

Transportation Baseline Report

Oak Street Refinement Plan Forest Grove, Oregon



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SCJ ALLIANCE
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Draft Transportation Baseline Report

Project Information

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1. INTRODUCTION AND BACKGROUND

This technical report is one of several that are being prepared to support development of the Oak Street Refinement Plan for the City of Forest Grove. This Plan is being prepared consistent with the requirements of ORS 197.200 related to refinement plans and is being prepared in cooperation with Metro, Washington County and ODOT. The Refinement Plan will address issues related to future urban development in the study area including designated land uses, required infrastructure, supportive economic analysis, financing, and identification of governmental implementation responsibilities.

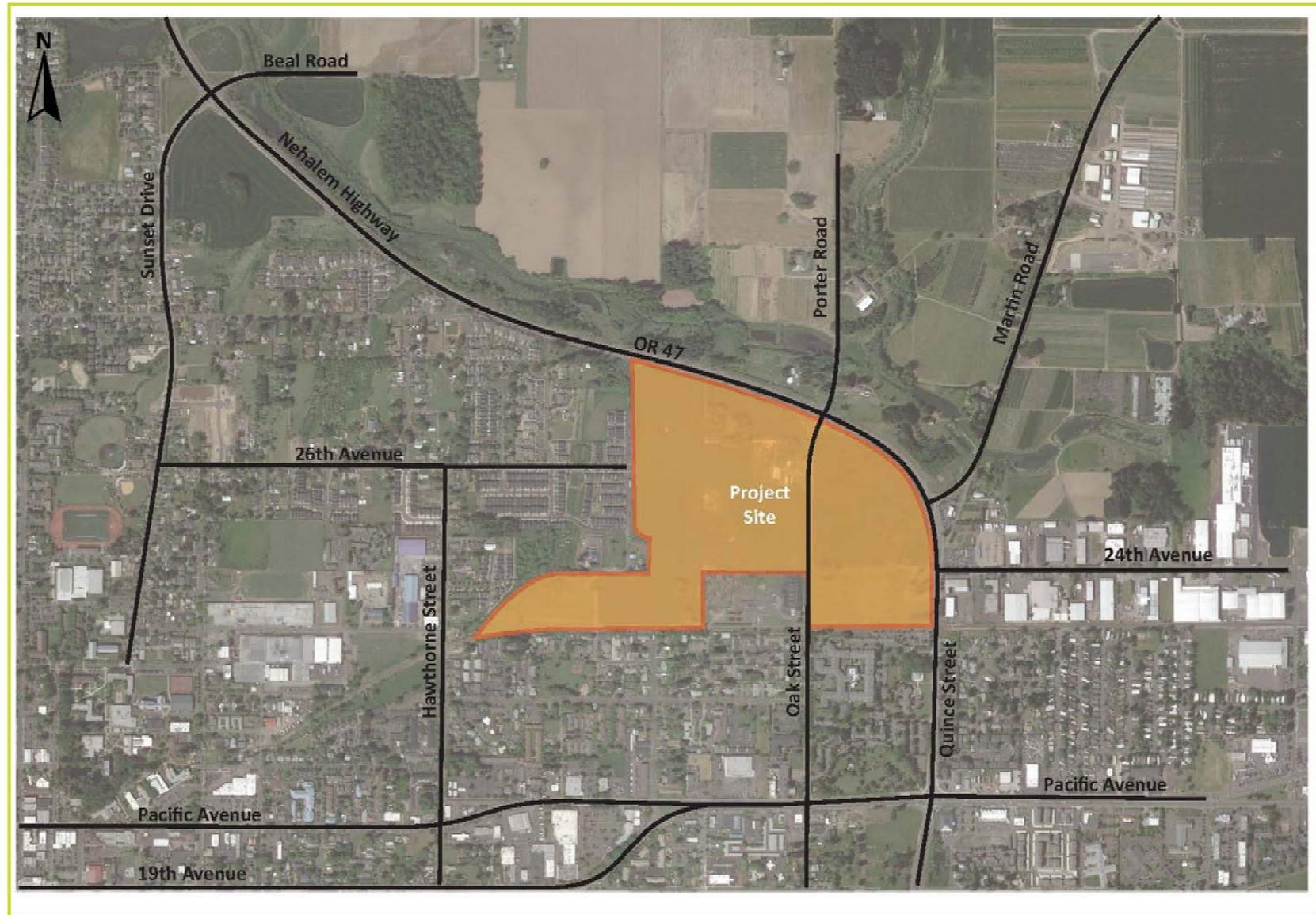
The approximately 90-acre site is located on the edge of the Forest Grove city limits, immediately north of the existing railroad owned by ODOT, east of existing developed portions of the city, and west and south of OR 47. The location of the Oak Street Refinement Plan study area and its vicinity is illustrated in **Figure 1-1**.

The purpose of this technical report is to summarize existing and projected future transportation and traffic conditions in the vicinity of the study area. This baseline conditions analysis will be used to guide planning for future multimodal transportation facilities within the study area, and to assess potential transportation implications of development in this area on the larger multimodal system.

Key components of the multimodal transportation system analysis that is addressed in this report include:

- Multi-modal transportation goals and policies
- Street and roadway system characteristics including existing facilities, travel patterns and operations, safety, future recommended facilities, and expected 2040 traffic operations
- Bicycle and pedestrian facilities including existing/proposed sidewalks and trails
- Transit service including bus routes and park-and-ride facilities in the vicinity of the study area
- Existing rail facilities

Figure 1-1. Oak Street Refinement Plan Study Area and Vicinity



2. REVIEWED DOCUMENTS AND PLANS

Numerous state, regional, and local documents and plans were reviewed in the development of this report. These are listed and briefly described in this chapter.

2.1 STATE DOCUMENTS AND PLANS

Plans and other relevant documents prepared and/or adopted by the State of Oregon including the Oregon Department of Transportation (ODOT) that were reviewed include the following:

Oregon Highway Plan (OHP) – The OHP is the primary policy document governing planning and operation of the state’s highway system, which includes OR 47 along the northern and eastern edge of Forest Grove.

