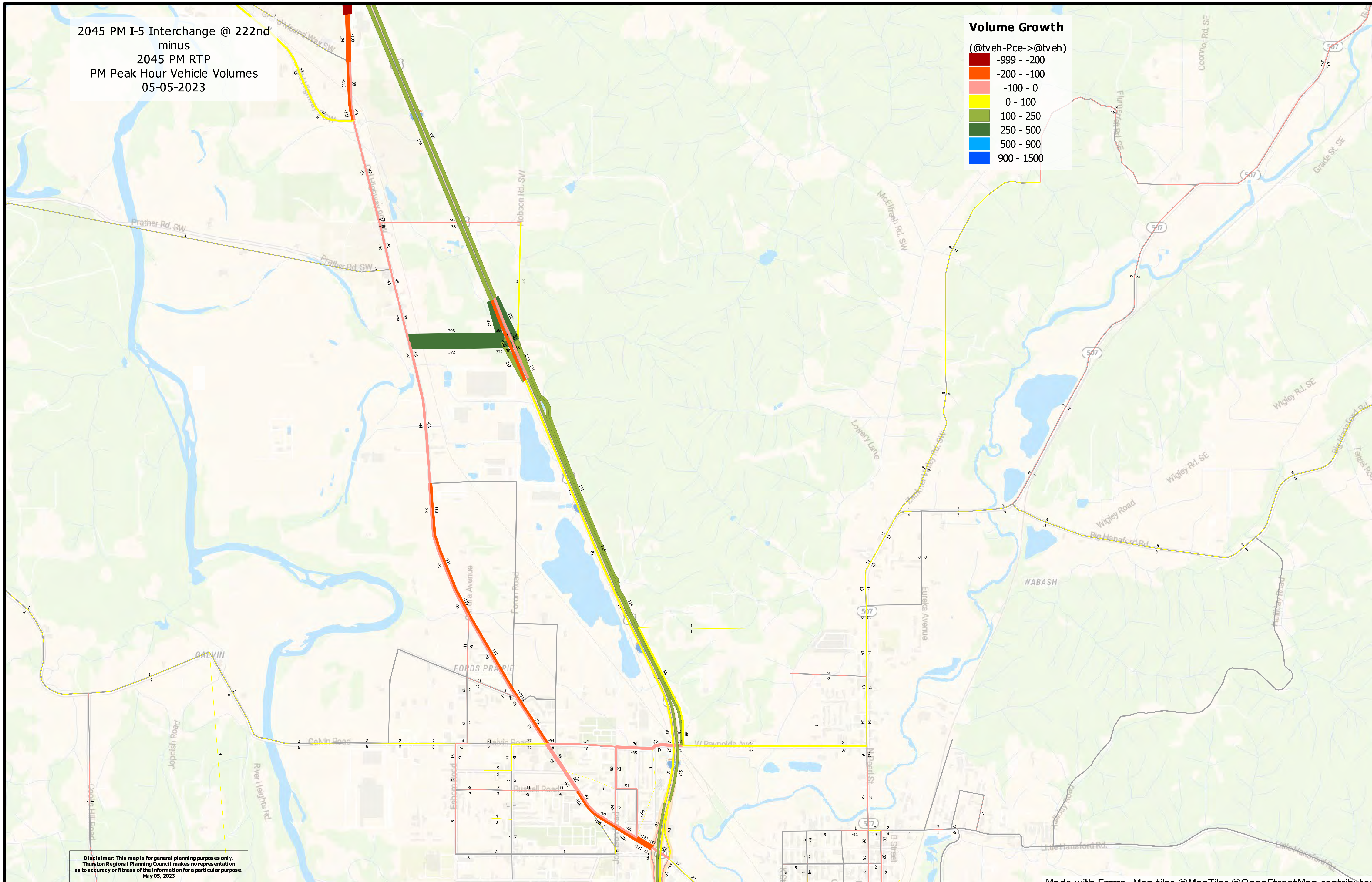

2045 PM I-5 Interchange @ 222nd
minus
2045 PM RTP
PM Peak Hour Vehicle Volumes
05-05-2023
Volume Growth
(@tveh-Pce->@tveh)
-999 - -200
-200 - -100
-100 - 0
0 - 100
100 - 250
250 - 500
500 - 900
900 - 1500
Prather Rd. SW
Hobson Rd. SW
McElfresh Rd. SW
Lowery Lane
Wigley Rd. SE
Wigley Road
Big Hanaford Rd.
Little Hanaford Rd.
Grade St. SE
Eureka Avenue
Galvin Road
W Reynolds Ave
Jopplish Road
River Heights Rd.
Cooks Hill Road
GALVIN
FORDS PRAIRIE
WABASH
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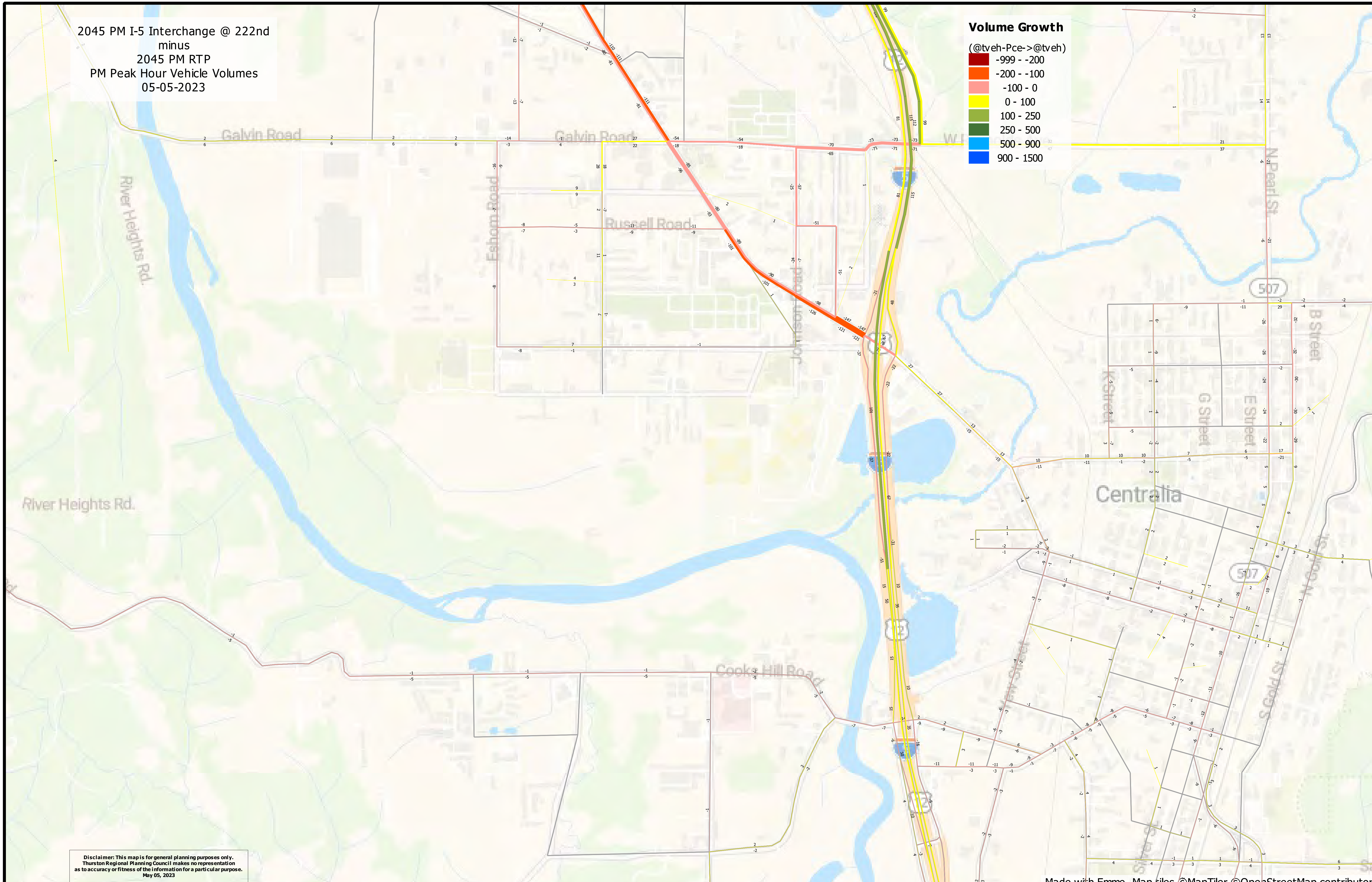
2045 PM I-5 Interchange @ 222nd
minus
2045 PM RTP
PM Peak Hour Vehicle Volumes
05-05-2023
Volume Growth
(@tveh-Pce->@tveh)
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-200 - -100
-100 - 0
0 - 100
100 - 250
250 - 500
500 - 900
900 - 1500
Galvin Road
Galvin Road
Eshom Road
Russell Road
River Heights Rd.
River Heights Rd.
Cooks Hill Road
N Pearl St
507
507
K Street
G Street
E Street
B Street
Centralia
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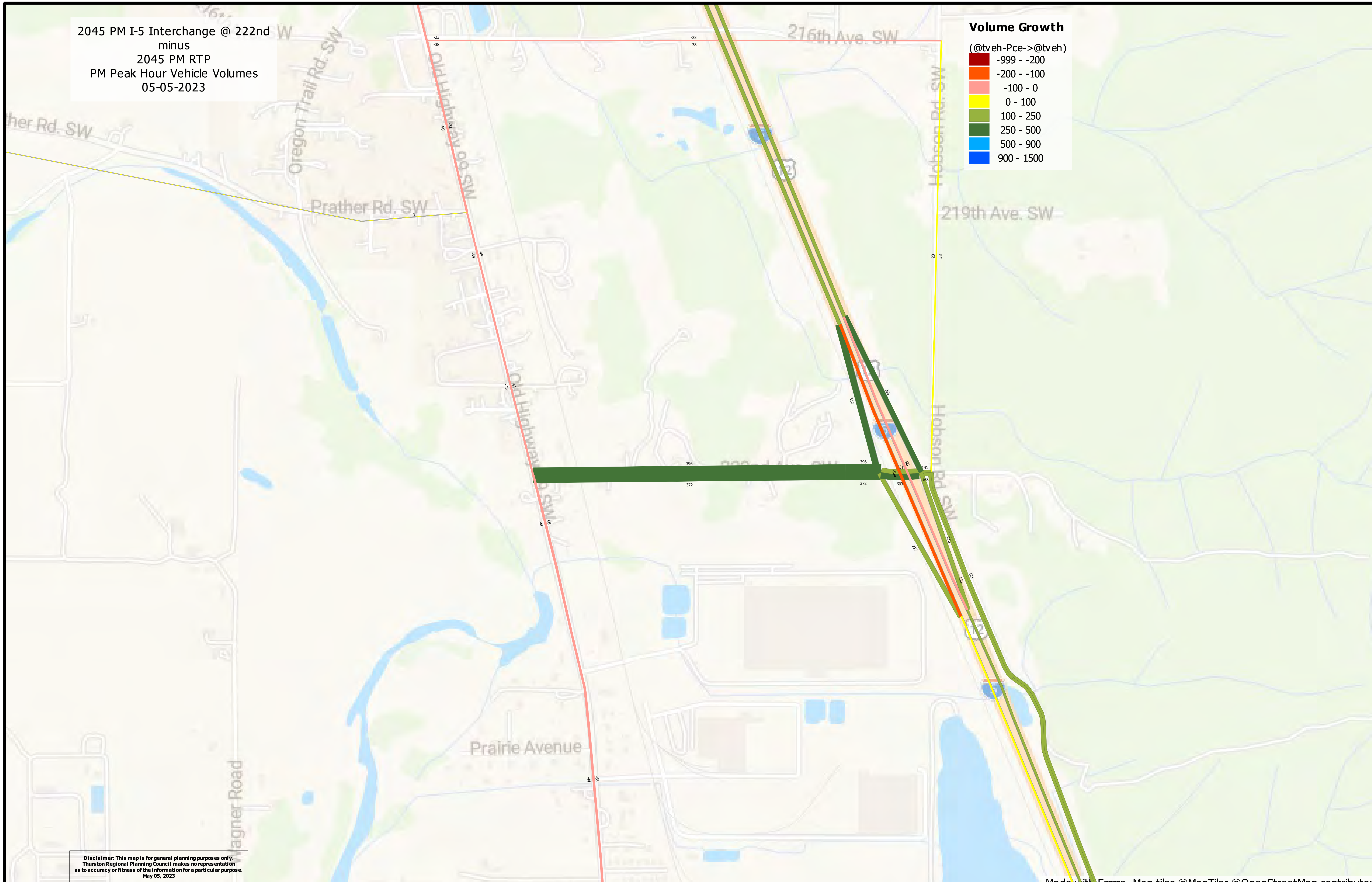
2045 PM I-5 Interchange @ 222nd
minus
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PM Peak Hour Vehicle Volumes
05-05-2023
Volume Growth
(@tveh-Pce->@tveh)
-999 - -200
-200 - -100
-100 - 0
0 - 100
100 - 250
250 - 500
500 - 900
900 - 1500
216th Ave. SW
Hobson Rd. SW
219th Ave. SW
Prather Rd. SW
Oregon Trail Rd. SW
Old Highway 99 SW
Prairie Avenue
Wagner Road
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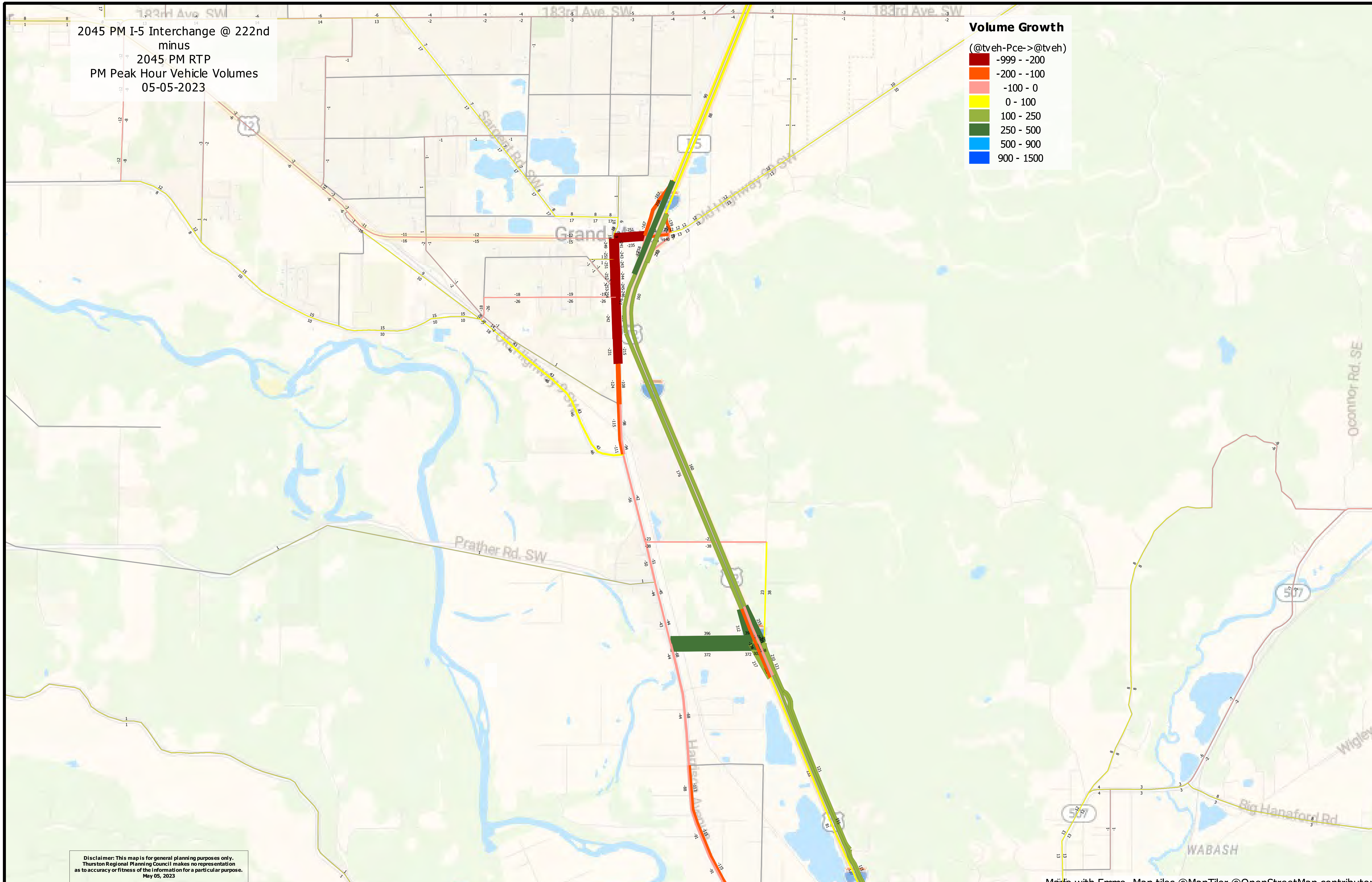
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Volume Growth
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-200 - -100
-100 - 0
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100 - 250
250 - 500
500 - 900
900 - 1500
183rd Ave. SW
Prather Rd. SW
Big Hanaford Rd
Oconnor Rd. SE
WABASH
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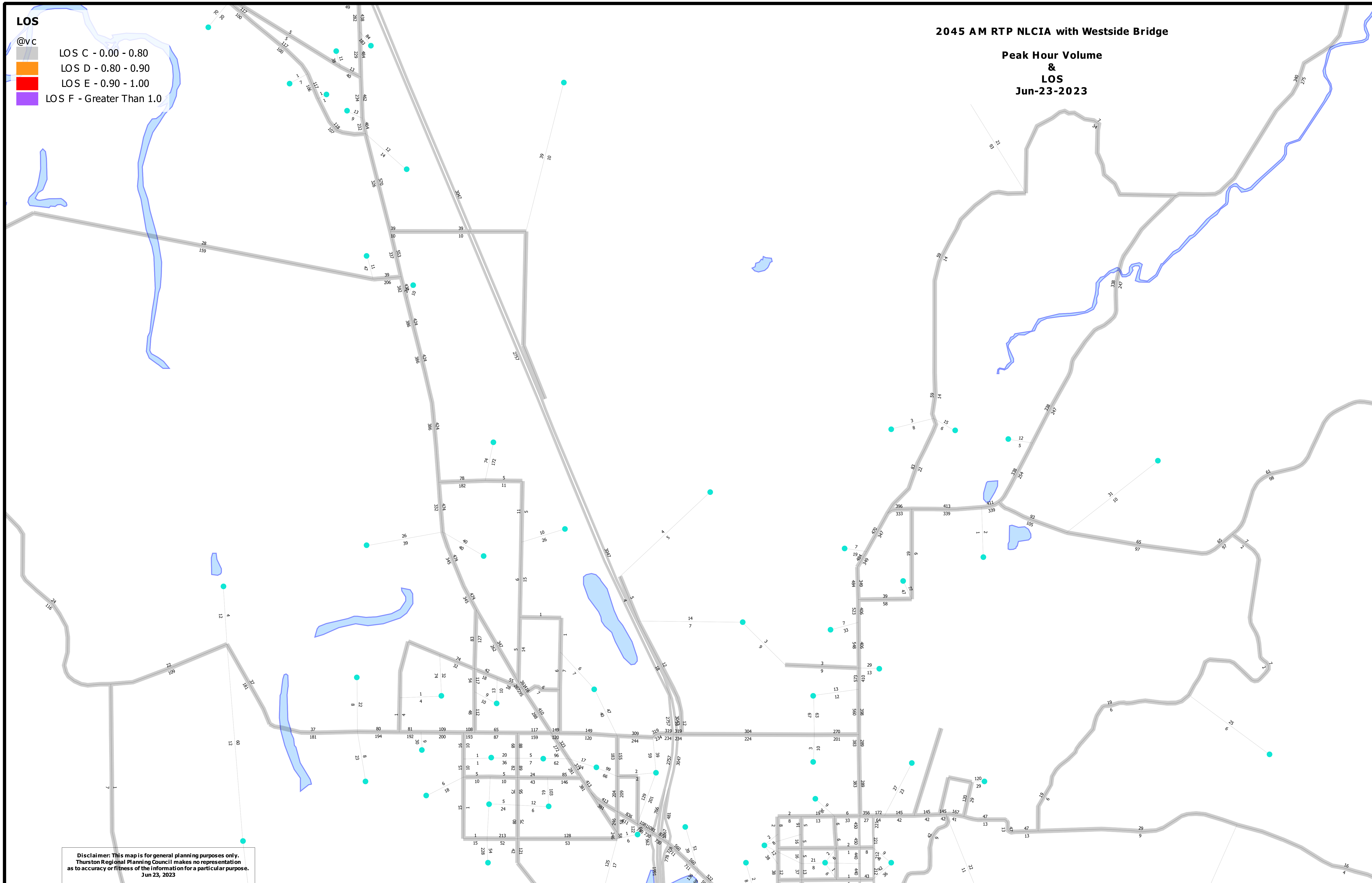
2045 AM RTP NLCIA with Westside Bridge
Peak Hour Volume
&
LOS
Jun-23-2023
LOS
@vc
LOS C - 0.00 - 0.80
LOS D - 0.80 - 0.90
LOS E - 0.90 - 1.00
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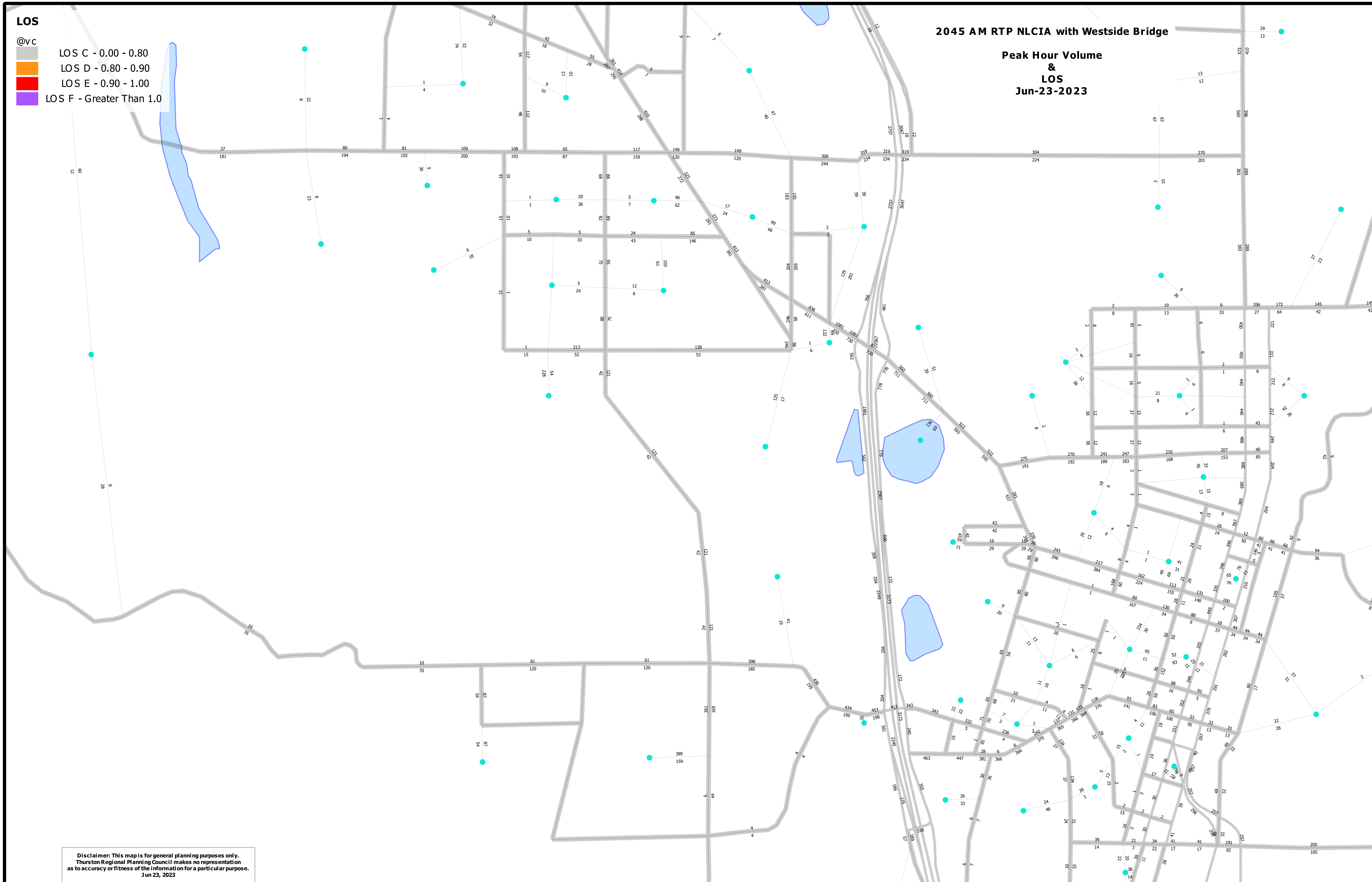
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Peak Hour Volume
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Jun-23-2023
LOS
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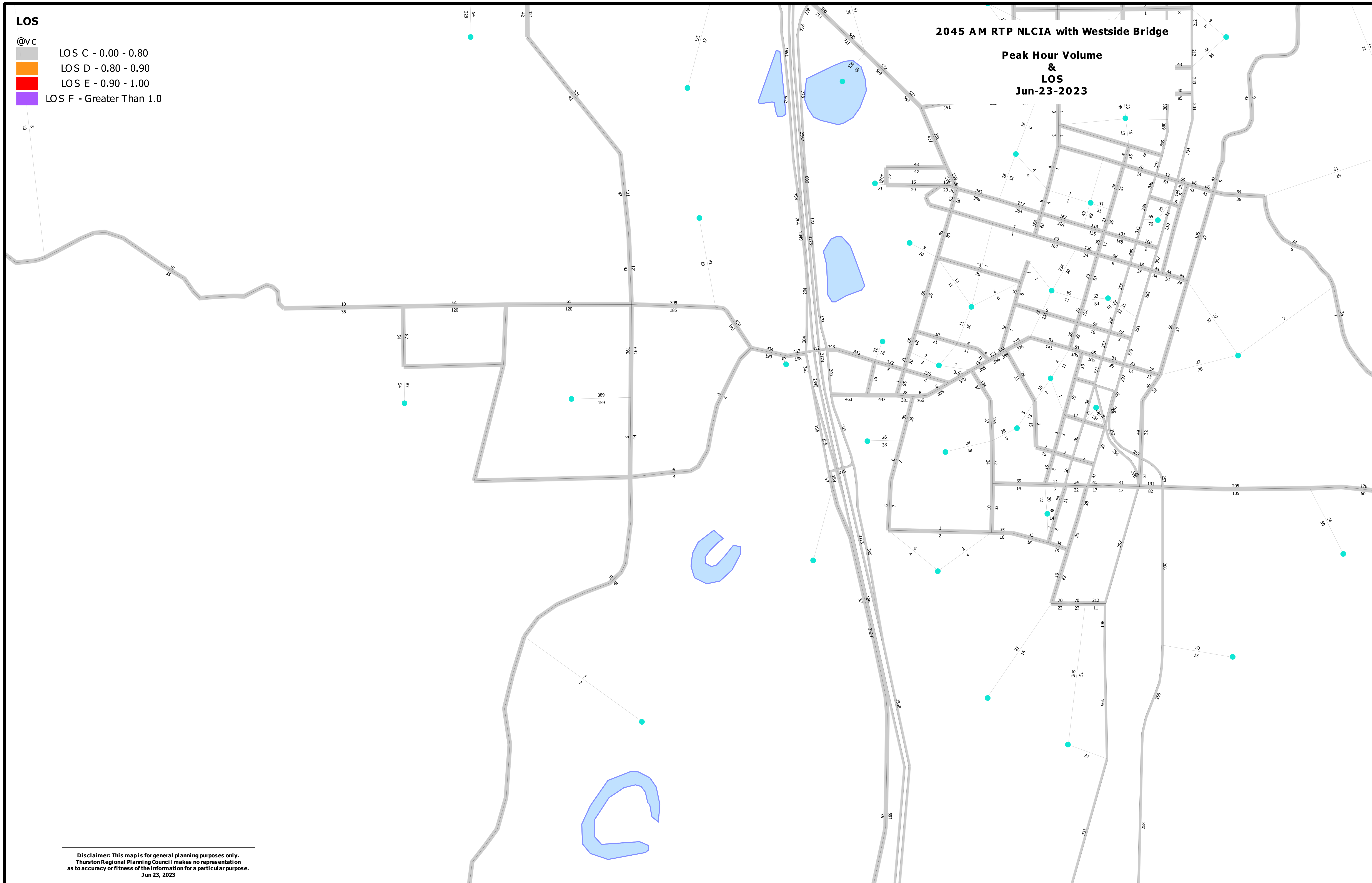
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Peak Hour Volume
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Jun-23-2023
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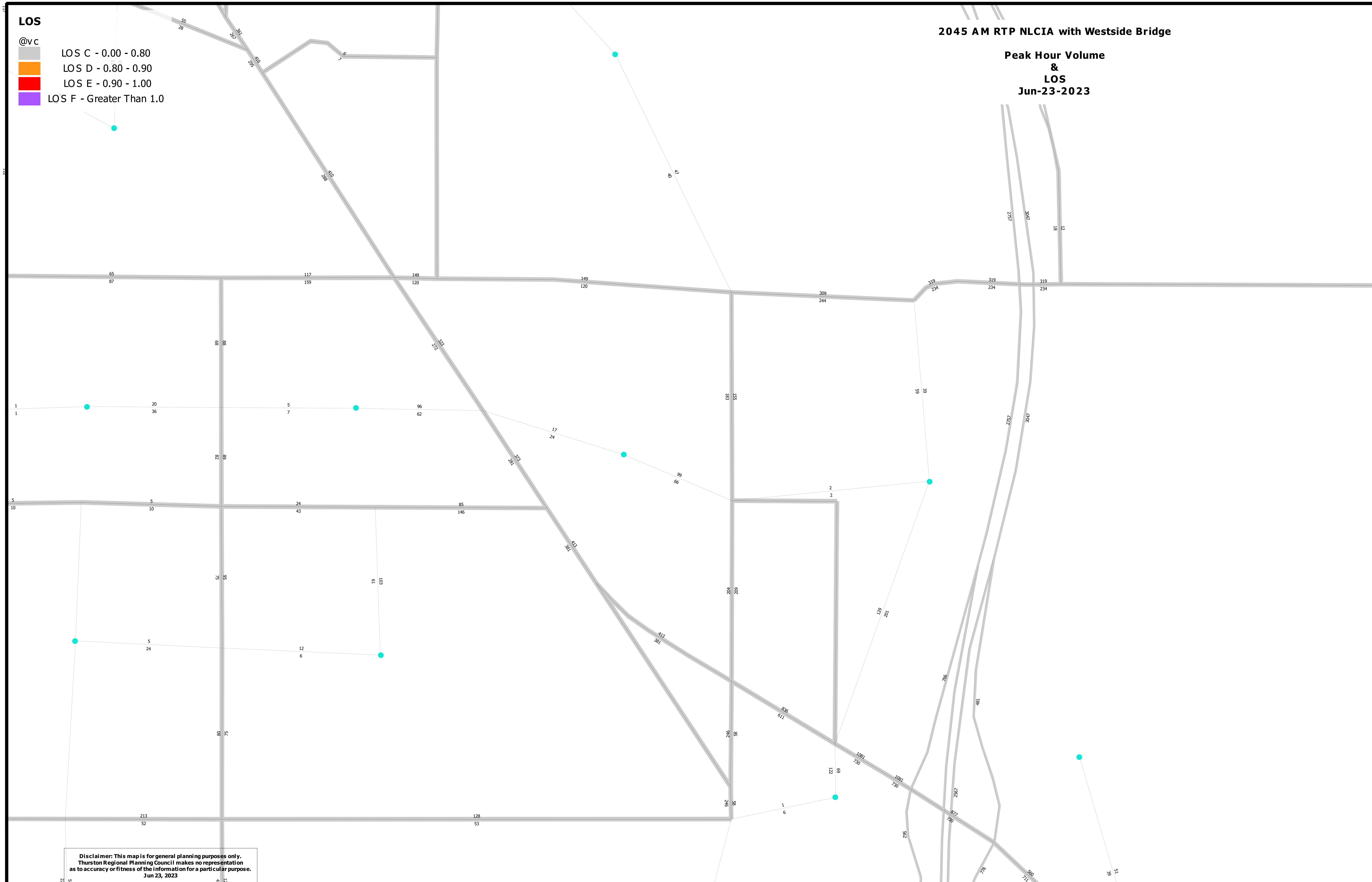
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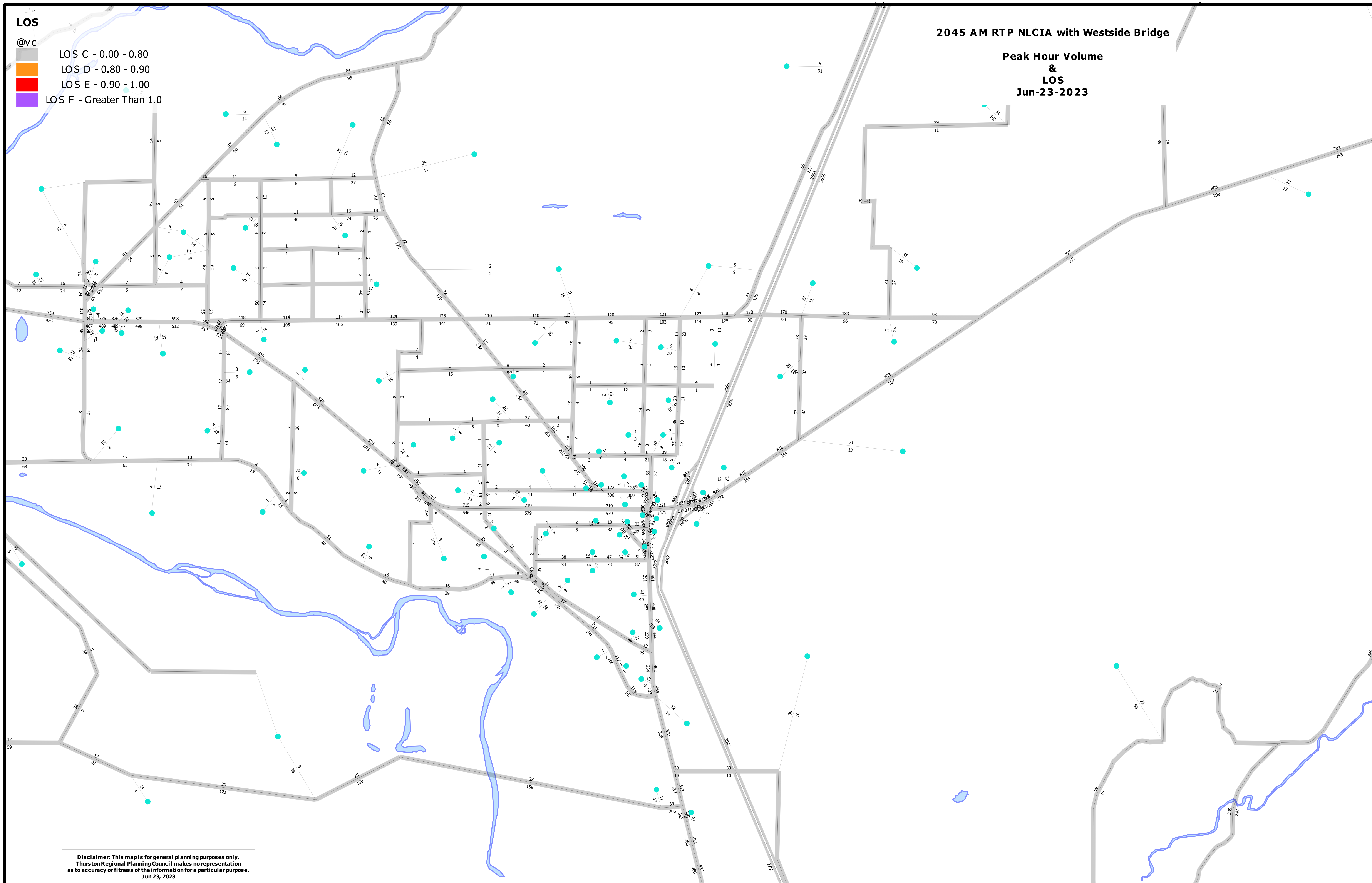
2045 AM RTP NLCIA with Westside Bridge
Peak Hour Volume
&
LOS
Jun-23-2023
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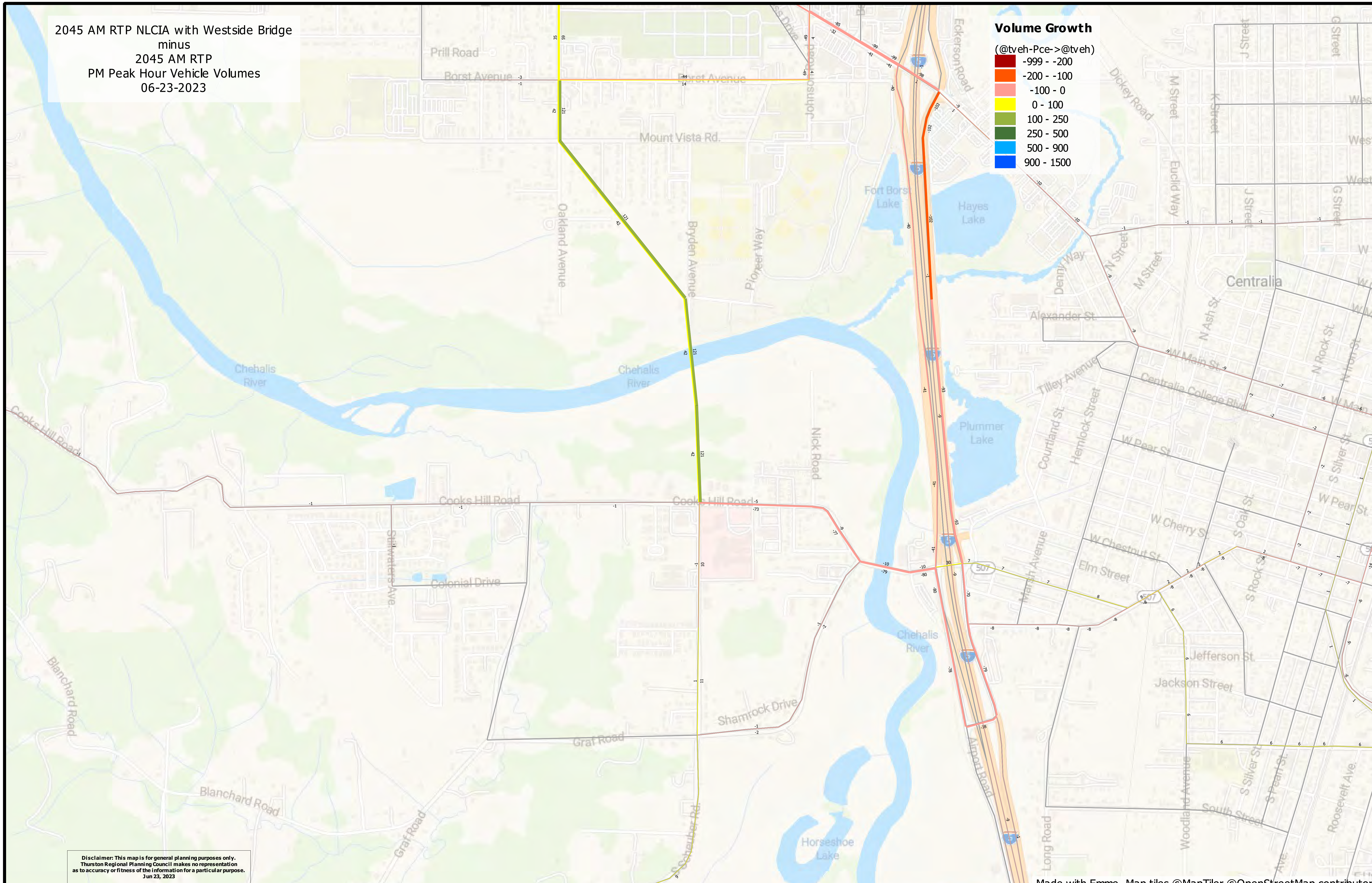