Oregon Bicycle and Pedestrian Plan – Serves as the planning and design manual for pedestrian and bicycle transportation in Oregon and is used to implement the actions recommended in the *Oregon Transportation Plan*. The technical section of the plan was updated in October 2010 and re-titled as the Bicycle and Pedestrian Design Guide to offer a greater level of guidance on the provision of bicycle and pedestrian facilities. In 2011, the design guidance was incorporated as Appendix L in the *Oregon Highway Design Manual*.

State Transportation Improvement Program, Draft 2018-2021 – As adopted by the Oregon Transportation Commission, this document outlines the highway system improvements that will be constructed by ODOT during the coming biennium.

Statewide Planning Goals – These goals guide all land use and transportation planning in Oregon. Amendments to the Forest Grove *Transportation System Plan (TSP)* and Community Development Code to implement recommendations of the Oak Street Refinement Plan will require consistency with statewide goals.

2.2 REGIONAL DOCUMENTS AND PLANS

Plans, codes, and other relevant documents prepared and adopted by Metro that were reviewed include the following:

Metro Regional Transportation Plan (RTP) – This region-wide plan provides general guidance about accommodating multimodal transportation needs on major streets and highways in the region – particularly OR 47 and Pacific Avenue. The RTP also identifies 24 regional mobility corridors in the region where travel movement is particularly important and should be facilitated to meet the RTP performance standards. The mobility corridor framework requires consideration of multiple facilities, modes, and land use when identifying transportation solutions for these key corridors. Particularly relevant to the Oak Street plan area is Regional Mobility Corridor #15 which runs along the Tualatin Valley Hwy (Hwy 8) and connects the Hillsboro Regional Center with the Cornelius and Forest Grove Town Centers.

Metro Regional Functional Plan (RFP) – This plan includes land use guidance for the preparation of Refinement Plans.

Metro Council Creek Trail Master Plan – This plan lays out a detailed concept for establishing a 25-mile regional trail between the Willamette and Tualatin Rivers on the west side of the Portland Metropolitan Area. When complete, the trail will provide a high quality connection between the communities of Banks, Forest Grove, and Hillsboro for recreational and commuter bicyclists and pedestrians. The trail will enhance local pedestrian and bicycle connectivity.

2.3 FOREST GROVE DOCUMENTS AND PLANS

Plans, codes, and other relevant documents prepared and adopted in the City of Forest Grove that were reviewed include the following:

Forest Grove Transportation System Plan – The TSP provides policy and programmatic guidance for developing, maintaining, and funding of the City’s multimodal transportation system and integrates that system with facilities under the jurisdiction of Washington County and ODOT. The TSP was adopted in 2014, updated in 2016 to include the Council Creek Trail, and updated in 2017 to include results from the Westside Planning Program.

Forest Grove Comprehensive Plan – The Forest Grove *Comprehensive Plan* provides policy guidance for development and operation of the multimodal transportation system within the city. The *Comprehensive Plan* also identifies the functional classification of several city streets and provides general guidance on multimodal transportation improvements

Forest Grove Development Code (DC) – The DC includes guidance on street standards and property access (17.8.610 Streets). Amendments to zoning and development requirements for the Oak Street plan area may be required to support the outcome of the planning process.

2.4 WASHINGTON COUNTY DOCUMENTS AND PLANS

Plans, codes, and other relevant documents prepared and adopted by Washington County that were reviewed include the following:

Washington County Transportation System Plan (TSP) – The Washington County TSP (updated September 2019) provides guidance on the planning, maintenance, and operation of the County’s multimodal transportation system. The TSP offers background information about the system and its use; current transportation goals, objectives, and strategies; designations of functional classification and number of lanes for county roads; designation of facilities for other transportation modes (pedestrian, bicycle, transit, and freight); and information on plan implementation. Particularly relevant to the Oak Street plan area are the County’s functional classification and design designations for nearby streets under its jurisdiction including OR 47 and Martin Road, and intersection operational performance standards.

Draft Technical Memorandum, NW Martin Road (OR 47 to Verboort Road), Alternatives Analysis, May 2018 – This report summarizes the development and evaluation of improvement alternatives for Martin Road, particularly at its intersection with OR 47. The single-lane roundabout improvement recommended for this location was used in the future conditions operations analysis documented in this Baseline conditions report.

3. GOALS AND POLICIES

The transportation goals and policies of the City's TSP form the vision for how the local transportation system will be developed and maintained over the next 20 years. The policy framework of the plan was organized as follows:

Goal - A statement that describes an ideal condition that the City desires to attain over time for various aspects of the transportation system.

Policy - One or more statements that are intended to outline specific measures that will be taken to achieve a goal.

Actions - Discrete steps to be completed that support or enact a specific policy statement.

The following section lists the recommended goals, policies and actions from the Forest Grove TSP that are particularly relevant to preparation of refinement plans in the Oak Street plan area.

Goal 1:	Develop and maintain a balanced transportation system that provides travel choices and reduces the number of trips by single occupant vehicles.
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- Policy a.** Provide a citywide network of safe and convenient walkways and bikeways that are integrated with other transportation modes and regional destinations.
- *Action: The City will develop new and improved pedestrian routes with ultimate goal of a complete 'pedestrian grid' in Forest Grove.*
- Policy c.** Support travel options that allow individuals to reduce single-occupant vehicle trips.
- Policy e.** Encourage local employment and commercial opportunities to reduce the number of locally generated regional work and shopping trips.

Goal 2:	Develop and maintain a transportation system that reduces the length of travel and limits congestion.
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- Policy a.** Enhance street system connectivity wherever practical and feasible.
- *Action: Establish design criteria and implementing ordinances to enable the connection of streets identified on the plan as funds are available and new development or redevelopment opportunities arise. Exceptions will be given where connections are prevented by topography, barriers such as railroads, expressway or pre-existing development, or environmental constraints.*
 - *Action: The City will develop a local and neighborhood street system with a preferred spacing of no more than 530 feet, between elements of the City street network.*
 - *Action: The City will develop a walkway route system with a preferred spacing of no more than 330 feet, between elements of the City pedestrian network.*
- Policy b.** Maintain traffic flow and mobility on arterial and collector roadways.

Goal 3:	Develop and maintain a transportation system that is safe.
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- Policy a.** Safe and secure pedestrian and bicycle ways shall be designed between parks and other activity centers in Forest Grove.
- Policy b.** Safe and secure routes to schools shall be designated for each school and any new residential project shall identify the safe path to school for children.
- Policy c.** All transportation-related improvements will be designed and constructed to meet City standards developed in the City's Design Standards, the Americans with Disabilities Act (ADA), and to encourage provisions for bicycling, walking and transit use.
- Policy e.** Generally favor granting property access from the street with the lowest functional classification.

Goal 4:	Design and construct transportation facilities in a manner that enhances the livability of Forest Grove.
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- Policy a.** Maintain the livability of Forest Grove through proper location and design of transportation facilities.
- *Action: Design streets and highways to respect the characteristics of the surrounding land uses, natural features and other community amenities.*
- Policy b.** Increase the health and physical well-being of citizens by providing safe and convenient opportunities for walking and bicycling.
- Policy c.** Protect residential neighborhoods from excessive through traffic and travel speeds while providing reasonable access to and from residential areas.
- Policy d.** Provide a seamless and coordinated transportation system that is barrier-free, provides affordable and equitable access to travel choices and serve the needs of all people and businesses, including people with low income, children, seniors and people with disabilities.
- *Action: Pedestrian crossing spacing, traffic signal spacing and landscape standards for arterials in Forest Grove shall be developed in conjunction with Washington County, ODOT and Metro.*
 - *Action: Construct new transportation facilities and rebuild existing facilities to fully comply with the Americans with Disabilities Act.*

Goal 5:	Promote the development of Forest Grove, the state, and the national economy through the efficient movement of people, goods, services, and information in a safe manner.
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- Policy c.** Grade separation or gate control should be considered for all railroad crossings.
- Policy d.** Provide transportation facilities that support land development that is consistent with the Comprehensive Plan.
- Policy e.** Evaluate land development projects to determine possible adverse traffic impacts.
- Policy f.** Ensure that all new development contributes a fair share toward on-site and off-site transportation system improvement remedies.
- *Action: Require dedication of land for future streets when development is approved.*

- *Action: The property developer shall be required to make street improvements for their portion of the street commensurate with the proportional benefit that the improvement provides the development.*

Goal 6:	Establish and maintain a context sensitive set of transportation design and development regulations.
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Policy b. Integrate bicycle and pedestrian facilities into all planning, design, construction and maintenance activities.

Policy c. Require developers to include pedestrian, bicycle, and transit-supportive improvements within proposed developments and to adjacent right-of way in accordance with adopted policies and standards.

Policy d. Promote context-sensitive transportation facility design, which fits the physical context, responds to environmental resources, and maintains safety and mobility.

- *Action: Amend their street design standards to allow for design exceptions for various street elements (e.g., reduced lane width, methods and materials for provisions of sidewalks, etc.) to fit constrained settings, or unusual applications. Design exceptions would be subject to the review and approval of the City Engineer.*
- *Action: Amend their street design standards to allow for options related to storm drainage design on city facilities. These 'green street' design options would be subject to the review and approval of the City Engineer.*

Goal 7:	Provide a transportation system that meets present needs without compromising the ability of future generations to meet their needs.
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Policy a. Encourage an energy efficient transportation system.

Policy b. Increase the use of walking and bicycling for all travel purposes.

Policy c. Improve and enhance the livability of Forest Grove residents by decreasing reliance on the automobile and increasing the use of other modes to minimize transportation system impacts on the environment.

Policy d. Practice stewardship of air, water, land, wildlife, and botanical resources. Take into account the natural environments in the planning, design, construction and maintenance of the transportation system.

Goal 8:	Provide transportation performance measures set and maintained by the City.
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Policy a. A minimum intersection level of service standard shall be set for the City of Forest Grove. All public facilities under the city's jurisdiction shall be designed to meet this standard.

- *Action: Level of service D shall be the City's mobility standard to balance provision of roadway capacity with level of service and funding.*

Goal 9:	Develop a transportation system that is consistent with the City's Comprehensive Plan and adopted state and regional plans.
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- Policy a.** Coordinate and cooperate with adjacent jurisdictions and other transportation agencies to develop transportation projects that benefit the City of Forest Grove and the region as a whole.
- Policy b.** Work collaboratively with other jurisdictions and agencies so the transportation system can function as one system.
- *Action: City will consider the State adopted mobility standards for all state facilities, based on the Oregon Highway Plan.*
- Policy g.** Coordinate with ODOT to address improvements to State highways within Forest Grove that will benefit all modes of transportation.

Goal 10:	Efficiently use funding sources to implement transportation system improvement projects recommended in the TSP.
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- Policy a.** Provide a cost-effective transportation system where the public, land use development and users pay their respective share of the system's costs proportional to their respective demands placed upon the multimodal system.
- Policy d.** Identify local street improvement projects that can be funded by the State of Oregon to improve the state highway system.
- *Action: The City will identify local street system improvements that are cost-effective in improving state facility conditions. These projects could be candidates for State financial assistance.*
- Policy e.** Provide funding for local match share of joint funded capital projects with other public partners.
- Policy g.** Ensure pavement continuous sidewalks on at least one side of the street at a minimum for collector and local streets.

4. STREETS AND ROADS

This chapter presents detailed information about the existing street and roadway system, and its existing patterns of use and deficiencies. A discussion of future (2040) roadway needs and improvements recommendations based on the TSP is included in Chapter 7. Included in this chapter is information related to the following:

- Functional Classification of Streets
- Street Jurisdiction
- Roadway Design Characteristics (including cross-sections, local street connectivity, street grades and green streets)
- Existing Street Characteristics (including pavement condition, speeds and intersection traffic control)
- Existing Traffic Volumes
- Existing Traffic Performance
- Existing Traffic Safety

4.1 FUNCTIONAL CLASSIFICATION OF STREETS

The functional classification system is designed to serve a variety of transportation needs within the community ranging from short local trips to longer distance regional trips. The classification of a road or street relates to the predominate type of trip it serves (i.e., local, community or regional) and addresses the competing functional nature of roadway facilities as they relate to access, mobility, multi-modal transport, and facility design for these different types of trips. The goal of selecting functional classes for particular roadways is to provide a suitable balance of these four competing objectives that range from a high degree of through movement with little property access (arterials) to a high degree of local property access with minimal through movement (i.e., local street). **Figure 4-1** illustrates the balance between mobility and accessibility by road classification.