2045 AM RTP NLCIA with Westside Bridge
minus
2045 AM RTP
PM Peak Hour Vehicle Volumes
06-23-2023
Volume Growth
(@tveh-Pce->@tveh)
-999 - -200
-200 - -100
-100 - 0
0 - 100
100 - 250
250 - 500
500 - 900
900 - 1500
Prill Road
Borst Avenue
Mount Vista Rd.
Oakland Avenue
Bryden Avenue
Pioneer Way
Johnson Road
Eckerson Road
Dickey Road
Fort Borst Lake
Hayes Lake
Chehalis River
Cooks Hill Road
Nick Road
Plummer Lake
Centralia
Alexander St.
W Main St.
Centralia College Blvd
Tilley Avenue
Courtland St.
Hemlock Street
W Pear St
W Cherry St
W Chestnut St
Elm Street
Marsh Avenue
Colonial Drive
Stillwaters Ave.
Shamrock Drive
Graf Road
Blanchard Road
Airport Road
Long Road
Jefferson St.
Jackson Street
South Street
Woodland Avenue
Roosevelt Ave.
Horseshoe Lake
Scheuber Rd.
M Street
K Street
J Street
G Street
Euclid Way
Denny Way
N Street
N Ash St.
N Rock St.
S Oak St.
S Rock St.
S Silver St.
S Pearl St.
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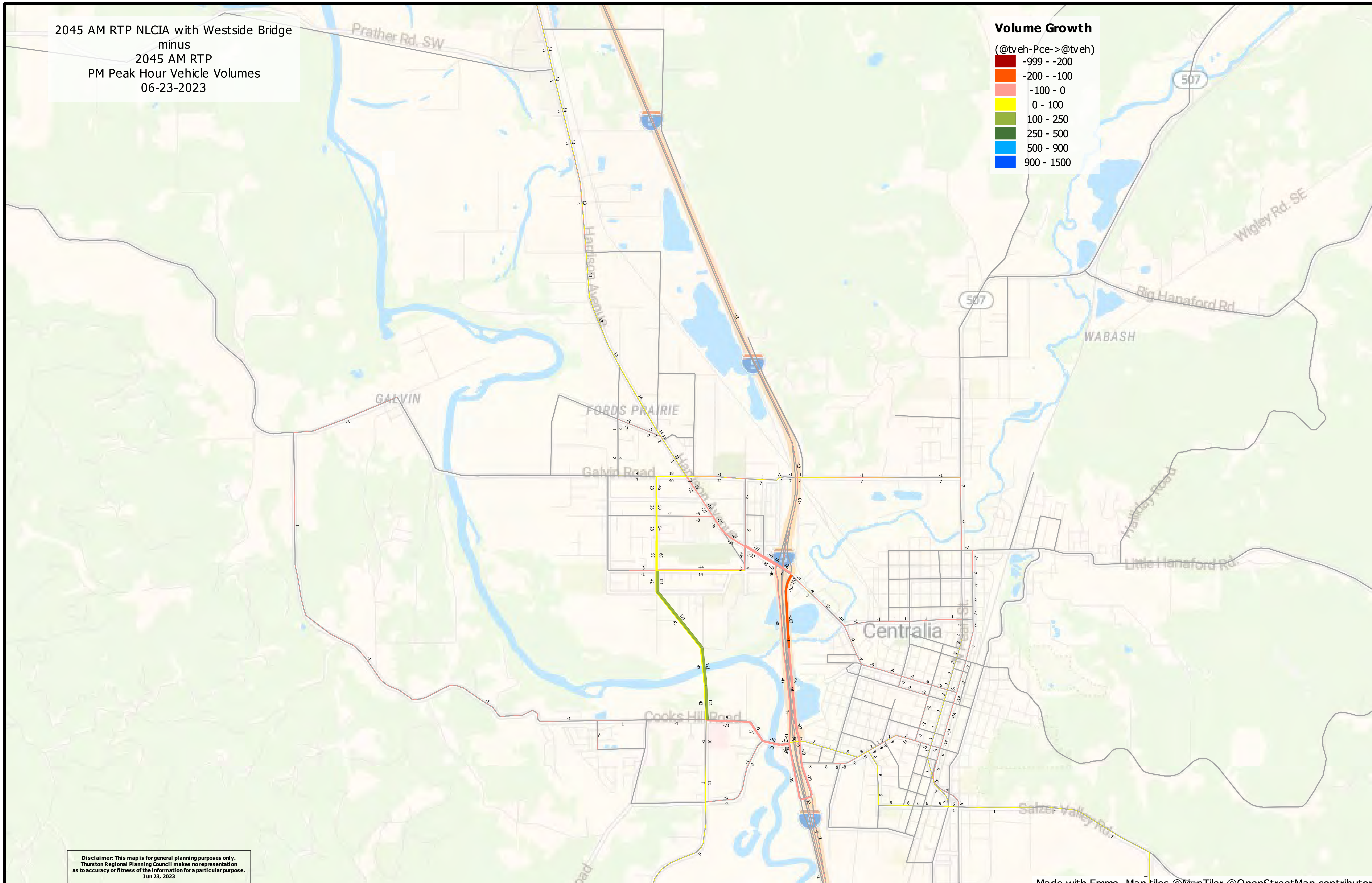
2045 AM RTP NLCIA with Westside Bridge
minus
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06-23-2023
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(@tveh-Pce->@tveh)
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-100 - 0
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100 - 250
250 - 500
500 - 900
900 - 1500
Prather Rd. SW
Harrison Avenue
FORDS PRAIRIE
GALVIN
Galvin Road
Cooks Hill Road
Centralia
WABASH
Big Hanaford Rd.
Little Hanaford Rd.
Wigley Rd. SE
Salzer Valley Rd.
507
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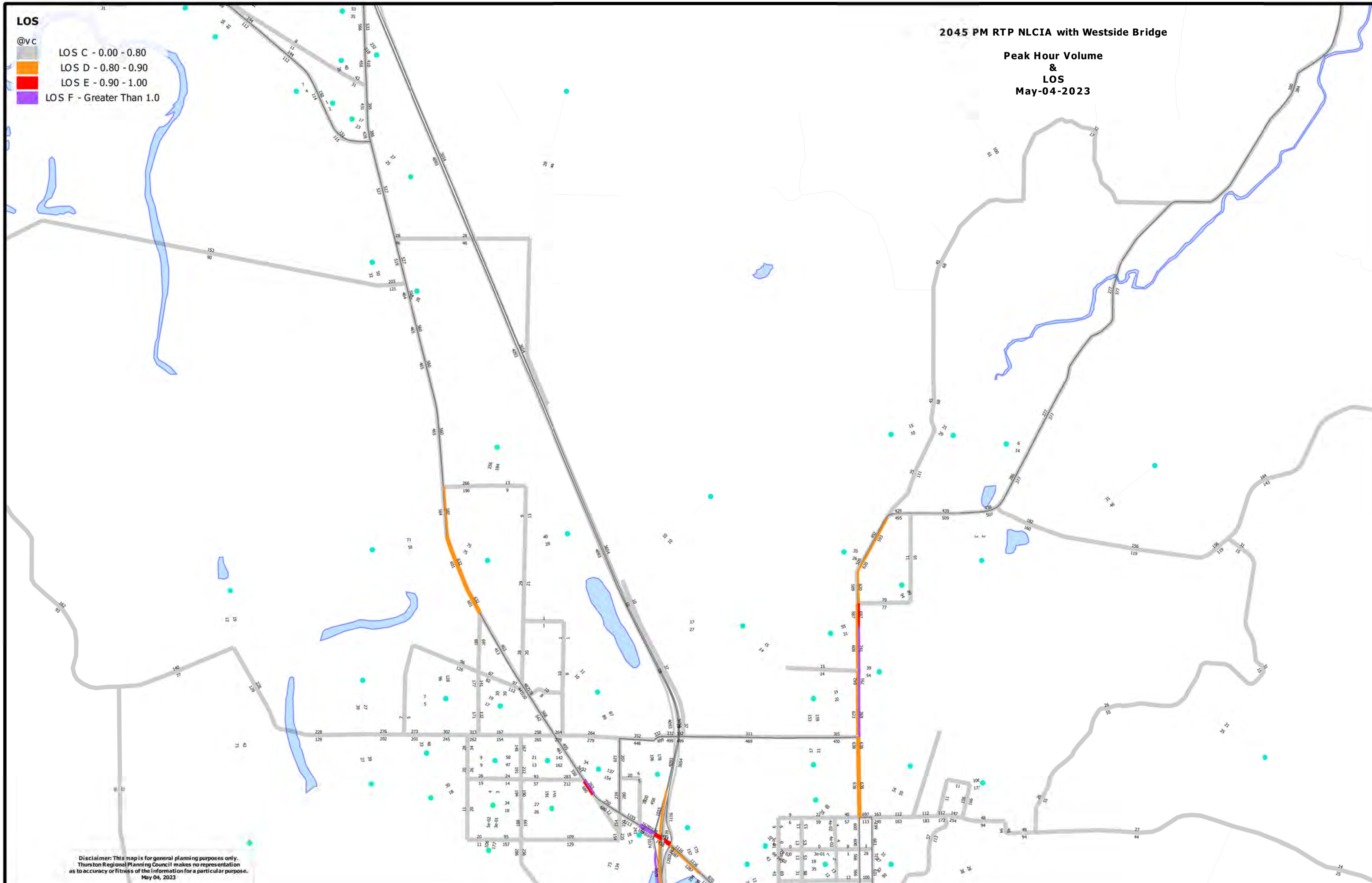