4.1.1 Classification of Study Area Streets

The existing functional classification of streets in the study area is summarized in **Table 4-1**. Any street not designated as either an arterial, collector, or neighborhood route is considered a local street. Some Washington County roadway classifications differ from those identified by the City of Forest Grove. Metro typically classifies roads that are considered to be of regional significance. Metro classifications are from the 2018 *Regional Transportation Plan*.

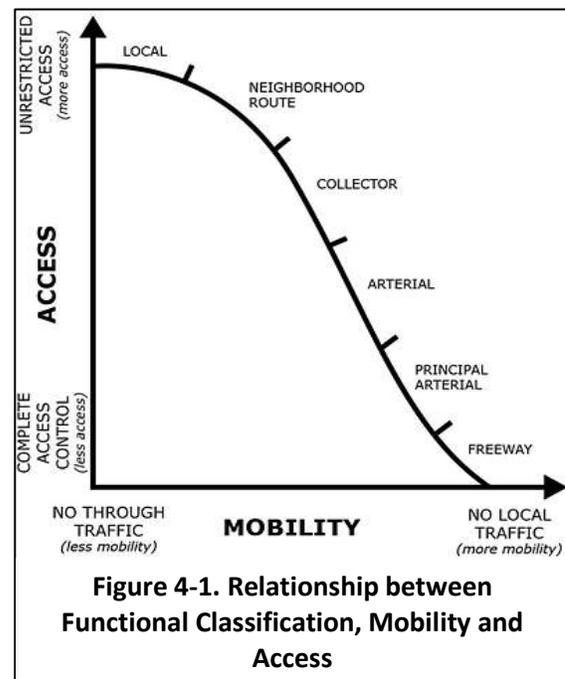


Table 4-1. Major Street Network Classifications

Street	Functional Classification			Lanes
	Forest Grove	Washington County	Metro	
Highway 47 (Nehalem Hwy/Quince Street)	Principal Arterial	Principal Arterial	Throughway	2
Martin Road	Arterial	Arterial	Arterial (outside UGB)	2
Pacific Avenue (vicinity of Quince Street)	Arterial	Arterial	Throughway/ Minor Arterial	4
Oak Street (north of Pacific)	Collector	Collector	NA	2
Sunset Drive	Collector	Collector	NA	2
22 nd Avenue	Collector	Collector	NA	2
23 rd Avenue	Collector	Collector	NA	2
24 th Avenue	Collector	Collector	NA	2
26 th Avenue	Collector	Collector	NA	2
Hawthorne Street	Collector	Collector	NA	2
Maple Street	Local	NA	NA	2
Porter Road	NA	NA	NA	2

Source: 2014 Forest Grove TSP, Washington County TSP and 2018 Metro *Regional Transportation Plan*
NA = Data not available or not applicable

4.1.2 Street Functional Classification Definitions

The functional classification system used by city, state, and federal transportation agencies is based on the desired function of the roadway to accommodate through-traffic movement, access to adjacent properties, or a combination of these functions. The functional classifications are used in planning and designing roadway facilities.

Based on the adopted Forest Grove *Transportation System Plan*, the City's functional classification system includes five categories of roads: Principal Arterials, Arterials, Collectors, Neighborhood Routes and Local Streets. **Table 4-2** provides descriptions of these classifications.

Table 4-2. Functional Classification Definitions

Functional Classification	Description
Principal Arterials	These streets form the backbone of the road network and are generally labeled freeways and highways. These routes connect over the longest distance (miles) and are spaced less frequently than other arterials. These highways generally span several jurisdictions and can have statewide importance. Principal Arterial Highways generally have limited at-grade connections and are managed to minimize the degradation of capacity while providing limited access to abutting properties.
Arterials	These streets interconnect with the principal arterial highway system or other regional roads and provide general mobility within and between communities. Correctly sized arterials at appropriate intervals (generally at approximately one mile spacing) allow through trips to remain on the arterial system and discourage the use of local streets for cut-through traffic. Arterial streets link major commercial, residential, industrial and institutional areas.

Table 4-2 Continued. Functional Classification Definitions

Functional Classification	Description
Collectors	These streets provide both access and circulation between residential, commercial, industrial and agricultural community areas and the arterial system. As such, collectors tend to carry fewer motor vehicles than arterials, with reduced travel speeds and will often have more signalized intersections. Collectors connect neighborhoods to community centers, corridors, or other nearby destinations in an urban area. Spacing of Collectors is generally less than one mile.
Neighborhood Routes	These streets are located in residential neighborhoods and provide connectivity to the Collector and Arterial system. They do not serve citywide or community circulation and typically serve trips over a distance of less than $\frac{3}{4}$ mile. Neighborhood Routes provide access to adjacent properties as well as through traffic movement and are characterized by lower speeds and fewer traffic signals. Spacing of Neighborhood Routes is generally less than one mile. Traffic management or calming measures are often allowed.
Local/Access Streets	Provides access to abutting properties. Local streets include a variety of designs and spacing depending on access needs

4.2 STREET JURISDICTION

Roadway ownership and maintenance responsibilities of the various roads throughout the study area are identified in **Table 4-3**. Highway 47 is a state highway and under ODOT jurisdiction. Martin Road, 24th Avenue, and Porter Road are under the jurisdiction of Washington County. The remaining roadways are under the jurisdiction of the City of Forest Grove.

Table 4-3. Roadway Jurisdictional Ownership

Street	Current Jurisdiction
Highway 47 (Nehalem Hwy/Quince Street)	Oregon Dept. of Transportation
Martin Road	Washington County
Pacific Avenue	Forest Grove
Oak Street	Forest Grove
Sunset Drive	Forest Grove
22 nd Avenue	Forest Grove
23 rd Avenue	Forest Grove
24 th Avenue	Washington County
26 th Avenue	Forest Grove
Hawthorne Street	Forest Grove
Porter Road	Washington County

Source: Forest Grove TSP, 2014.