LOS
@vc
LOS C - 0.00 - 0.80
LOS D - 0.80 - 0.90
LOS E - 0.90 - 1.00
LOS F - Greater Than 1.0
2045 PM RTP NLCIA with Westside Bridge
Peak Hour Volume
&
LOS
May-04-2023
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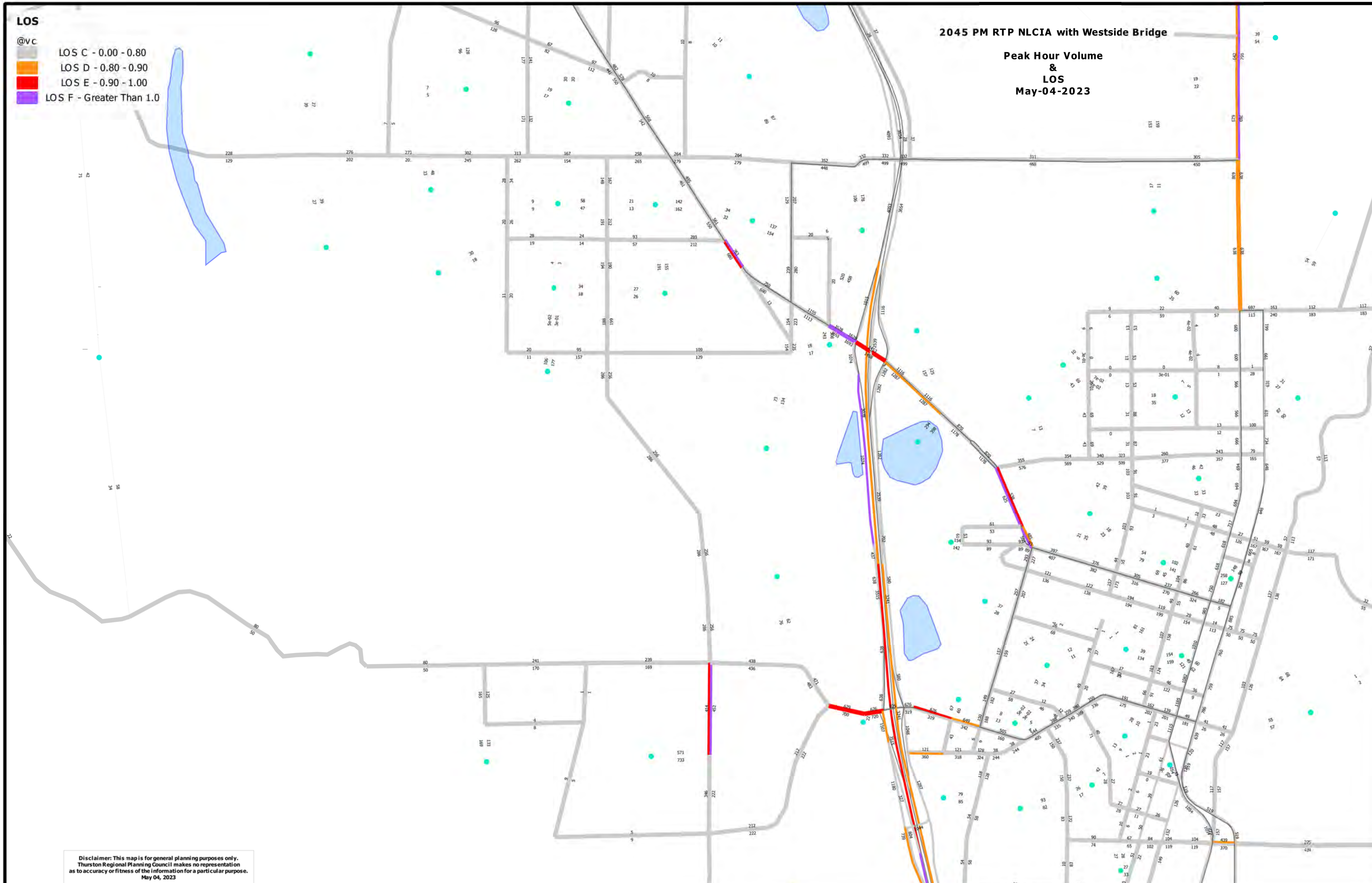
May 04, 2023


2045 PM RTP NLCIA with Westside Bridge
Peak Hour Volume
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LOS
May-04-2023
LOS
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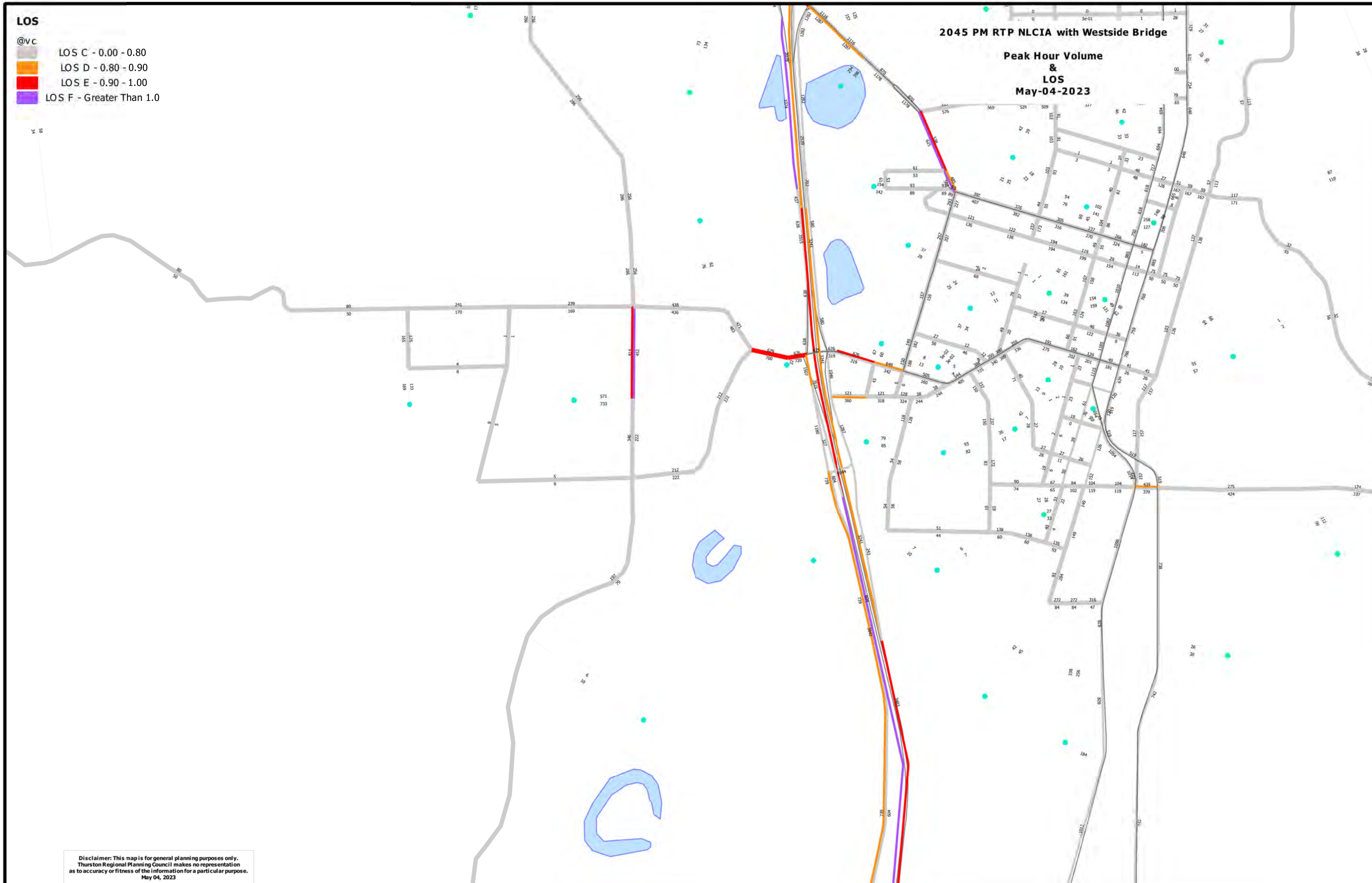
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LOS C - 0.00 - 0.80
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2045 PM RTP NLCIA with Westside Bridge
Peak Hour Volume
&
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May-04-2023
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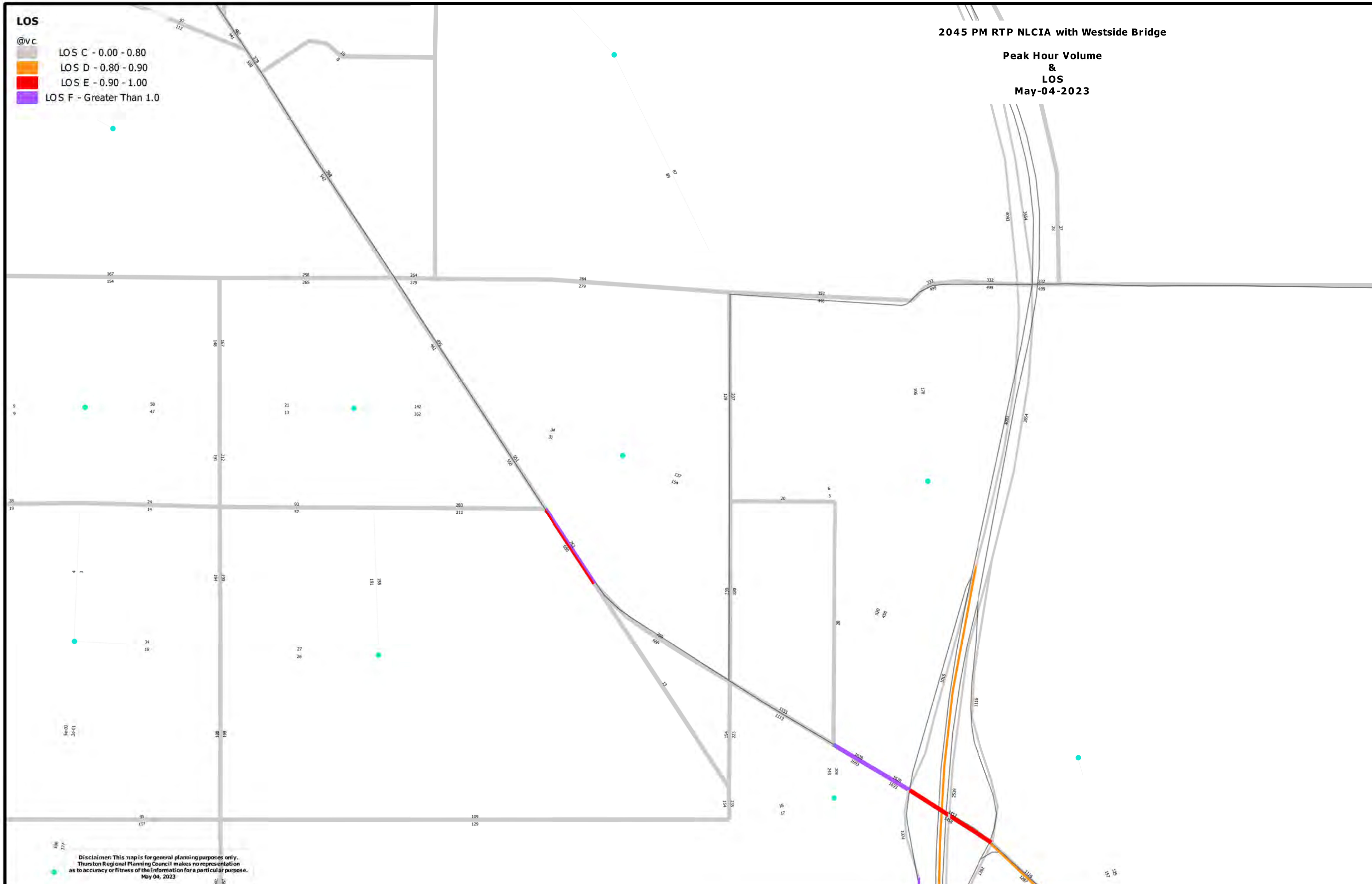
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LOS E - 0.90 - 1.00
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2045 PM RTP NLCIA with Westside Bridge
Peak Hour Volume
&
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May-04-2023
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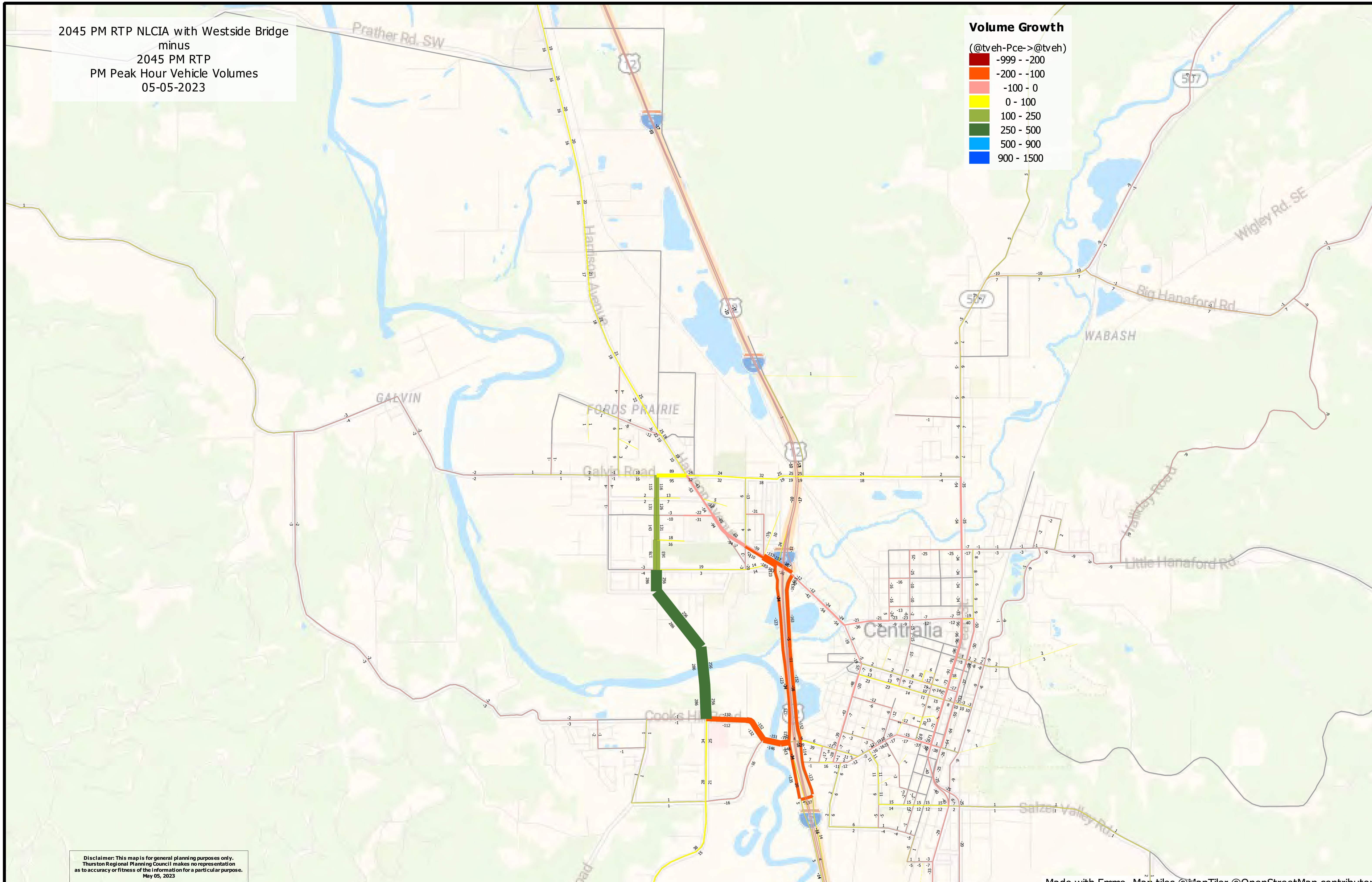
2045 PM RTP NLCIA with Westside Bridge
minus
2045 PM RTP
PM Peak Hour Vehicle Volumes
05-05-2023
Volume Growth
(@tveh-Pce->@tveh)
-999 - -200
-200 - -100
-100 - 0
0 - 100
100 - 250
250 - 500
500 - 900
900 - 1500
Prather Rd. SW
Harrison Avenue
GALVIN
FORDS PRAIRIE
Galvin Road
Cooks Hill Road
Centralia
WABASH
Big Hanaford Rd
Little Hanaford Rd
Wigley Rd. SE
Salzer Valley Rd
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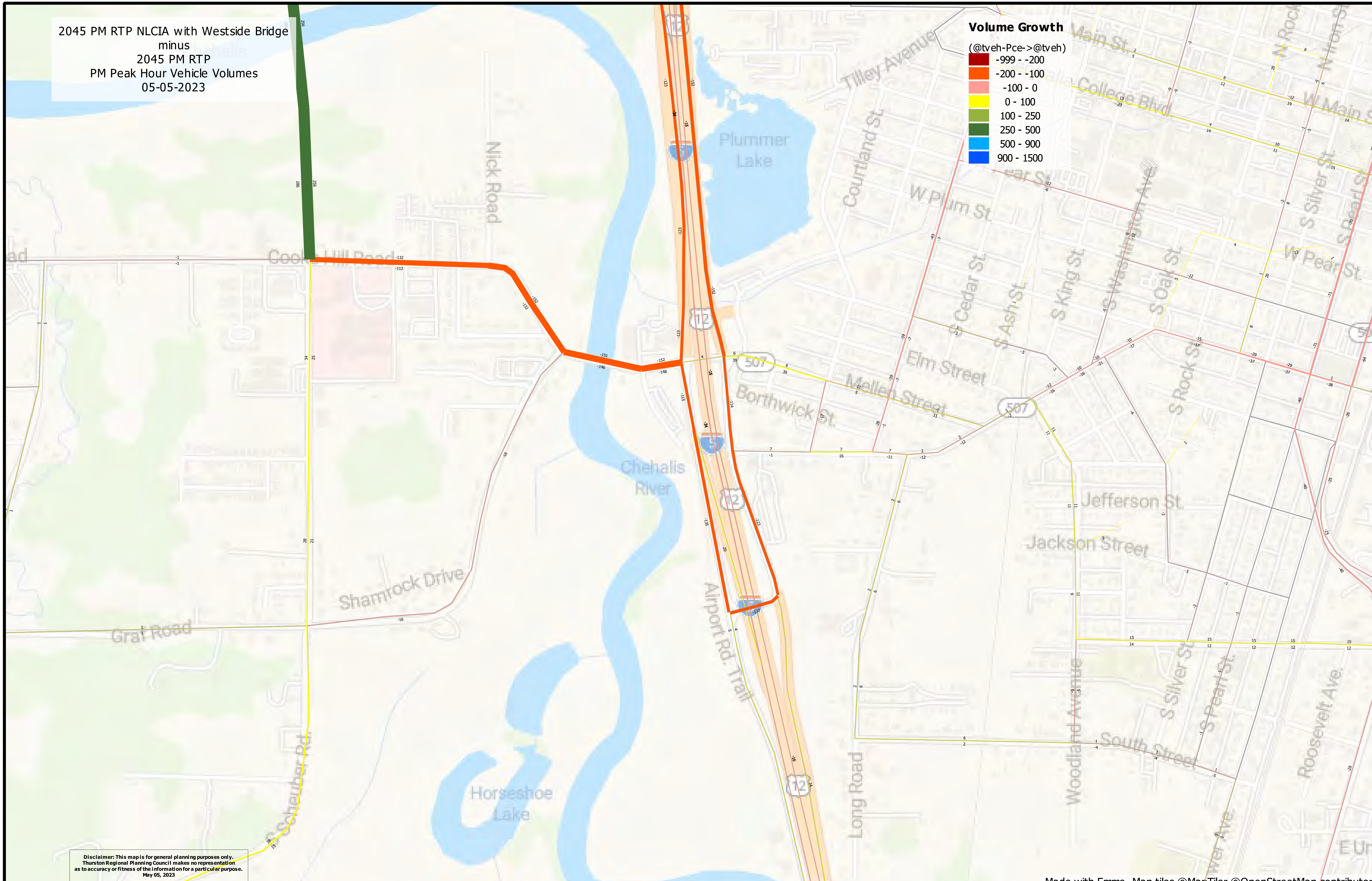
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2045 PM RTP
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05-05-2023
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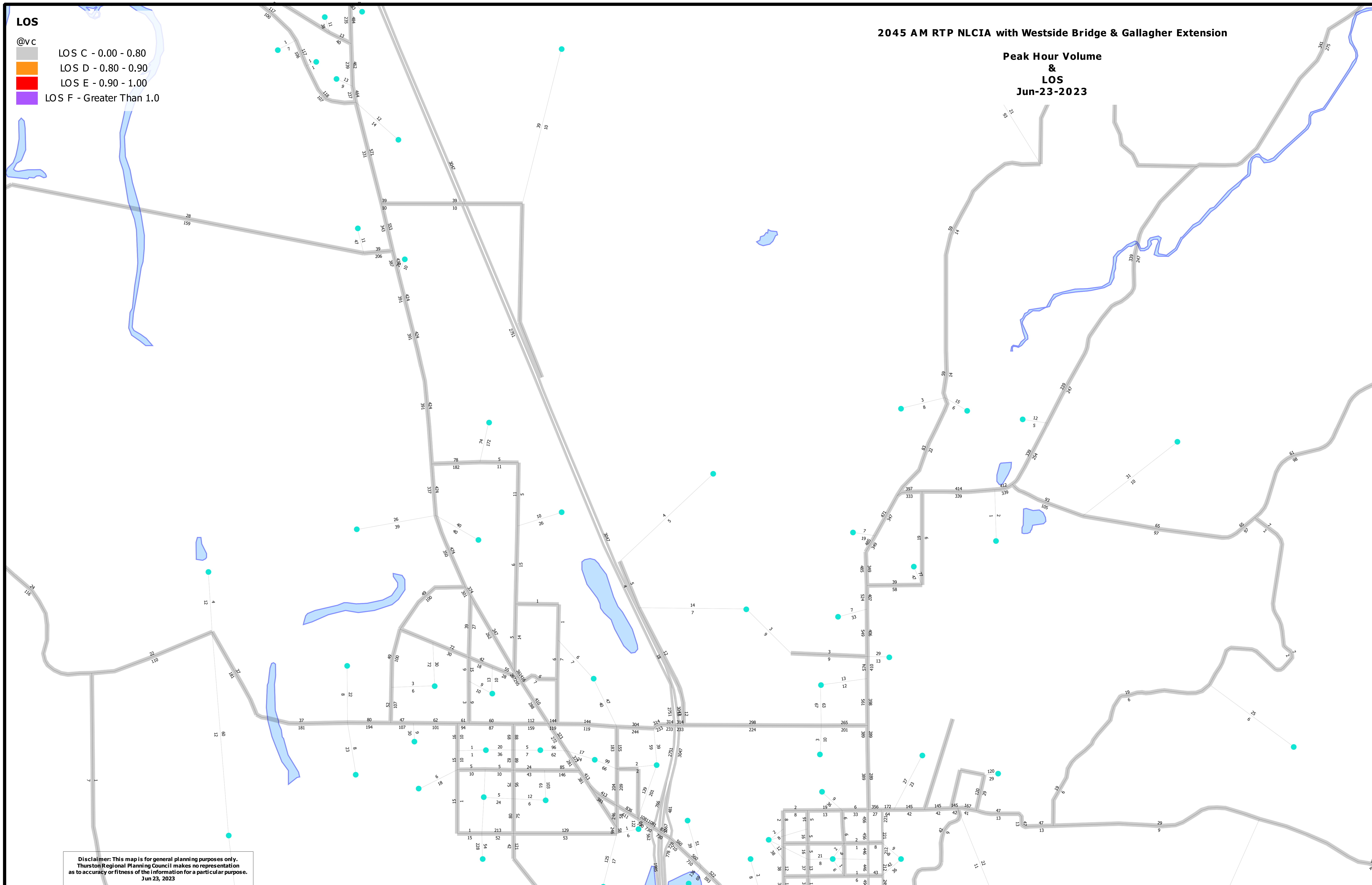
Plummer Lake
Chehalis River
Horseshoe Lake
Nick Road
Tilley Avenue
Courtland St.
W Plum St.
Main St.
College Blvd
W Main St
W Pear St.
Elm Street
Mellen Street
Borthwick St.
S Cedar St.
S Ash St.
S King St.
S Washington Ave.
S Oak St.
S Rock St.
S Silver St.
S Pearl St.
Jefferson St.
Jackson Street
South Street
Woodland Avenue
Long Road
Roosevelt Ave.
Airport Rd. Trail
Shamrock Drive
Graf Road
Cooks Hill Road
S Scheuber Rd