4.3 ROADWAY DESIGN CHARACTERISTICS

Design characteristics of streets in Forest Grove were developed as part of the TSP and codified in the City's Development Code to meet the purpose and demand for each functionally-classified facility type. Because the actual design of a roadway can vary, the objective was to define a system that allows standardization of key characteristics to provide consistency, but also to provide criteria for application

that provides some flexibility, while meeting standards. In addition, guidance for the development of Green Streets consistent with regional policy is provided in this section.

4.3.1 Design Guidance

Table 4-4 summarizes key roadway design features that are pertinent to the layout of a system of study area collector streets. This guidance is based on the Forest Grove Development Code. As noted in the table, sidewalks would be required on both sides of all streets within the study area. Bike lanes and/or multi-use pathways were identified for those streets included for bikeway development in the City’s TSP. Minimum street right of way and paved widths are identified by functional classification.

Table 4-4. Design Parameters for Major Study Area Streets

Street	Classification	Lane Width	Parking	Bike Lanes	Sidewalks	Landscape Strip	Min. ROW	Min. Paved Width
Oak Street	Collector	10-12 ft	5-8 ft	5-6 ft	5-7 ft	0-8 ft	66 ft	40 ft
Laurel Street	Collector	10-12 ft	5-8 ft	5-6 ft	5-7 ft	0-8 ft	66 ft	40 ft
Maple Street	Local	14-16 ft	NA	NA	5 ft	5 ft	50 ft	32 ft
23 rd Avenue	Collector	10-12 ft	5-8 ft	5-6 ft	5-7 ft	0-8 ft	66 ft	40 ft
26 th Avenue	Collector	10-12 ft	5-8 ft	5-6 ft	5-7 ft	0-8 ft	66 ft	40 ft

Source: Forest Grove Development Code, Section 17.8.610 Streets and 2014 *Transportation System Plan*.

4.3.2 Local Street Connectivity

Much of the local street network in Forest Grove is fairly well connected, with multiple access opportunities for entering or exiting neighborhoods. This is particularly true for the area south of Pacific Avenue, where a “grid” street system is in place. However, north of Pacific Avenue, including the Oak Street plan area, the same level of connectivity is not complete. There are a number of locations where, due to the lack of connection points, neighborhood traffic is funneled onto one single street. This type of street network results in out-of-direction travel for motorists and an imbalance of traffic volumes. In addition to motor vehicles, direct connections contribute greatly to accessibility for pedestrians and bicyclists.

By providing connectivity between neighborhoods, out-of-direction travel and vehicle miles traveled (VMT) can be reduced, accessibility between various modes can be enhanced and traffic levels can be balanced out between various streets. The proposed connections in this section are intended to accomplish these objectives. Local connections can reduce potential neighborhood traffic impacts and mitigate capacity deficiencies by better dispersing traffic.

The preferred criteria used for providing connections is as follows

- Every 300 to 500 foot grid for pedestrians and bicycles
- Every 500-1,000 foot grid for automobiles

This guidance is generally consistent with the Title 1 of the Metro *Regional Transportation Functional Plan* (3.08.110) which lays criteria for planning new street construction or reconstruction to meet the objectives of the *Regional Transportation Plan*. The RTFP identifies the need for a network of major arterial roads on approximate one-mile spacing, and a network of minor arterial or collector streets at one-half mile spacing. Consideration in laying out these facilities is given to existing topography,

constraints in built and natural environmental features, and other issues. The RTFP encourages development of a street network that is logical and direct, and that incorporates connections not only within the development but also to existing streets. Provision of direct public right-of-way routes with limited closed end street design is supported.

The RTFP requires city and/or county regulations to provide:

- Full street connections with spacing of no more than 530 feet between connections except where not reasonably practical or cost-effective.
- Bicycle and pedestrian accessways on public easements or right-of-way spaced not more than 330 feet apart where full street connections are not possible (and where not precluded for the same reasons that full street connections cannot be made).

4.3.3 Green Streets

An additional element of roadway design that should be considered for construction projects in the Oak Street plan area is to include “green streets” characteristics. The main concept behind green street design is the incorporation of storm water management with environmentally sound street design to help protect streams and wildlife habitat. Green streets also have the additional benefit of adding other enhancing elements to the street right-of-way area, including increased safety and attractiveness for pedestrians and maximizing opportunities for street trees and other landscaping. Additionally, green street design allows for multimodal travel choices, and a visual and physical connection to public and open spaces. **Table 4-5** is a matrix outlining different green street design elements/techniques.

Application of green street design is generally not based on functional class and can span across and be applicable to multiple types of streets. Green street design may not be suitable in many circumstances. The soils within an area where green street design could be implemented need to be tested to determine the rate of infiltration they can sustain. In addition to green streets, traditional storm water management facilities need to be designed to control overflow if the capacity of the green streets are exceeded.

Table 4-5. Green Street Design Elements

Element	Application	How It Works
Rainwater Harvesting	Capture and re-use stormwater runoff for landscape irrigation.	Stormwater is conveyed to storage facilities and collected during the wet season for use during the dry season.
Permeable Paving	Replace most of the impermeable surfaces in the right-of-way with permeable materials, such as permeable pavement, concrete, or paving blocks.	The permeable materials allow water infiltration through the surface to the subgrade.
Bio-retention	Aboveground or subgrade containers are used to promote infiltration and evapotranspiration of stormwater.	Engineered or amended soils can be used to promote this process.
Bio-swales	Subgrade channels with vegetation used to convey and treat stormwater.	Vegetation is used to control flow velocities and settle pollutants.

4.4 EXISTING STREET CHARACTERISTICS

The field inventory of existing streets that was conducted for the TSP was updated using video resources to determine characteristics of roadways in the study area. Data collected included descriptions of existing street facilities, posted speed limits and intersection controls. These characteristics define the backbone transportation system upon which new roadway improvement concepts for the Oak Street area will be developed, as well as factors that affect roadway and intersection capacity and influence driver route choices.

4.4.1 Existing Streets and Roadways

The project study area is served by a roadway system that includes both State Highways and city streets. State Highways serving the project study area include OR 47 and OR 8 (Pacific Avenue/Baseline Road). OR 47 is designated by the City as a Principal Arterial, while OR 8 is designated as an Arterial. Other streets serving the project study area include Pacific and 19th Avenues (City Arterials), north/south collector facilities such as Oak Street, Laurel Street and Hawthorne Street, and east/west collectors such as 23rd and 26th Avenues.

Table 4-6 summarizes key features of the street system that serves the project study area. These features and their implications for development of the transportation system in the project study area are described in the following paragraphs.

Table 4-6. Summary of Key Features for Existing Streets

Roadway	Limits	Agency	Classification		Speed	Mobility Standard	Access Spacing
			City	ODOT			
OR 47	Pacific to 24th	State	Principal Arterial	District Hwy	25 mph	v/c=0.99	350 ft
OR 47	24 th to approx. 500 feet w/o Martin	State	Principal Arterial	District Hwy	40 mph	v/c=0.99	500 ft
OR 47	Approx 500 feet w/o Martin to west of Porter	State	Principal Arterial	Statewide Hwy	40 mph	v/c=0.99	990 feet
OR 47	West of Porter	State	Principal Arterial	Statewide Hwy	50 mph	v/c=0.99	990 feet
OR 8	East of Quince	State	Arterial	Statewide Hwy	40 mph	v/c=0.99	990 feet
Pacific Avenue	West of Quince	Forest Grove	Arterial	NA	35 mph	v/c=0.90 ^a	--
19 th Avenue	West of Maple	Forest Grove	Arterial	NA	35 mph	v/c=0.90 ^a	--
Hawthorne Street	Pacific to 26 th	Forest Grove	Collector	NA	25 mph	LOS E ^b	--
Oak Street	Pacific to OR 47	Forest Grove	Collector	NA	25 mph	LOS E ^b	--
Laurel Street	North of Pacific	Forest Grove	Collector	NA	25 mph	LOS E ^b	--
Maple Street	North of Pacific	Forest Grove	Local	NA	25 mph	LOS E ^b	--
23 rd Avenue	Sunset to Hawthorne	Forest Grove	Collector	NA	25 mph	LOS E ^b	--
26 th Avenue	Sunset to Juniper	Forest Grove	Collector	NA	25 mph	LOS E ^b	--

a Recommended for signalized intersections in Forest Grove TSP.

b Recommended for unsignalized intersections in Forest Grove TSP.

Oregon Highway 47

OR Highway 47 is a two-lane Principal Arterial that passes along the eastern edge of the study area, running north/south from its intersection with Pacific Avenue and then turning to the northwest along the northern edge of the study area through the intersection with Sunset Drive and beyond. From Pacific Avenue to approximately 500 feet west of Martin Road, OR 47 is designated by ODOT as a District Highway. Between Pacific Avenue and 24th Avenue, OR 47 is known as Quince Street and is signed for 25 mph speeds. It has a required access spacing of 350 feet.

From 24th Avenue to approximately 500 feet west of Martin Road, OR 47 is signed for 40 mph speeds and has a required access spacing of 500 feet. This District Highway designation would allow development of enhanced street connectivity to the state highway such as the proposed extension of Martin Road through the study area from the existing intersection on OR 47 as discussed in the City's TSP. OR 47 crosses the railroad tracks just to the south of 24th Avenue. This crossing includes reinforced pavement with crossing gates with warning bells and flashers.

Northwest of the intersection of OR 47 with Martin Road, the highway designation changes to Statewide Highway with speed limits ranging from 40 mph to 50 mph. Access spacing requirements increase to 990 or 1,100 feet, respectively, for these two speed zones. This designation offers fewer opportunities for added street intersections serving the focus study area.

There are currently bicycle lanes and sidewalks on OR 47 between Pacific Avenue and the railroad tracks. From the railroad crossing to beyond Sunset Drive there is a multi-use path along the west and south sides of OR 47 as well as bicycle lanes or wide shoulders. There is also a sidewalk along the east side of OR 47 as far north as the Martin Road intersection. There is a center turn lane between Pacific Avenue and the railroad tracks and left turn channelization in a highway median from 24th Avenue to beyond Sunset Drive.

Oregon Highway 8

OR 8 (Pacific Avenue) serves the project study area by connecting the City of Forest Grove to Cornelius, Hillsboro, and other destinations to the east. The state highway designation terminates at the intersection with OR 47 (Pacific Avenue). OR 8 is designated by the City as an Arterial and by ODOT as a Statewide Highway. Pacific Ave/OR 8 travels through the study area as a four-lane arterial with center left turn lane, bike lanes and wide shoulders before splitting into a one-way couplet with 19th Avenue at Maple Street. The existing speed limit approaching Quince Street (OR 47) is 40 mph with a required access spacing of 990 feet.

Martin Road

Martin Road is a two lane rural road under the jurisdiction of Washington County. The road has minimal shoulders and operates at 50 mph with frequent driveways in many locations. Martin Road provides access to the City of Forest Grove from its surrounding agricultural area including Verboort and ultimately links the community to US 26 which accesses other destinations in Washington County and the City of Portland. Washington County is currently conducting design for improvements along Martin Road to widen and improve existing pavement including bicycle lanes between Verboort Road and OR 47. The existing stop-controlled intersection with OR 47 will be rebuilt to provide a single lane

roundabout. According to information on the Washington County website, this new roundabout is expected to be complete by the fall of 2022.

The City's TSP recommends the future extension of Martin Road to the southwest of OR 47 to provide access to the Oak Street plan area, ultimately connecting to 23rd Avenue.

Collector Roadways

The remaining streets in the study area are maintained by the City of Forest Grove and, with the exception of Maple Street, are classified as collector routes. Maple Street north of Pacific Avenue is classified as a local road. All the local and collector streets included in Table 4-6 have two travel lanes, no bicycle lanes, and sidewalks in many locations although the system is incomplete. These streets have a posted speed limit of 25 mph.

4.4.2 Traffic Speed

Speed zones on arterials and collectors within the City of Forest Grove are summarized in **Table 4-6**. There are three ways a speed zone can be established by statute. One is in a "residence district", another is a "business district" and the third is a school zone.¹ A residence district can be posted at 25 mph. A business district and a school zone can be posted at 20 mph. In all other cases, an engineering study is required to determine the appropriate speed zone (the basis is the 85th percentile speed).² The study is typically done by the appropriate ODOT region office. The recommendation (based on the engineering study) is then forwarded from the ODOT region office to Salem to be approved by the State Traffic Engineer.