2045 AM RTP NLCIA with Westside Bridge & Gallagher Extension
Peak Hour Volume
&
LOS
Jun-23-2023
LOS
@vc
LOS C - 0.00 - 0.80
LOS D - 0.80 - 0.90
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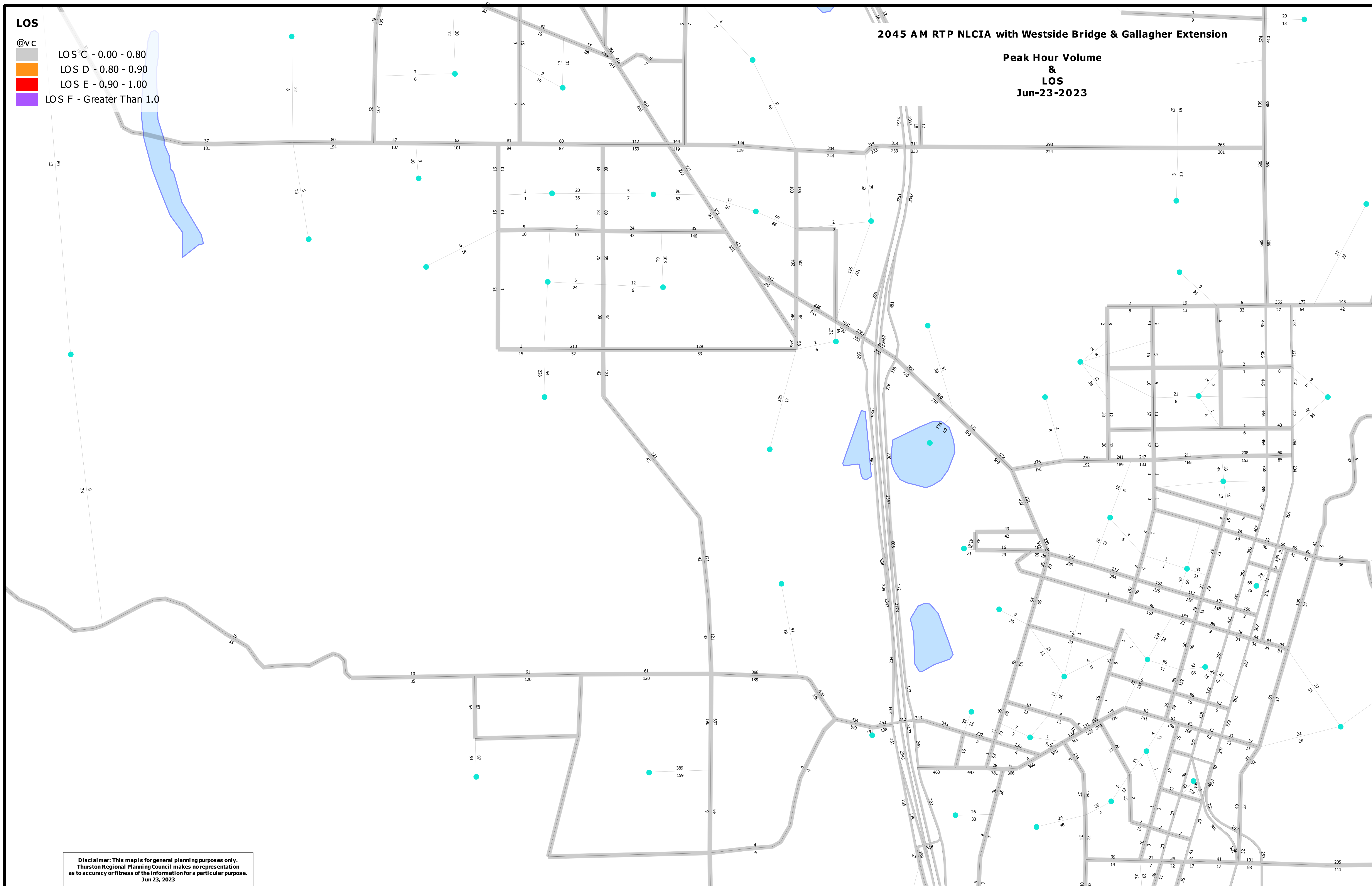
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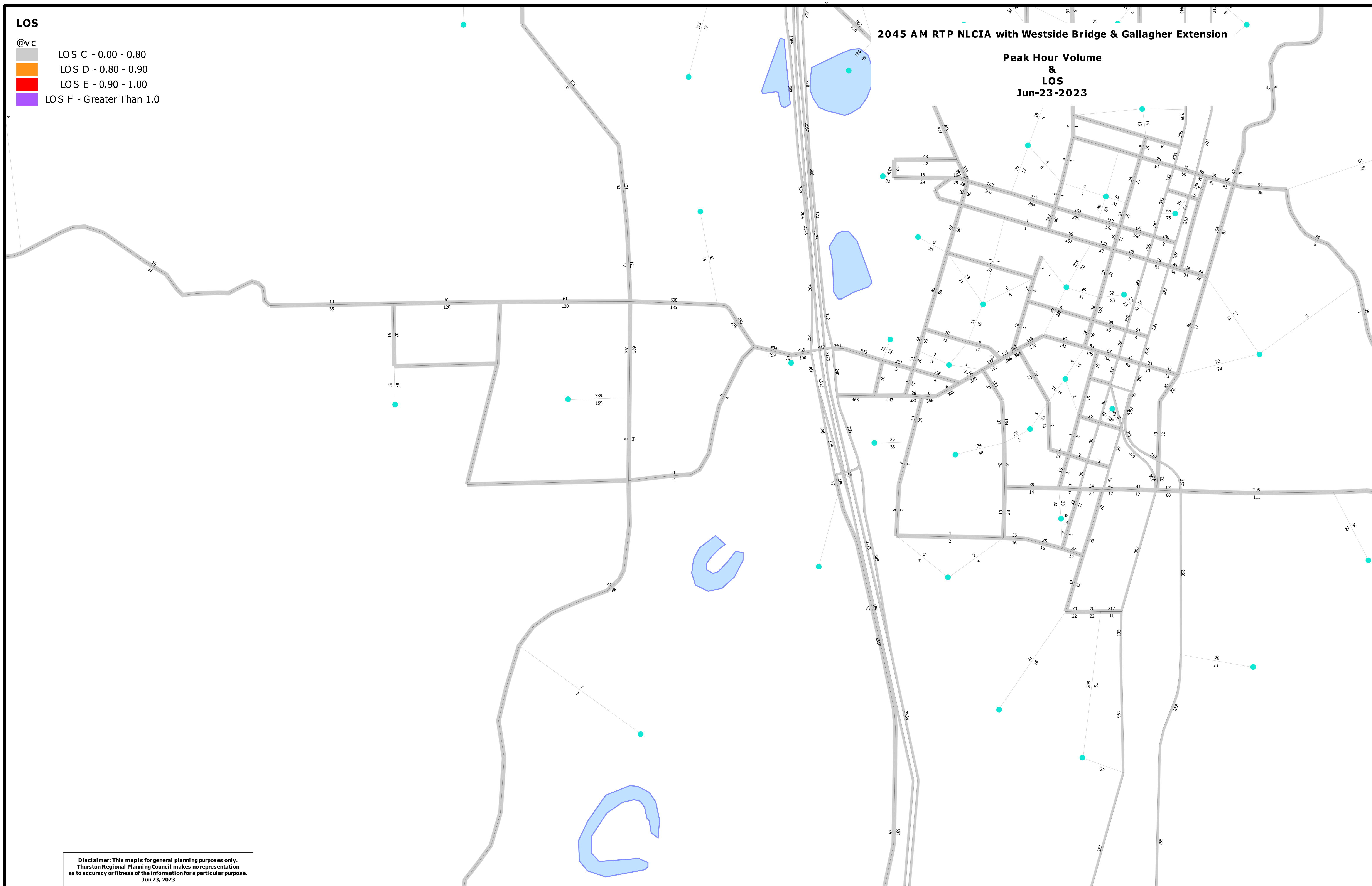
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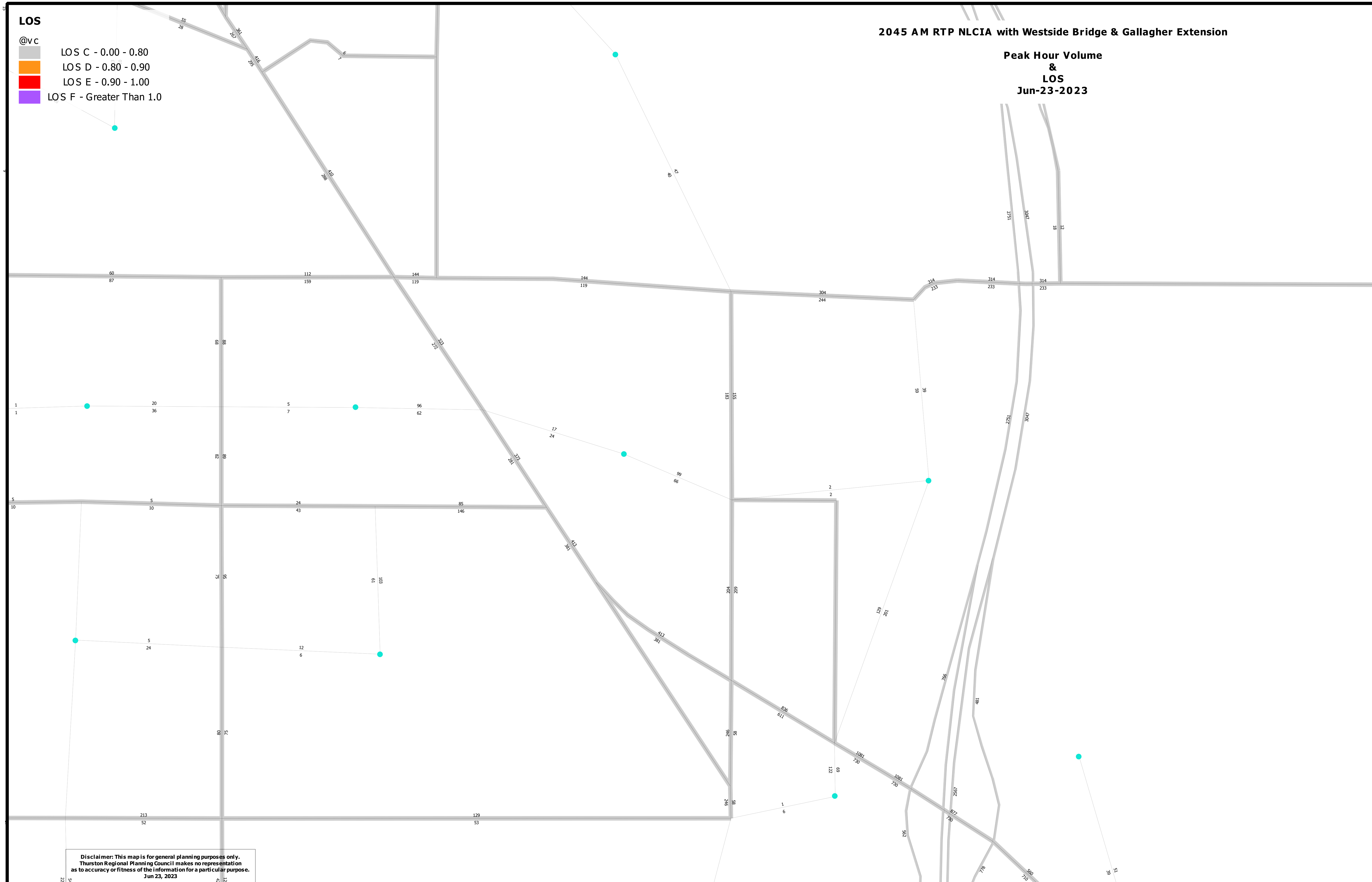
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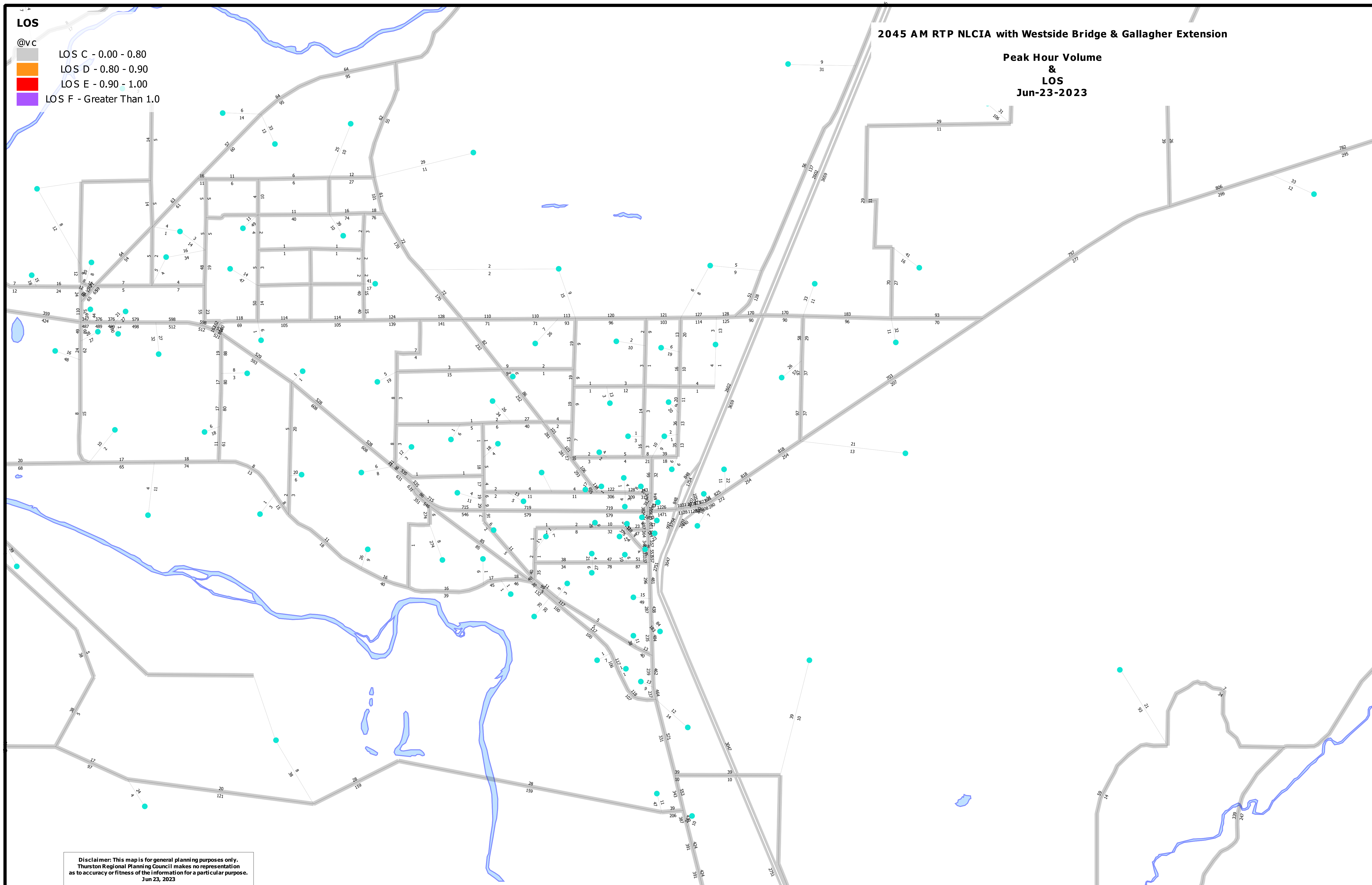
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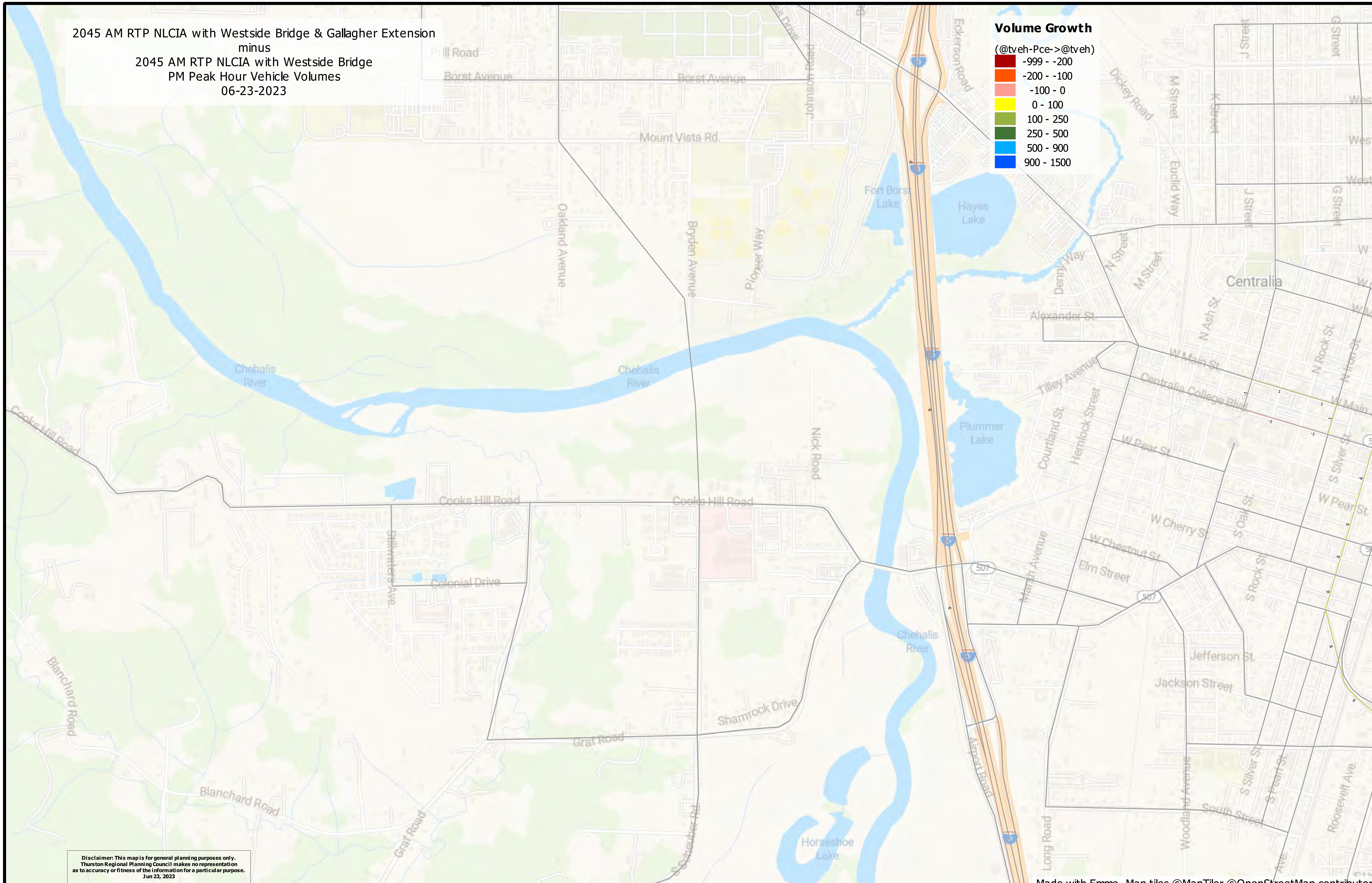
2045 AM RTP NLCIA with Westside Bridge & Gallagher Extension
minus
2045 AM RTP NLCIA with Westside Bridge
PM Peak Hour Vehicle Volumes
06-23-2023
Volume Growth
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Centralia
Chehalis River
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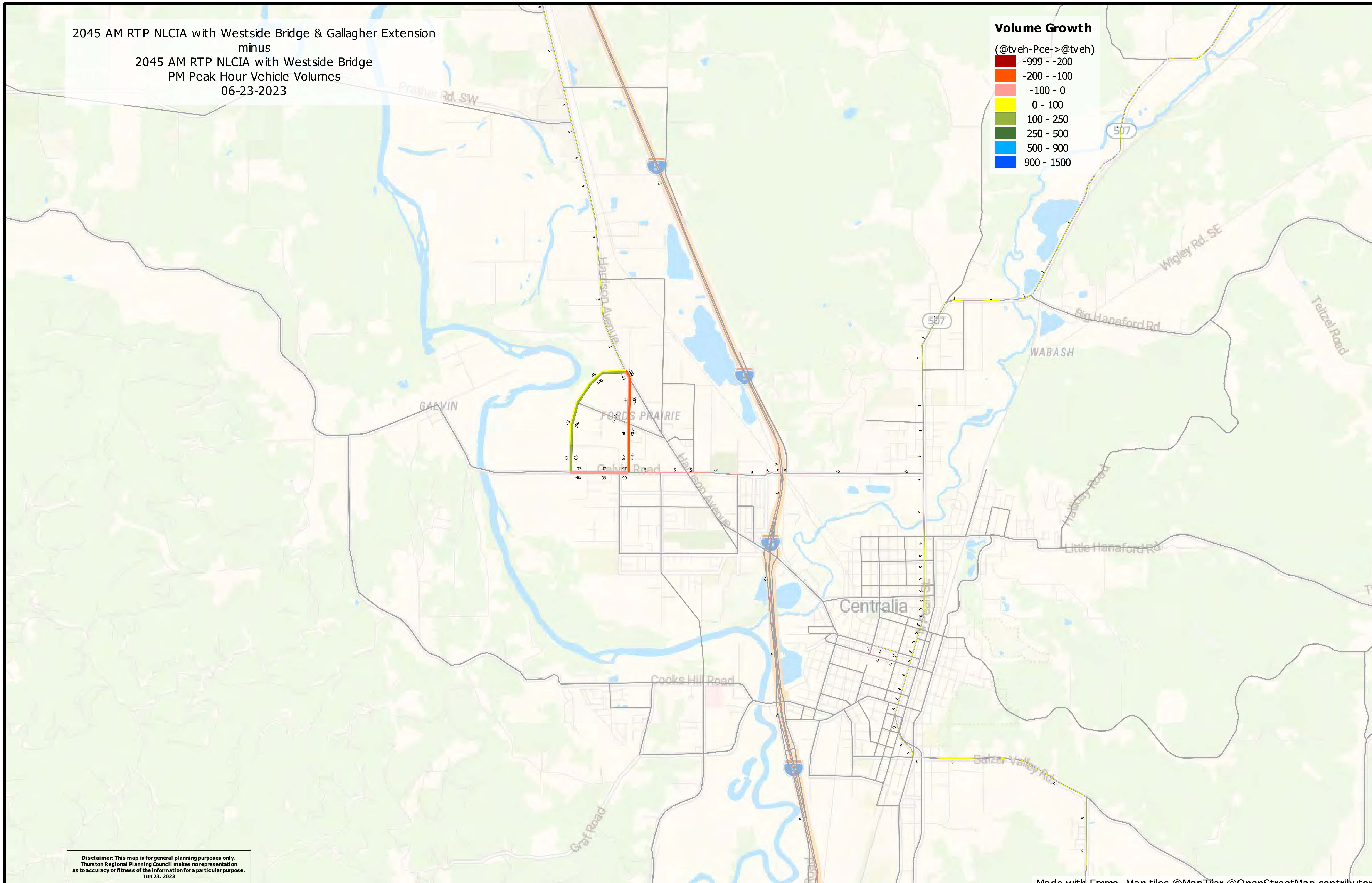
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507
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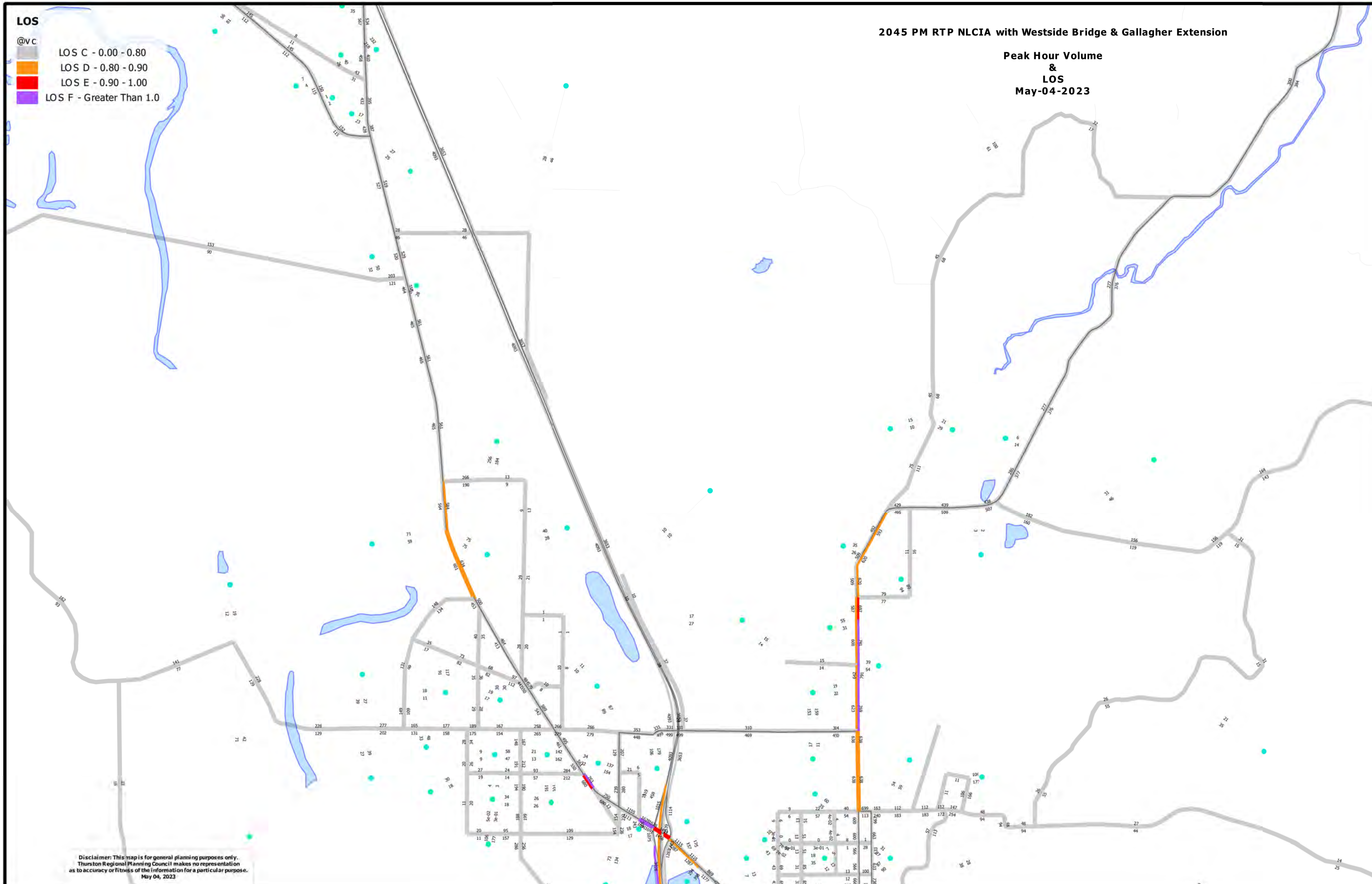
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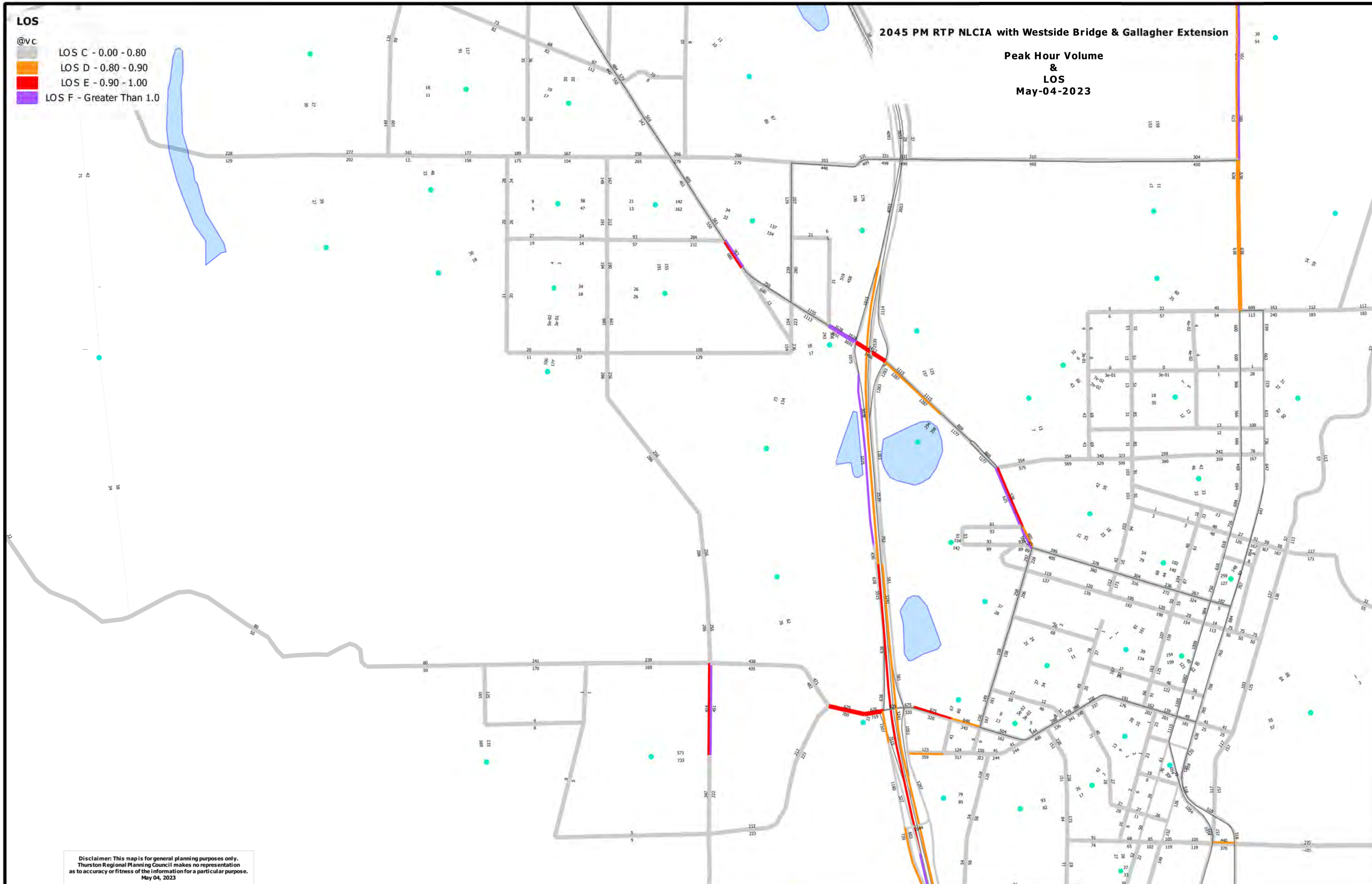
Disclaimer: This map is for general planning purposes only. Thurston Regional Planning Council makes no representation as to accuracy or fitness of the information for a particular purpose.
May 04, 2023