If the jurisdiction requesting the speed study does not agree with the results of the engineering study and recommendation to the State Traffic Engineer, the jurisdiction can appeal the decision to the Speed Zone Review Panel (which meets once a year).

Vehicle speeds on several collector and residential streets are a concern for the community. In most cases, speeding becomes very noticeable when it is above 30-35 miles per hour. Speeding typically occurs on local streets where the streets are wide and straight for long stretches, or where downhill grades are extended.

4.4.3 Intersection Control

Two of the intersections in the study area are currently traffic signal-controlled – OR 47/Quince Street with Pacific Avenue and OR 47 with Sunset Drive. The intersections of OR 47 with Oak/Porter Street and Martin Road are controlled by two-way stop signs on the side streets. The intersection of OR 47 with Martin Road is currently in design for construction of a single lane roundabout which is expected to be complete by the fall of 2022.

¹ Speed zones can be established by statute which is vaguely defined in the Oregon Vehicle Code in 801.430.

² The 85th percentile vehicle speed represents a condition when 15 percent of the vehicles surveyed were traveling faster than the 85th percentile speed and 85 percent were traveling slower than the 85th percentile speed.

4.5 EXISTING TRAFFIC VOLUMES

Figure 4-2 presents existing PM peak hourly traffic volumes at key study area intersections. Traffic volume data was collected on July 14, 2020. According to ODOT's analysis procedures this data was seasonally adjusted to form the basis of existing conditions operations analysis. This adjustment was based on the last five years of volume data collected at Automated Traffic Recording station (ATR) 34-009. Based on that data a seasonal adjustment factor of 1.023 was calculated and applied to the counts.

Additionally, ODOT requested that the raw traffic count data be modified to include an adjustment for traffic volume variations that have been observed due to the COVID-19 pandemic. To measure and study the effects of COVID-19 on traffic in Oregon, ODOT has been publishing a weekly traffic report which documents the change in volume from 2019 to 2020 on select major routes within the state. Using this data as collected for a highway with similar characteristics to OR 47, a specific adjustment factor was identified in consultation with ODOT staff. This adjustment factor was based on data collected on OR 18 to the west of McMinnville in the report published on July 24, 2020. A negative adjustment factor of 2 percent was identified and applied to the traffic count data. Traffic count data and adjustments are presented in **Appendix A**.

4.6 EXISTING TRAFFIC PERFORMANCE

While analysis of traffic flows and functional classifications are useful in understanding the general nature of traffic in an area, traffic volumes alone indicate neither the ability of the street network to carry additional traffic, nor the quality of service afforded by the street facilities. For this, the concept of level of service has been developed to correlate traffic volume data to subjective descriptions of traffic performance at intersections, and specific mobility targets have been identified that determine when performance is acceptable or not.

Mobility standards for ODOT, Washington County and the City of Forest Grove apply to roadways under their jurisdiction. ODOT defines a maximum volume-to-capacity ratio for Highway 47 of 0.99³.

Washington County defines acceptable performance in urban areas as volume-to-capacity (v/c) ratio of 0.99 with LOS E or better⁴ in the highest peak hour with v/c of 0.90 or LOS D in the second highest hour. The City of Forest Grove uses a v/c ratio of 0.90 for signalized intersections and LOS E for the stop-controlled movement at unsignalized intersections.

Table 4-6 provides a summary of PM peak hour levels of service at the four intersections selected for analysis as part of the Oak Street Refinement Plan. This analysis is based on the PM peak hour forecasts described above which are illustrated as turning movement projections shown in Figure 4-2. The 2020 analysis also makes the following assumptions:

- Uses existing intersection peak hour factors (PHFs)
- Uses an intersections saturation flow rate of 1750 for three of the four intersections. With an overall truck percentage less than 5.0 percent, the intersection of OR 47 with Pacific Avenue uses a saturation flow rate of 1900 based on guidance in the ODOT Analysis Procedures Manual.

³ *Oregon Highway Plan, Policy Element, Table 7, Oregon Department of Transportation, 1999.*

⁴ *Washington County 2035 Transportation System Plan, Washington County, 2019.*

Figure 4-2. Existing Traffic Volumes



Table 4-7. Existing 2020 PM Peak Hour Intersection Level of Service

Intersection	Mobility Target	Level of Service (LOS)	Average Delay (Seconds)	Volume / Capacity (V/C)
<i>Unsignalized Intersections</i>				
OR Highway 47 @ Oak Street	V/C=0.99	D	27.1	0.31
OR Highway 47 @ Martin Road	V/C=0.99	F	127.3	1.13
<i>Signalized Intersection</i>				
OR Highway 47 @ Sunset Drive	V/C=0.99	C	32.5	0.43
OR Highway 47 @ Pacific Avenue	V/C=0.99	D	47.6	0.90

Note: Performance results for the unsignalized intersections represent the worst movement.

Bold text indicates location and year when mobility target is expected to be exceeded.

Source: SCJ Alliance, 2020

As noted in the table, all study area intersections are currently operating at better than their mobility targets with the exception of OR 47 at Martin Road. This intersection currently exceeds its mobility target of 0.99. To address this problem location, Washington County is currently designing improvements for single lane roundabout traffic control which is scheduled to open in 2022. Operations with this improvement are expected to be substantially better than the mobility target. Operations analysis worksheets for the 2020 PM peak hour are included in **Appendix B**.

4.7 TRAFFIC SAFETY

Crash data was obtained for the study intersections from Oregon Department of Transportation for the period between January 1, 2014 and December 31, 2018 (this is the most recently available data). This data has been analyzed and the results are depicted in the following four tables for study area intersections and the segment of OR 47 between Sunset Drive and Pacific Avenue as a whole. Review of data included identification of the total number of crashes, crashes by type and severity and crash rates. Crash data is included in **Appendix C**.