LOS
@vc
LOS C - 0.00 - 0.80
LOS D - 0.80 - 0.90
LOS E - 0.90 - 1.00
LOS F - Greater Than 1.0
2045 PM RTP NLCIA with Westside Bridge & Gallagher Extension
Peak Hour Volume
&
LOS
May-04-2023
Disclaimer: This map is for general planning purposes only.
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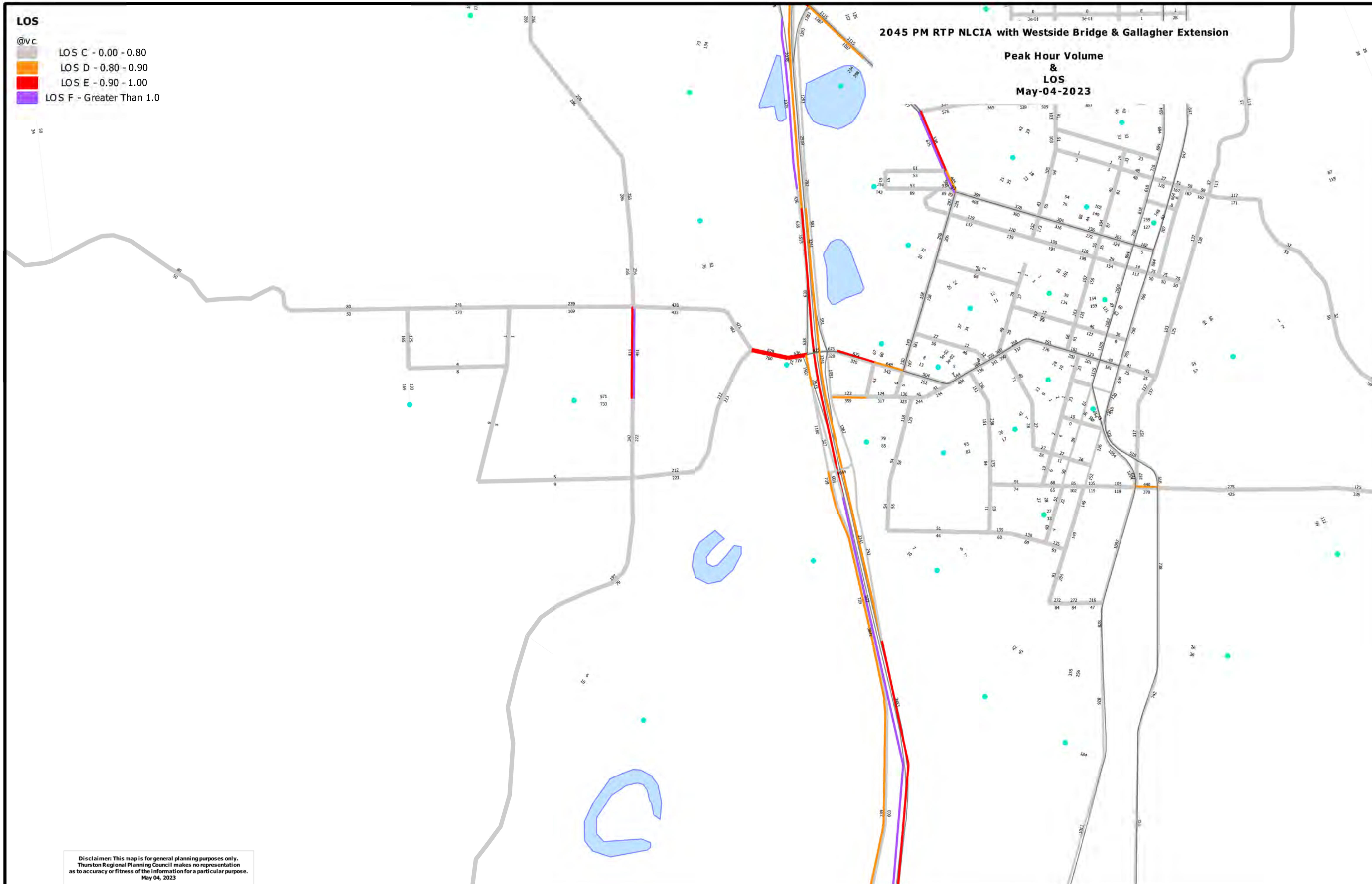
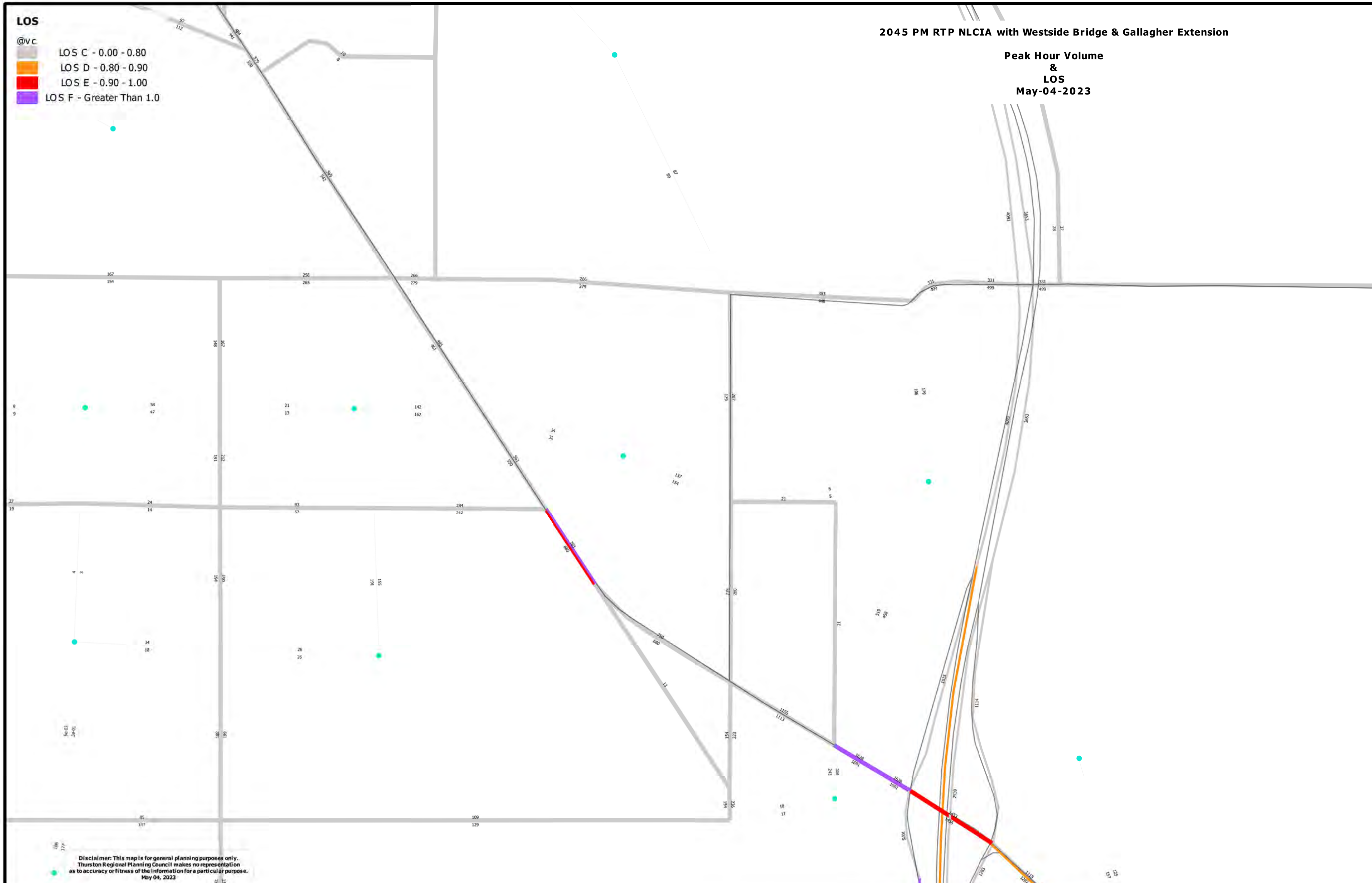
May 04, 2023


2045 PM RTP NLCIA with Westside Bridge & Gallagher Extension
Peak Hour Volume
&
LOS
May-04-2023
LOS
@vc
LOS C - 0.00 - 0.80
LOS D - 0.80 - 0.90
LOS E - 0.90 - 1.00
LOS F - Greater Than 1.0
Disclaimer: This map is for general planning purposes only. Thurston Regional Planning Council makes no representation as to accuracy or fitness of the information for a particular purpose.
May 04, 2023



LOS
@vc
LOS C - 0.00 - 0.80
LOS D - 0.80 - 0.90
LOS E - 0.90 - 1.00
LOS F - Greater Than 1.0
2045 PM RTP NLCIA with Westside Bridge & Gallagher Extension
Peak Hour Volume
&
LOS
May-04-2023
Disclaimer: This map is for general planning purposes only.
Thurston Regional Planning Council makes no representation
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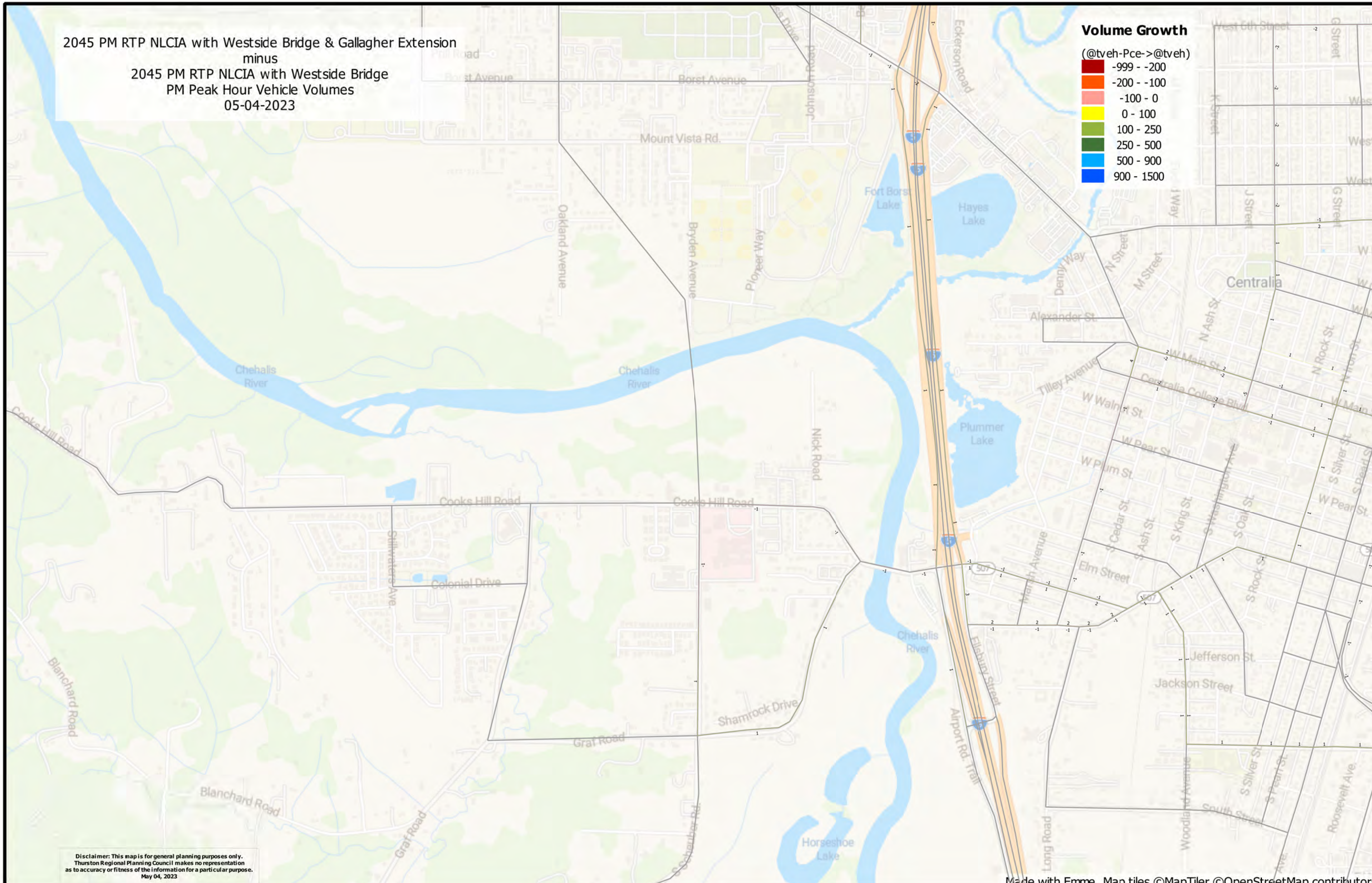
May 04, 2023


2045 PM RTP NLCIA with Westside Bridge & Gallagher Extension
minus
2045 PM RTP NLCIA with Westside Bridge
PM Peak Hour Vehicle Volumes
05-04-2023
Volume Growth
(@tveh-Pce->@tveh)
-999 - -200
-200 - -100
-100 - 0
0 - 100
100 - 250
250 - 500
500 - 900
900 - 1500
Borst Avenue
Mount Vista Rd.
Johnson Road
Eckerson Road
Oakland Avenue
Bryden Avenue
Pioneer Way
Fort Borst Lake
Hayes Lake
Plummer Lake
Centralia
Chehalis River
Cooks Hill Road
Stillwaters Ave
Colonial Drive
Nick Road
Alexander St.
W Main St.
Centralia College Blvd
Tilley Avenue
W Walnut St.
W Pear St.
W Plum St.
Elm Street
Marsh Avenue
Jefferson St.
Jackson Street
South Street
Woodland Avenue
Roosevelt Ave.
Shamrock Drive
Graf Road
Blanchard Road
Airport Rd. Trail
Ellsbury Street
Long Road
Horseshoe Lake
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May 04, 2023
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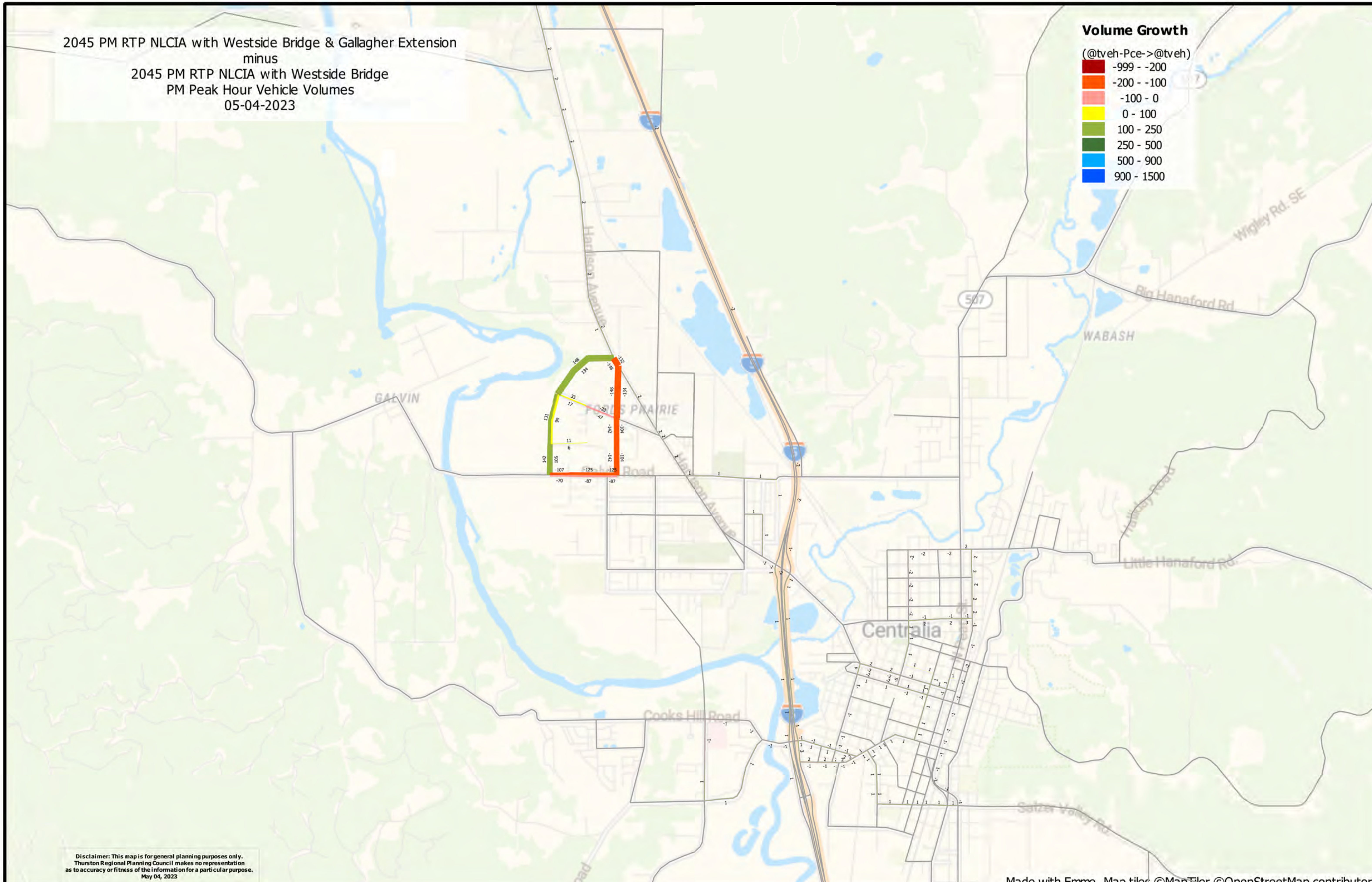

2045 PM RTP NLCIA with Westside Bridge & Gallagher Extension
minus
2045 PM RTP NLCIA with Westside Bridge
PM Peak Hour Vehicle Volumes
05-04-2023
Volume Growth
(@tveh-Pce->@tveh)
-999 - -200
-200 - -100
-100 - 0
0 - 100
100 - 250
250 - 500
500 - 900
900 - 1500
Harrison Avenue
FORDS PRAIRIE
GALVIN
WABASH
Big Hanaford Rd
Wigley Rd. SE
Little Hanaford Rd
Centralia
Cooks Hill Road
Salzer Valley Rd
507
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May 04, 2023
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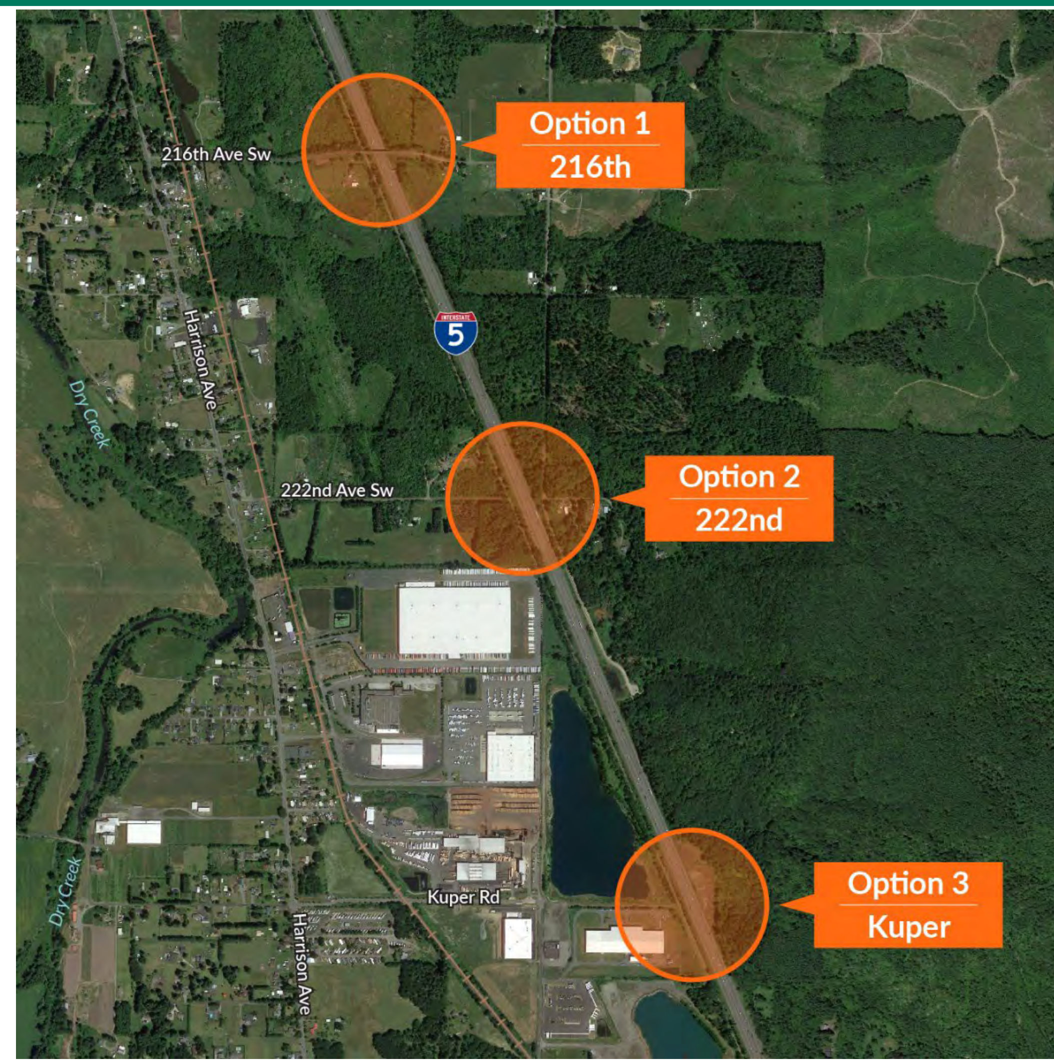
APPENDIX D.1 RECOMMENDATIONS MATRIX

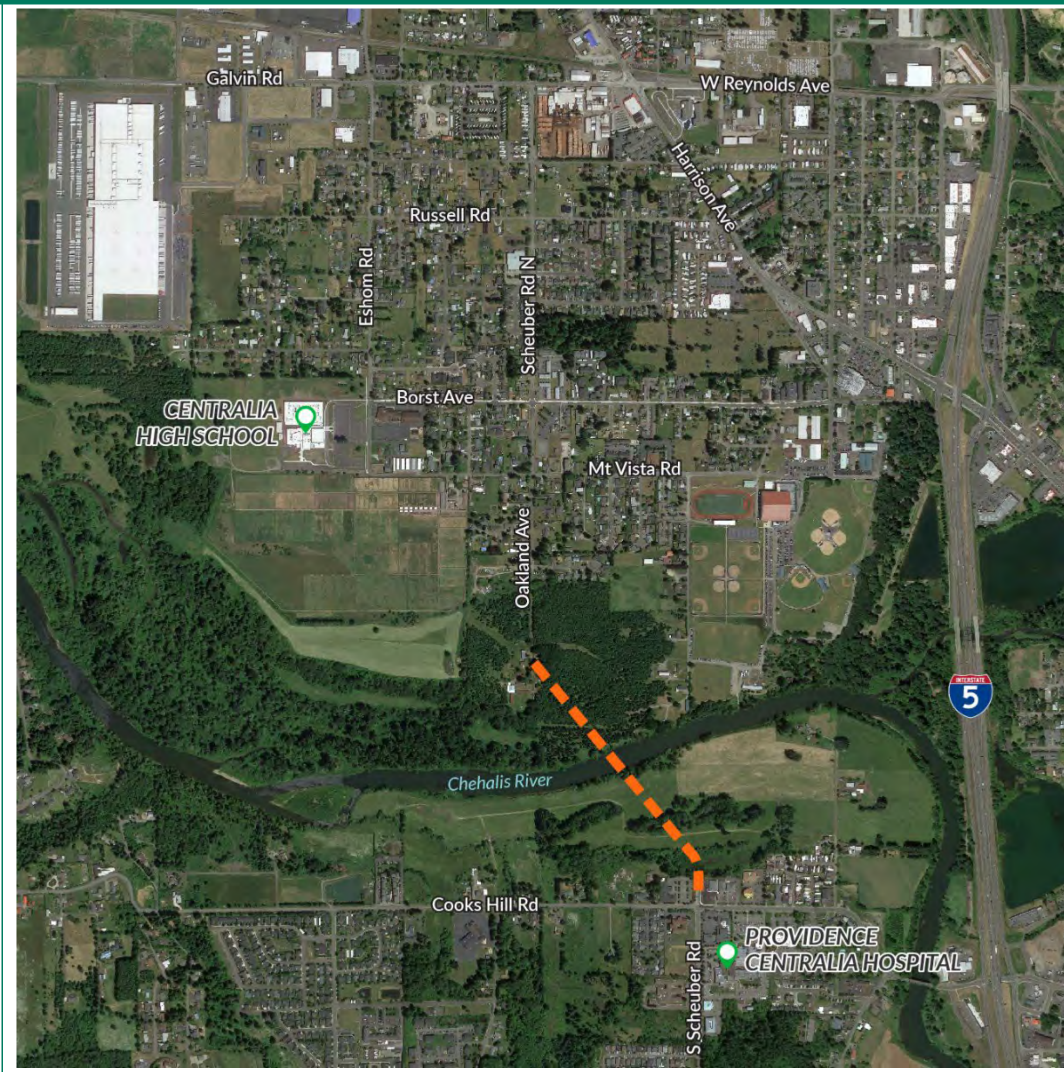
NLCIA RECOMMENDATIONS MATRIX – JULY 17, 2023

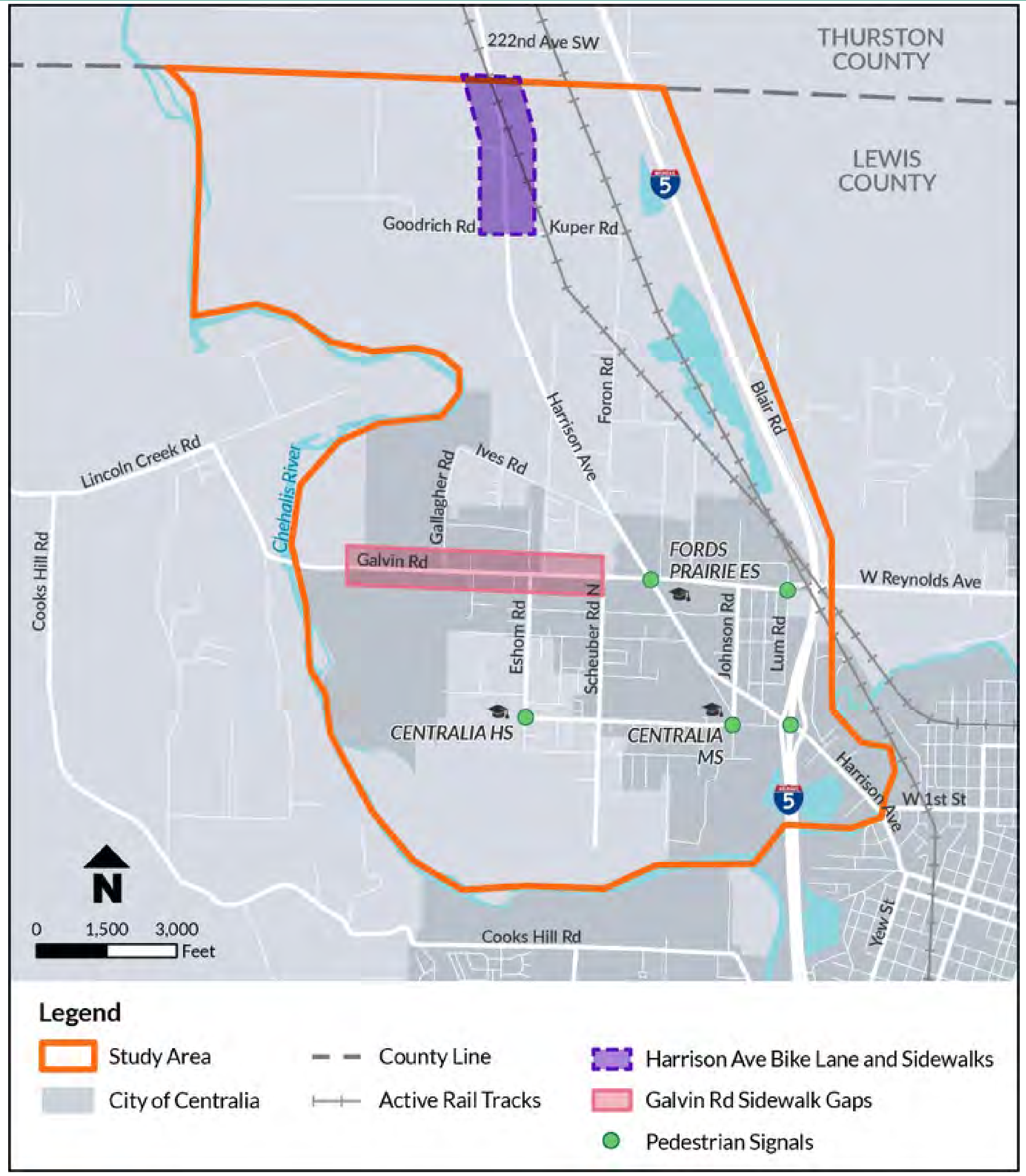
Freight-Focused Improvements

Description	Summary Map	Screening Result / Justification	Additional Notes
New I-5 interchange near Lewis/ Thurston county line • **Option 1:** Connect 216th to I-5 (Thurston County) • **Option 2:** Connect 222nd to I-5 (Thurston County) • **Option 3:** Connect Kuper Rd to I-5 (Lewis County) **Benefits:** • Expected to relieve pressure on existing interchanges and Harrison Avenue • Would improve freight access to I-5 for industrial properties in North Lewis County • All options would meet FHWA spacing standards **Challenges:** • All options would have to cross R-1 railroad near Harrison and R-4 railroad near I-5 • Options 1 and 2 are in Thurston County • Option 3 is very close to landslide hazard area • All options would require out-of-direction travel for trucks accessing the Port of Centralia • Access to eastside roadway network will be difficult and costly due to challenging terrain and environmental constraints		• Interchange concept passed Level I screening with 24 points • **216th Ave option** scored the highest of the three interchange locations in Level II screening and is the project team's recommended option • **Level II screening results:** ○ 216th Ave: 73 points ○ 222nd Ave: 70 points ○ Kuper Rd: 71 points	• These are the only feasible locations for a new I-5 connection near the study area • Interchange can be designed to be forward-compatible as one part of constructing a more complete road network in the area

Description	Summary Map	Screening Result / Justification	Additional Notes
Extend Gallagher Rd north to Harrison Ave **Benefits:** Would decrease NB trips to Grand Mound interchange by 1 mile – projected to divert some freight trips away from Harrison interchange even without new County line interchange		• Passed Level I screening with 27 points • Passed Level II screening with 78.5 points • Strong benefits for freight traffic to Port properties, especially those on Galvin Rd	• Suggested by Port Commissioners at February 2023 workshop • Currently in County TIP – not funded

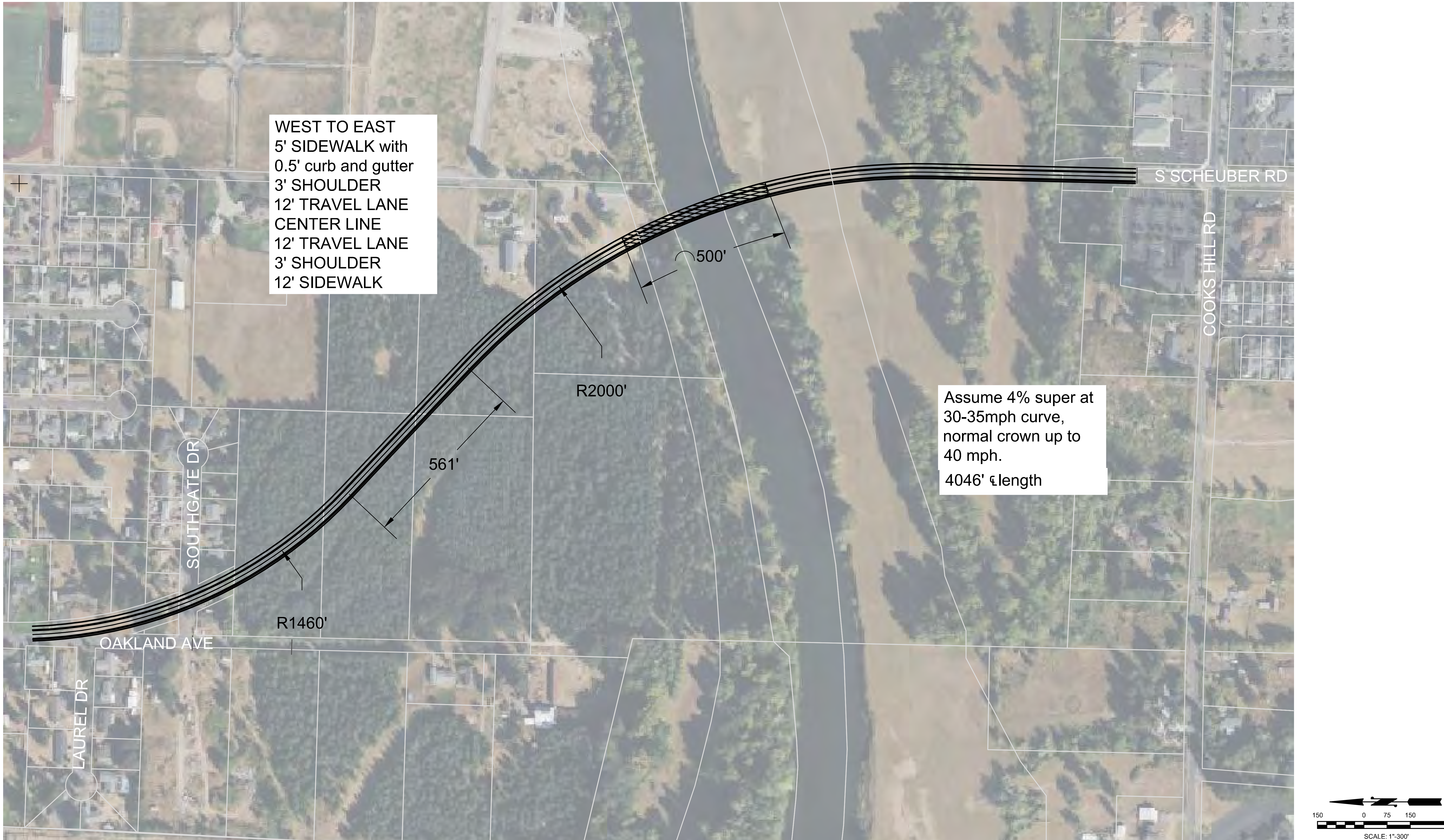
Holistic Transportation System Improvements

Description	Summary Map	Screening Result / Justification	Additional Notes
Westside Connector: new bridge over Chehalis River, connecting Fords Prairie area to Mellen St interchange via Cooks Hill Rd • **Preferred bridge alignment:** Connect Oakland Ave to S Scheuber Rd **Benefits:** • Improves local connectivity – alternative to I-5 for local trips would reduce traffic near the Harrison / I-5 interchange • Provides a multimodal connection across the Chehalis River • Provides emergency flood route to Providence Hospital • Minimal property impacts **Challenges:** • High cost • Environmental clearance could be lengthy process • Potential for cultural resources impacts		• Passed Level I screening with 23 points • Passed Level II screening with 76 points • Strong support from stakeholders and general public, with some neighbor concern about impacts • Would connect community south of the river more directly to businesses and services in the north • Would not be designated as a freight route, but would divert local traffic away from Harrison / I-5 interchange area	• Westside Connector concept has been referenced in local plans for decades and benefits appear to have been already examined • FHWA would likely require local road network improvements (such as building the bridge) before considering a new interchange on I-5

Description	Summary Map	Screening Result / Justification	Additional Notes
Bike lanes and sidewalks on Harrison Ave north of Kuper Rd (originally proposed shared-use path) **Benefits:** • Consistency with design of County-led Harrison/Reynolds Improvements Project • Provides physical separation from vehicles **Challenges:** • Minor property impacts		• Passed Level 1 screening with 28 points • Passed Level 2 screening with 78.5 points • Would add improved active transportation connection between two counties and address gap in network • Compatible with the vision of improving access and safety for all modes	• Harrison/Reynolds project design includes three lanes - one lane each direction + two-way left turn lane. Typical cross-section includes curb, sidewalk and gutter. Project is currently funded for full design but is still seeking construction funding. • Coordination with Harrison/Reynolds Improvements Project will ensure best implementation of active transportation improvements.
Complete missing sidewalks on Galvin Rd near distribution center **Benefits:** • Will connect existing isolated sidewalk segments and remove pedestrians from shoulder of roadway **Challenges:** • More costly than a shared-use path • Minor property impacts		• Passed Level I screening with 26 points • Passed Level II screening with 80.5 points • Compatible with the vision of improving access and safety for all modes	
Pedestrian signal improvements at key intersections, including: • Harrison and Reynolds • Near Harrison/I-5 interchange • Lum and Reynolds • Intersections near schools **Benefits:** • Improved safety for pedestrians **Challenges:** • Causes slight reduction in green time for traffic movements		• Passed Level I screening with 27 points • Passed Level II screening with 81 points • Compatible with the vision of improving access and safety for all modes	

Description	Summary Map	Screening Result / Justification	Additional Notes
Consolidate driveways on Harrison Ave between View and Lowe Streets **Benefits:** • Smoother traffic flow • Fewer conflicts between vehicles and bikes/peds (right hooks, etc.) **Challenges:** • Will likely be expensive to purchase access control in this location • Perceived impact to commercial properties is likely significant		• Passed Level I screening with 25 points • Passed Level II screening with 82 points • Strong benefits for traffic operations near I-5 interchange on Harrison	• WSDOT currently controls signals at Belmont/Harrison and Johnson/Harrison but does not have access control • Attempts to negotiate driveway closures at the local level have not been successful • Per City of Centralia's request, the project team also recommends installing center curb median and restricting turn movements
Adaptive signal controller installation near retail along Harrison/Reynolds corridors **Benefits:** • Likely improvements to traffic flow, particularly for less predictable traffic conditions associated with retail and services as opposed to commute trips. **Challenges:** • Likely requires vendor-led installation with substantial upfront cost. Could also result in long term reliance on outside management and maintenance of hardware/ software. • Long term operations and maintenance are another consideration – increased cost if SWR, City or County are not able to manage the system.		• Passed Level I screening with 25 points • Passed Level II screening with 81.5 points • Compatible with the vision of improving access and safety for all modes	• May be easier to implement at signals already controlled by WSDOT

APPENDIX D.2 5% DESIGN PLAN SHEETS



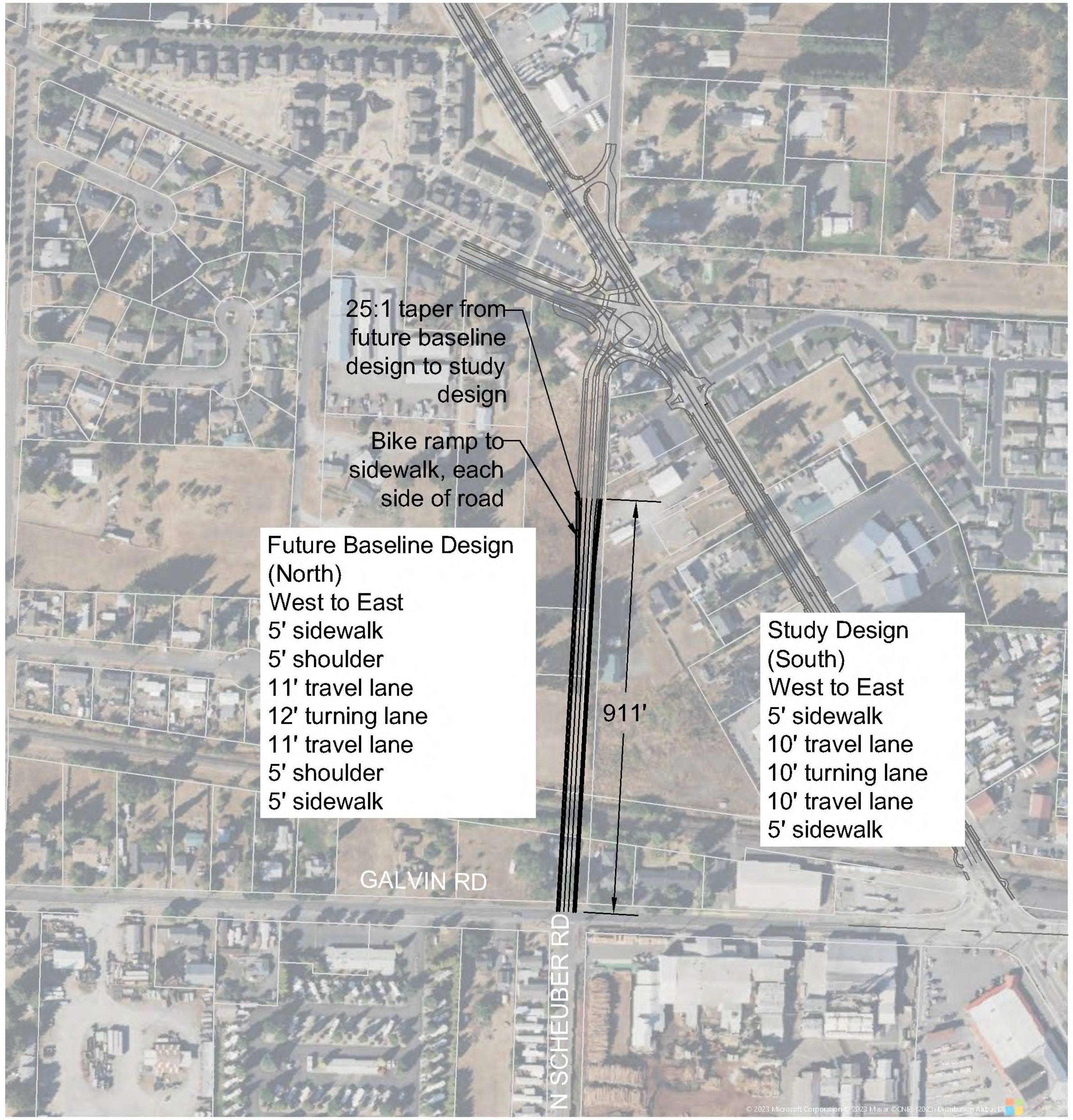
WSP USA Inc.
1300 SW 5th Ave
Suite 3100
Portland, OR 97201
Tel: 1 503 274 8772

NORTH LEWIS COUNTY INDUSTRIAL ACCESS TRANSPORTATION STUDY

ALTERNATIVE 1 WESTSIDE CONNECTOR

JUNE 22, 2023

C:\Users\USAJ689120\WSP 0365\WSDOT I-5 N. Lewis Co. IA Trans Study – Documents\General\5_Identification and Evaluation of Alternatives\Work Element 5.4 Evaluation of Alternatives\CADD-Design\sheets-rollplots\1-WESTSIDE_CONNECTOR.dwg, 6/20/2023 8:59 AM



150 0 75 150 300

SCALE: 1"-300'

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Suite 3100
Portland, OR 97201
Tel: 1 503 274 8772

NORTH LEWIS COUNTY INDUSTRIAL ACCESS TRANSPORTATION STUDY

ALTERNATIVE 1 N SCHEUBER WESTSIDE CONNECTOR

JUNE 22, 2023

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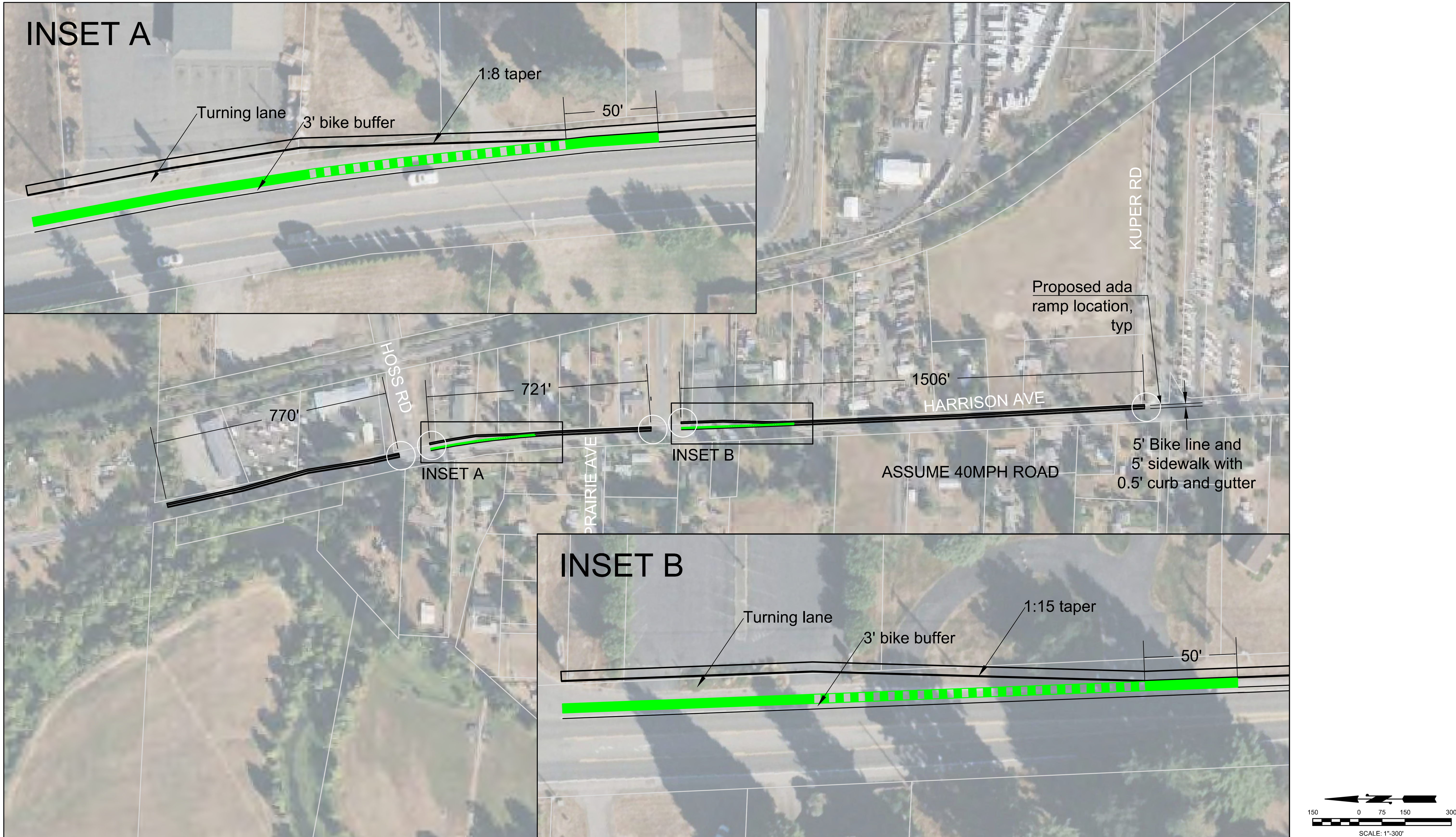

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WSDOT

NORTH LEWIS COUNTY INDUSTRIAL ACCESS TRANSPORTATION STUDY

ALTERNATIVE 2 HARRISON BIKE-PED IMPROVEMENTS

JUNE 22, 2023

C:\Users\USAJ689120\WSP 0365\WSDOT I-5 N. Lewis Co. IA Trans Study - Documents\General\5_Identification and Evaluation of Alternatives\Work Element 5.4 Evaluation of Alternatives\CADD-Design\sheets-rollplots\2-HARRISON_SHARED_USE.dwg, 6/20/2023 9:28 AM

150 0 75 150 300

SCALE: 1"=300'

WSP USA Inc.
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Suite 3100
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WSDOT

NORTH LEWIS COUNTY INDUSTRIAL ACCESS TRANSPORTATION STUDY

ALTERNATIVE 3 GALVIN RD SIDEWALKS

JUNE 22, 2023

C:\Users\USAJ689120\WSP O365\WSDOT I-5 N. Lewis Co. IA Trans Study - Documents\General\5_Identification and Evaluation of Alternatives\Work Element 5.4 Evaluation of Alternatives\CADD-Design\sheets-rollplots\3-GALVIN_RD_SIDEWALKS.dwg, 6/20/2023 9:08 AM

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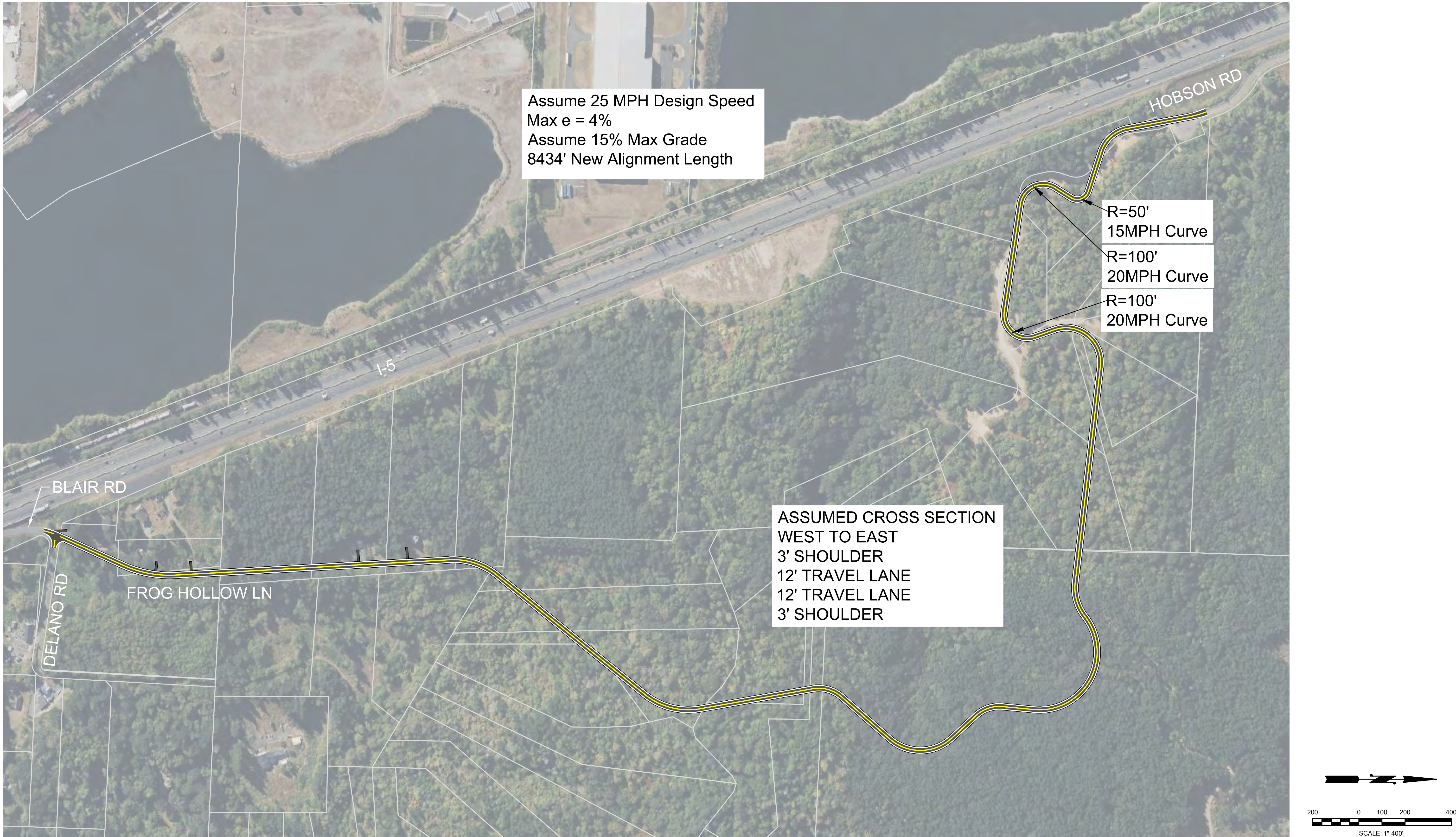
NORTH LEWIS COUNTY INDUSTRIAL ACCESS TRANSPORTATION STUDY

ALTERNATIVE 4 GALLAGHER RD

JUNE 22, 2023

C:\Users\odonnella\WSP 0365\WSDOT I-5 N. Lewis Co. IA Trans Study - Work Element 5.4 Evaluation of Alternatives\CADD-Design\sheets-rollplots\4-GALLAGHER-RD-SHEET.dwg, 6/20/2023 2:19 PM



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WSDOT

NORTH LEWIS COUNTY INDUSTRIAL ACCESS TRANSPORTATION STUDY

ALTERNATIVE 5 BLAIR-HOBSON CONNECTION

JUNE 22, 2023

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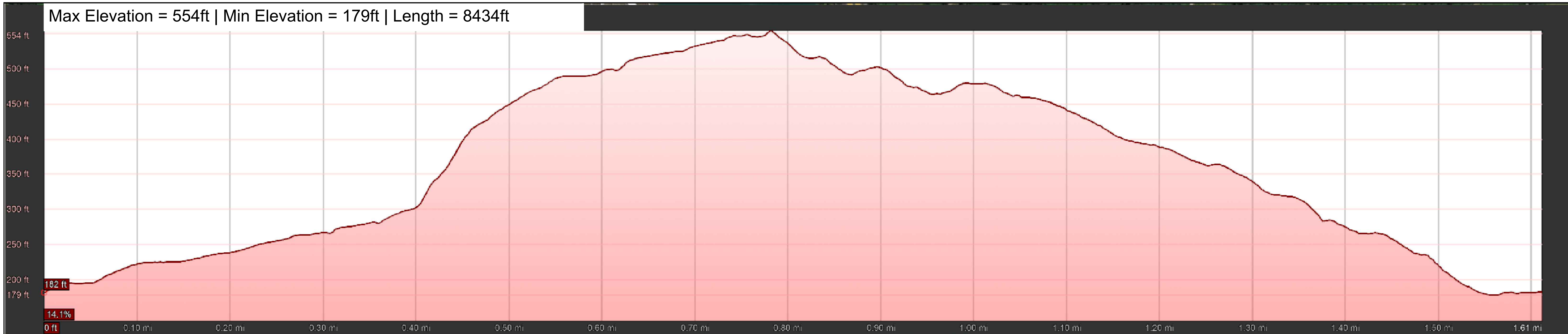
WSDOT

NORTH LEWIS COUNTY INDUSTRIAL ACCESS TRANSPORTATION STUDY

ALTERNATIVE 5 BLAIR-HOBSON CONNECTION 2

JUNE 22, 2023



Alignment 1 - Mountainous Road Profile

Alignment 2 - Parallel to I-5 Profile

Note: Profiles are NTS

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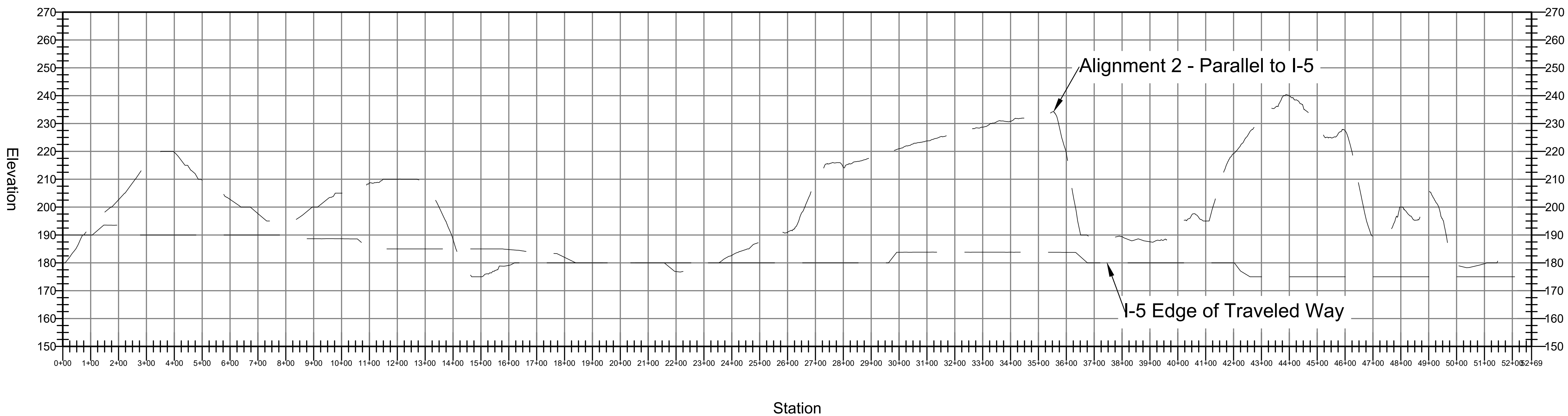
NORTH LEWIS COUNTY INDUSTRIAL ACCESS TRANSPORTATION STUDY

BLAIR-HOBSON CONNECTION PROFILES

JUNE 22, 2023

Alignment 2 - Parallel to I-5 Wall Profile



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NORTH LEWIS COUNTY INDUSTRIAL ACCESS TRANSPORTATION STUDY

BLAIR-HOBSON CONNECTION WALL PROFILE

JUNE 22, 2023

LEGEND:

ADAPTIVE SIGNALS

50 0 75 150 300

SCALE: 1"=300'

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NORTH LEWIS COUNTY INDUSTRIAL ACCESS TRANSPORTATION STUDY

6.1 ADAPTIVE SIGNAL CORRIDOR

JUNE 22, 2023

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LEGEND:

HIGHEST PRIORITY

NEXT HIGHEST PRIORITY

IF DRIVEWAY, THEN

CAN BE CLOSED

50 0 75 150 300

SCALE: 1"=300'

WSP USA Inc.
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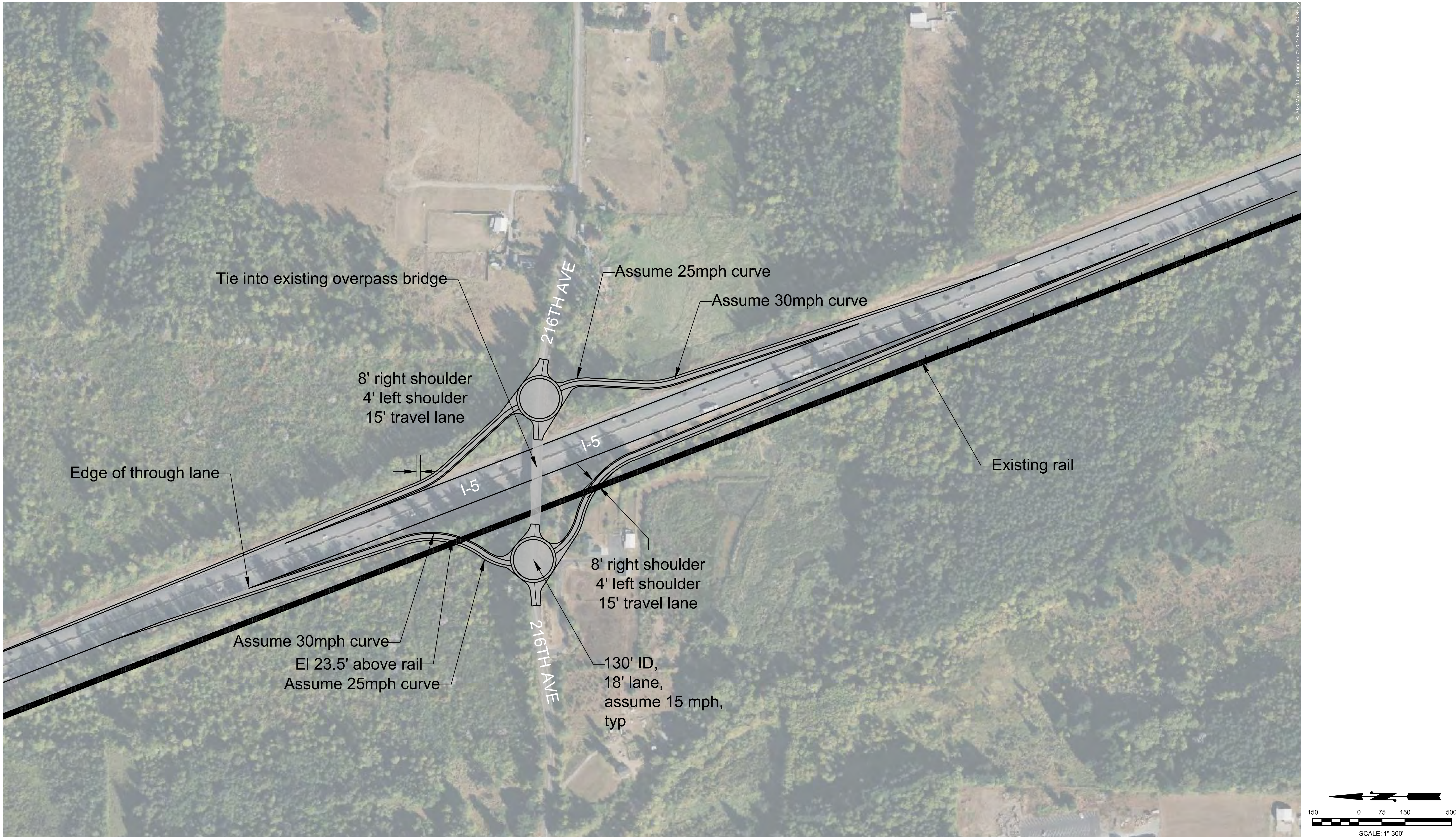
NORTH LEWIS COUNTY INDUSTRIAL ACCESS TRANSPORTATION STUDY

6.2 ACCESS CONSOLIDATION

JUNE 22, 2023

C:\Users\odonnella\WSP 0365\WSDOT I-5 N. Lewis Co. IA Trans Study - Work Element 5.4 Evaluation of Alternatives\CADD-Design\sheets-rollplots\6-1-Harrison.dwg, 6/13/2023 3:39 PM



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NORTH LEWIS COUNTY INDUSTRIAL ACCESS TRANSPORTATION STUDY

ALT 7B NEW I-5 INTERCHANGE AT 216TH AVE

JUNE 22, 2023

C:\Users\USAJ689120\WSP 0365\WSDOT I-5 N. Lewis Co. IA Trans Study - Documents\General\5_Identification and Evaluation of Alternatives\Work Element 5.4 Evaluation of Alternatives\CADD-Design\sheets-rollplots\7B-I-5 Interchange -116th.dwg, 6/20/2023 10:06 AM

APPENDIX D.3 COST ESTIMATE WORKSHEETS

NORTH LEWIS COUNTY INDUSTRIAL ACCESS TRANSPORTATION STUDY

BUDGETARY COST ESTIMATE AND NARRATIVE

Updated September 26, 2023

PURPOSE:

Develop an early cost evaluation for the North Lewis County Industrial Access Transportation Study (NLCIATS).

SCOPE:

Determination of quantities and budgetary cost opinions for new, alternate routes for vehicular and truck traffic in the proximity of the Harrison Avenue interchange at I-5 (Exit 82) that will lead to identification of a recommended set of improvement strategies to the industrially zoned properties in North Lewis County.

This estimate exhibits unit prices for high level scopes of work and taken from historical WSDOT unit costs, RS Means, as well as estimator experience and previous project history. The estimate was completed with 5% plans and is not broken down by labor, equipment, materials or subcontractors. The final opinion of cost for each item does include construction direct and indirect construction costs, contractor overhead (including staff, temp conditions, insurance, bonding, markup, etc.), design fees and design support during construction, and project contingency. Estimated costs are stated in 2023 dollars and do not account for escalation or inflation for future work. Future, final project costs would include an additional 0.5% adjustment to account for long term facility maintenance, in line with WSDOT guidance.

INCLUSIONS:

- Labor, equipment, materials, subcontractors for completion of the projects
- Assumptions for basic utility requirements
- Identifiable utility conflicts
- Flagging (RR and traffic)
- Training and orientations
- Safety equipment and personnel
- Mobilization and demobilization of labor, materials and equipment in and out of the work areas.
- Supervision and management of work
- Design fees and DSDC
- Contingency costs

EXCLUSIONS:

- Unknown major utility/data conflicts
- Additional geotechnical surveys/ evaluations preconstruction
- Soft costs
- Cost escalation to future work/ YOE
- Anticipated inflation for future work or YOE
- Maintenance and operations costs

NLCIATS
Draft Opinion of Cost
Summary Sheet

Description	Opinion of Cost (2023$)
Westside Connector	$55,350,000
N Scheuber Westside	$3,850,000
Galvin Rd Sidewalks	$1,090,000
Harrison Shared Use	$1,320,000
Gallagher Rd	$20,070,000
Blair Hobson Connector	$166,720,000
Adaptive Signals	$940,000
6.2 Access Consolidation	$260,000
7A- New I-5 Interchange	$101,170,000
Pedestrian Hybrid Beacons	$870,000

NLCIATS
Draft Opinion of Cost
Westside Connector

Westside Connector- East				
Description	**Quantity**	**Units**	**Unit Price**	**Total**
Quantities				
Alignment Length	4,046	LF	-	-
Roadway Width	30	LF	-	-
Roadway Area	121,380	SF	-	-
Sidewalk Width (total)	17	SF	-	-
Bridge Approach Footprint	65,123	SF	-	-
Bridge Approach Avg Depth	15	LF	-	-
Bridge Length	500	LF	-	-
Bridge Width	50	LF	-	-
Costs				
Mob/ Demob @ 10%	1	LS	$3,200,000	$3,200,000
Tree Removal	550	EA	$1,500	$825,000
Clear/Grub	6	ACRE	$15,000	$83,595
Excavation/Haul	13,487	CY	$45	$606,900
Embankment/Haul	13,487	CY	$55	$741,767
Utilities	4,046	LF	$125	$505,750
Grading	26,973	SY	$8	$215,787
Misc Ret. Walls	2,000	SF	$150	$300,000
Base/Compact- Roadway	4,496	CY	$75	$337,167
Base/Compact- Flatwork	2,930	CY	$75	$219,720
Asphalt Paving	8,991	TN	$125	$1,123,889
Pavement Markings	4,046	RF	$12	$48,552
Sidewalk Area	7,642	SY	$80	$611,396
C & G	8,092	LF	$38	$307,496
Bridge Approach Fill	72,359	CY	$40	$2,894,356
Bridge Area	25,000	SF	$350	$8,750,000
ROW	323,680	SF	$20	$6,473,600
Environmental	1	YR	$312,000	$312,000
Landscaping/Restoration	1	LS	$50,000	$50,000
			Direct Total	$27,606,973
			Contractor OH, Markup, GC's, Insurance, Bonds:	$9,662,441
			Construction Cost:	$37,269,414
			Design and DSDC (10%)	$3,726,941
			Subtotal:	$40,996,355
			Contingency (@ 35%):	$14,348,724
			Total Opinion of Cost	**$55,350,000**

NLCIATS
Draft Opinion of Cost
N Scheuber

N Scheuber Westside				
Description	**Quantity**	**Units**	**Unit Price**	**Total**
Alignment Length	911	LF	-	-
Roadway Width	30	LF	-	-
Roadway Area	27,330	SF	-	-
Sidewalk Width (total)	10	SF	-	-
Bridge Approach Footprint	0	SF	-	-
Bridge Approach Avg Depth	0	LF	-	-
Bridge Length	0	LF	-	-
Bridge Width	0	LF	-	-
Crossing and Signals	1	LS	-	-
Mob/ Demob @ 10%	1	LS	$240,000	$240,000
Tree Removal	5	EA	$1,500	$7,500
Clear/Grub	1	ACRE	$15,000	$18,822
Excavation/Haul	169	CY	$45	$7,592
Embankment/Haul	169	CY	$55	$9,279
Utilities	911	LF	$125	$113,875
Grading	6,073	SY	$8	$48,587
Misc Ret. Walls	0	SF	$150	$0
Base/Compact Roadway	1,012	CY	$75	$75,917
Base/Compact- Flatwork	388	CY	$75	$29,101
Asphalt Paving	2,024	TN	$125	$253,056
Grade Crossing and Signals	1	LS	$325,000	$325,000
Pavement Markings	911	RF	$12	$10,932
Sidewalk Area	1,012	SY	$80	$80,978
C & G	1,822	LF	$38	$69,236
Bridge Approach Fill	0	CY	$40	$0
Bridge Area	0	SF	$350	$0
ROW	27,330	SF	$20	$546,600
Environmental	3	MO	$26,100	$78,300
Landscaping/Restoration	1	LS	$5,000	$5,000
			Direct Total	$1,919,774
			Contractor OH, Markup, GC's, Insurance, Bonds:	$671,921
			Construction Cost:	$2,591,695
			Design and DSDC (10%)	$259,169
			Subtotal:	$2,850,864
			Contingency (@ 35%):	$997,802
			Total Opinion of Cost	**$3,850,000**

NLCIATS
Draft Opinion of Cost
Galvin Rd Sidewalks

Galvin Rd Sidewalks				
Description	**Quantity**	**Units**	**Unit Price**	**Total**
Sidewalk Length	4,078	LF	-	-
Sidewalk Width	5	LF	-	-
C & G Length	4,078	LF	-	-
Mob/Demob	1	LS	$50,000	$50,000
Demo/removals	24,468	SF	$2.50	$61,170
Finegrade	24,468	SF	$2.00	$48,936
Base/Compact- Flatwork	868	CY	$75.00	$65,135
C & G	4,078	LF	$38	$154,964
Sidewalks	2,266	SY	$80	$181,244
ROW	0	SF	$20	$0
Traffic Control	1	LS	$25,000	$25,000
Landscaping/Restoration	1	LS	$5,000	$5,000
			Direct Total	$541,449
			Contractor OH, Markup, GC's, Insurance, Bonds:	$189,507
			Construction Cost:	$730,956
			Design and DSDC (10%)	$73,096
			Subtotal:	$804,052
			Contingency (@ 35%):	$281,418
			Total Opinion of Cost	**$1,090,000**

NLCIATS
Draft Opinion of Cost
Harrison Shared Use

Harrison Shared Use				
Description	**Quantity**	**Units**	**Unit Price**	**Total**
Roadway Widening- Length	750	LF	-	-
Roadway Widening- Width	8	LF	-	-
Sidewalk Length	2,997	LF	-	-
Sidewalk Width	5	LF	-	-
C & G Length	2,997	LF	-	-
Mob/Demob	1	LS	$76,000	$76,000
Demo/removals	23,982	SF	$1.50	$35,973
Finegrade	23,982	SF	$1.00	$23,982
Base/Compact Roadway	222	CY	$75	$16,667
Base/Compact- Flatwork	638	CY	$75	$47,869
C & G	2,997	LF	$38	$113,886
Asphalt Paving	444	TN	$125	$55,556
Sidewalks	1,665	SY	$80	$133,200
Pavement Marking	2,997	RF	$10	$29,970
ROW	9,750	SF	$20	$195,000
Landscaping/Restoration	1	LS	$2,500	$2,500
			Direct Total	$654,602
			Contractor OH, Markup, GC's, Insurance, Bonds:	$229,111
			Construction Cost:	$883,713
			Design and DSDC (10%)	$88,371
			Subtotal:	$972,084
			Contingency (@ 35%):	$340,229
			Total Opinion of Cost	**$1,320,000**

NLCIATS
Draft Opinion of Cost
Gallagher Rd

Gallagher Rd				
Description	**Quantity**	**Units**	**Unit Price**	**Total**
Alignment Length	5,121	LF	-	-
Roadway Width	30	LF	-	-
Roadway Area	118,608	SF	-	-
Roadway Area- Widening	58,300	SF	-	-
Sidewalk Width (total)	17	SF	-	-
Bridge Approach Footprint	0	SF	-	-
Bridge Approach Avg Depth	0	LF	-	-
Bridge Length	0	LF	-	-
Bridge Width	0	LF	-	-
Mob/ Demob @ 10%	1	LS	$620,000	$620,000
Tree Removal	50	EA	$1,500	$75,000
Clear/Grub	7	ACRE	$15,000	$105,806
Excavation/Haul	2,500	CY	$45	$112,500
Embankment/Haul	2,500	CY	$55	$137,500
Utilities	5,121	LF	$125	$640,125
Utility Pole Impacts	1	LS	$240,000	$240,000
Grading	19,656	SY	$8	$157,252
Misc Ret. Walls	1,000	SF	$125	$125,000
Base/Compact- Roadway	4,393	CY	$75	$329,467
Base/Compact- Roadway Widening	2,159	CY	$75	$161,944
Base/Compact- Flatwork	3,599	CY	$75	$269,919
Asphalt Paving	8,786	TN	$125	$1,098,222
Asphalt Paving- Widening	4,319	TN	$125	$539,815
Pavement Markings	5,121	RF	$12	$61,452
Sidewalk Area	9,389	SY	$80	$751,080
C & G	10,242	LF	$38	$389,196
At Grade RR Crossing & Signal	1	EA	$325,000	$325,000
Bridge Approach Fill	0	CY	$40	$0
Bridge Area	0	SF	$350	$0
ROW	176,908	SF	$20	$3,538,160
Environmental	1	YR	$312,000	$312,000
Landscaping/Restoration	1	LS	$20,000	$20,000
			Direct Total	$10,009,438
			Contractor OH, Markup, GC's, Insurance, Bonds:	$3,503,303
			Construction Cost:	$13,512,741
			Design and DSDC (10%)	$1,351,274
			Subtotal:	$14,864,015
			Contingency (@ 35%):	$5,202,405
			Total Opinion of Cost	**$20,070,000**

NLCIATS
Draft Opinion of Cost
Blair-Hobson Connection

Blair Hobson				
Description	**Quantity**	**Units**	**Unit Price**	**Total**
Alignment Length	5,271	LF	-	-
Roadway Width	30	LF	-	-
Roadway Area	158,130	SF	-	-
Sidewalk Width (total)	0	SF	-	-
Bridge Approach Footprint	0	SF	-	-
Bridge Approach Avg Depth	0	LF	-	-
Bridge Length	0	LF	-	-
Bridge Width	0	LF	-	-
Mob/ Demob @ 10%	1	LS	-	-
Tree Removal	300	EA	$1,500	$450,000
Clear/Grub	7	ACRE	$15,000	$108,905
Excavation/Haul	17,570	CY	$45	$790,650
Embankment/Haul	17,570	CY	$55	$966,350
Utilities	5,271	LF	$125	$658,875
Grading	35,140	SY	$7	$245,980
Misc Ret. Walls	316,800	SF	$225	$71,280,000
Base/Compact- Roadway	5,857	CY	$75	$439,250
Base/Compact- Flatwork	0	CY	$75	$0
Asphalt Paving	11,713	TN	$125	$1,464,167
Pavement Markings	5,271	RF	$12	$63,252
Sidewalk Area	0	SY	$80	$0
C & G	0	LF	$38	$0
Bridge Approach Fill	0	CY	$40	$0
Bridge Area	0	SF	$350	$0
ROW	316,260	SF	$20	$6,325,200
Environmental	1	YR	$312,000	$312,000
Landscaping/Restoration	1	LS	$55,000	$55,000
			Direct Total	$83,159,629
			Contractor OH, Markup, GC's, Insurance, Bonds:	$29,105,870
			Construction Cost:	$112,265,499
			Design and DSDC (10%)	$11,226,550
			Subtotal:	$123,492,049
			Contingency (@ 35%):	$43,222,217
			Total Opinion of Cost	**$166,720,000**

NLCIATS
Draft Opinion of Cost
Adaptive Signals

Adaptive signals				
Description	**Quantity**	**Unites**	**Unit Price**	**Total**
Mob/ Demob	1	LS	$25,000	$25,000
Adaptive signals and systems	5	EA	$60,000	$300,000
Traffic Control	1	LS	$35,000	$35,000
Misc required upgrades	5	EA	$10,000	$50,000
Landscaping/Restoration	1	LS	$55,000	$55,000
			Direct Total	$465,000
			Contractor OH, Markup, GC's, Insurance, Bonds:	$162,750
			Construction Cost:	$627,750
			Design and DSDC (10%)	$62,775
			Subtotal:	$690,525
			Contingency (@ 35%):	$241,684
			Total Opinion of Cost	**$940,000**

NLCIATS

Draft Opinion of Cost

Harrison Access Consolidation

6.2- Access Consolidation				
Description	**Quantity**	**Units**	**Unit Price**	**Total**
Pavement/Driveway removals	6	EA	-	-
Pavement/Driveway removals- Length (total)	425	LF	-	-
Pavement/Driveway removals- Avg Width	10	LF	-	-
Sidewalk Length	425	LF	-	-
Sidewalk Width	10	LF	-	-
C & G Length	425	LF	-	-
Mob/Demob	1	LS	$16,000	$16,000
Demo/removals	4,250	SF	$8.00	$34,000
Finegrade	4,250	SF	$1.00	$4,250
Base/Compact Roadway	0	CY	$75	$0
Base/Compact- Flatwork	157	CY	$75	$11,806
C & G	425	LF	$38	$16,150
Asphalt Paving	0	TN	$125	$0
Sidewalks	472	SY	$80	$37,778
Pavement Marking	425	RF	$10	$4,250
Traffic Control	1	LS	$12,000	$12,000
ROW	0	SF	$20	$0
Landscaping/Restoration	1	LS	$5,000	$5,000
			Direct Total	$125,233
			Contractor OH, Markup, GC's, Insurance, Bonds:	$43,832
			Construction Cost:	$169,065
			Design and DSDC (10%)	$16,907
			Subtotal:	$185,972
			Contingency (@ 35%):	$65,090
			Total Opinion of Cost	**$260,000**

NLCIATS
Draft Opinion of Cost
I-5 Interchange at 216th Ave

I-5 Interchange				
Description	**Quantity**	**Units**	**Unit Price**	**Total**
Total ramp length	9,097	LF	-	-
Ramp Width	27	LF	-	-
Ramp Area	245,619	SF	-	-
RAB Lane length	942	LF	-	-
RAB Width	18	LF	-	-
Tie in road length	500	LF	-	-
Tie in road width (avg)	45	LF	-	-
Sidewalk Width (total)	0	SF	-	-
Bridge Approach Footprint	16,000	SF	-	-
Bridge Approach Avg Depth	15	LF	-	-
Bridge 1 Length (total)	250	LF	-	-
Bridge 2 Length (total)	120	LF	-	-
Bridge 3 Length (total)	120	LF	-	-
Bridge Width	32	LF	-	-
Mob/ Demob @ 10%	1	LS	$6,000,000	$6,000,000
Tree Removal	982	EA	$1,500	$1,473,714
Clear/Grub	11	ACRE	$15,000	$169,159
Excavation/Haul	27,291	CY	$45	$1,228,095
Embankment/Haul	27,291	CY	$55	$1,501,005
Utilities	10,539	LF	$125	$1,317,375
Grading	54,582	SY	$7	$382,074
Misc Ret. Walls	96,000	SF	$175	$16,800,000
Base/Compact	9,097	CY	$75	$682,275
Asphalt Paving- Ramps	18,194	TN	$125	$2,274,250
Asphalt Paving- RAB	1,256	TN	$125	$157,000
Asphlat Paving- Tie ins	1,667	TN	$125	$208,333
Pavement Markings	10,539	RF	$12	$126,468
Sidewalk Area	0	SY	$80	$0
Curb (mountable at RAB?)	820	LF	$60	$49,200
Bridge Approach Fill	116,200	CY	$40	$4,648,000
Bridge 1 Area	8,000	SF	$350	$2,800,000
Bridge 2 Area	3,840	SF	$300	$1,152,000
Bridge 3 Area	3,840	SF	$300	$1,152,000
ROW	307,024	SF	$20	$6,140,475
Environmental	2	YR	$312,000	$624,000
Traffic Control	1	LS	$1,500,000	$1,500,000
Landscaping/Restoration	1	LS	$75,000	$75,000
			Direct Total	$50,460,423
			Contractor OH, Markup, GC's, Insurance, Bonds:	$17,661,148
			Construction Cost:	$68,121,572
			Design and DSDC (10%)	$6,812,157
			Subtotal:	$74,933,729
			Contingency (@ 35%):	$26,226,805
			Total Opinion of Cost	**$101,170,000**

NLCIATS
Draft Opinion of Cost
Pedestrian Hybrid Beacons

Pedestrian Hybrid Beacon				
Description	**Quantity**	**Units**	**Unit Price**	**Total**
Connection to Harrison/Galvin	1	LS	$150,000	$150,000
Stand Alone @ Eshom & Borst	1	LS	$140,000	$140,000
Stand Alone @ Johnson & Borst	1	LS	$120,000	$120,000
Paving & Flatwork Demo/Repairs	1	LS	$12,000	$12,000
Landscaping/Restoration	1	LS	$7,500	$7,500
			Direct Total	$429,500
			Contractor OH, Markup, GC's, Insurance, Bonds:	$150,325
			Construction Cost:	$579,825
			Design and DSDC (10%)	$57,983
			Subtotal:	$637,808
			Contingency (@ 35%):	$223,233
			Total Opinion of Cost	**$870,000**