Table 4-8 presents a summary of crashes at the four study area intersections, identifies the existing crash rates, and notes the predominate type of crashes that are occurring at each location. Typically, intersections on collector and arterial roadways with a collision rate over 1.00 suggest further safety investigation is warranted. Only the intersection of OR 47 with Martin Road currently exceeds this metric with the predominate crash type being turning movements. However, the pending roundabout improvement at this location should help to resolve this problem and substantially enhance safety at this location.

Table 4-8. Intersection Crashes in Vicinity of Oak Street Plan Area, 2014-2018

Intersection	Total Crashes	Daily Traffic	Annualized Crash Rate	Predominate Crash Type
OR Highway 47 @ Sunset Drive	10	12,250	0.45	Turns
OR Highway 47 @ Oak Street	12	10,500	0.63	Angle
OR Highway 47 @ Martin Road	33	15,075	1.20	Turns
OR Highway 47/Quince Street @ Pacific Avenue	40	41,300	0.53	Rear End

Note: Crash rates are calculated per Million Entering Vehicles at the intersection.

Source: Oregon Department of Transportation (ODOT) crash analysis and reporting unit, 2020.

Table 4-9 summarizes the severity of existing crashes at the four study area intersections. As indicated in the table, there were no fatal crashes in the study area over the five-year analysis period. A total of 95 crashes were recorded at the study intersections. Fifty-six of the 95 recorded crashes (59 percent) involved injuries, while 39 (41 percent) involved property damage only. It is expected that the number of crashes recorded at the intersection of OR 47 with Martin Road will drop significantly when the roundabout is in place.

Table 4-9. Intersection Crashes by Severity, 2014-2018

Road	Severity of Crash			Total Crashes
	Fatal	Injury	PDO	
OR Highway 47 @ Sunset Drive	0	7	3	10
OR Highway 47 @ Oak Street	0	10	2	12
OR Highway 47 @ Martin Road	0	12	21	33
OR Highway 47/Quince Street @ Pacific Avenue	0	27	13	40
Totals	0	56	39	95

Note: PDO means Property Damage Only

Source: ODOT, 2020

Table 4-10 summarizes crash data by type for three roadway segments along OR 47. As shown in the table, crashes are fairly evenly distributed in each segment although the predominate crash type varies depending on location. Angle and turn crashes are more predominate in the segment between Sunset Drive and Oak Street which are the predominate type of crashes for both the Sunset Drive and Oak Street intersections. Turning crashes predominate in the segment between Oak Street and Martin Road which is consistent with the crash experience at the Martin Road intersection. Rear end crashes predominate between Martin Road and Pacific Avenue which is characteristic of the Pacific Avenue intersection. It should be noted that this data does not include the crashes attributable to the side street approaches at the intersections but only traffic actually on OR 47.

Table 4-10. Summary of Roadway Crashes by Type, 2014-2018

Road	Segment	Type of Crash						Total Crashes
		Angle	Turn	Rear End	Side-swipe	Fixed Object	Other	
OR Highway 47	Sunset Drive to Oak Street	11	7	3	1	4	2	28
OR Highway 47	Oak Street to Martin Road	1	26	2	1	1	0	31
OR Highway 47	Martin Road to Pacific Avenue	0	9	20	0	0	2	31

Source: ODOT, 2020

Table 4-11 presents a summary of roadway segment crashes by severity. As indicated in the table, there were no fatal crashes along OR 47 during the five-year period included in the data. Crashes along OR 47 were split between those involving injuries and those resulting only in property damage (a total of 52 injury crashes (58 percent) versus 38 PDO crashes (42 percent)).

Table 4-11. Summary of Roadway Crashes by Severity, 2014-2018

Road	Segment	Severity of Crash			Total Crashes
		Fatal	Injury	PDO	
OR Highway 47	Sunset Drive to Oak Street	0	21	7	28
OR Highway 47	Oak Street to Martin Road	0	12	19	31
OR Highway 47	Martin Road to Roy Pacific Avenue	0	19	12	31

Note: PDO means Property Damage Only

Source: ODOT, 2020

Table 4-12 presents a summary of crash data for the entire OR 47 corridor from Sunset Drive to Pacific Avenue and calculates an overall crash rate of 2.9 crashes per million vehicle miles of travel.

Table 4-12. Summary of Roadway Crashes by Severity, 2014-2018

East/West Roadway	North/South Roadway	Reported Crashes	Distance	ADT	Crash Rate (per MVMT)
OR Highway 47	Sunset Drive to Pacific Ave	90	1.69 miles	10,050	2.90

Note: MVMT means Million Vehicle Miles of Travel

Source: ODOT, 2020

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5. BICYCLE AND PEDESTRIAN TRANSPORTATION SYSTEMS

This section summarizes key features of the existing and proposed bicycle and pedestrian transportation systems in and around the Oak Street plan area in Forest Grove. Included is a discussion of:

- Existing bicycle and pedestrian facilities,
- Planning context for the development of new bicycle and pedestrian facilities, and
- Planned or programmed facilities

Key destinations for the active bicycle and pedestrian transportation systems within and near the study area include various schools, parks, and employment/retail commercial centers located within reasonable proximity. The Oak Street plan area is also the focus of a significant regional trail system which maximizes proximity to Council Creek and the scenic Tualatin Valley.

5.1 EXISTING BICYCLE FACILITIES

The Oregon Transportation Planning Rule requires adequate bicycle facilities on all arterials and major collectors in the state. A general inventory of the bike lane network within the City was conducted for the City’s 2014 TSP. This system is illustrated in **Figure 5-1** which was excerpted from the TSP.

Figure 5-1. Existing Bicycle Facilities



Source: *Transportation System Plan*, City of Forest Grove, 2014.

As noted in Figure 5-1, the arterial and collector roadway system within the vicinity of the Oak Street plan area has fairly continuous bicycle facilities. Key features of the existing bicycle circulation system that are relevant to the Oak Street plan area include:

- Bicycle lanes and/or wide shoulders are provided along OR 47 through the study area.
- Bicycle lanes also exist along both sides of Pacific and 19th Avenues except for the segment on the south side of Pacific Avenue between Oak and Quince Streets.
- Gaps in the existing bicycle system include all collector streets in the study area.
- Protected crossing locations along arterial streets exist in only a few locations. Along OR 47, the only existing signalized pedestrian crossings are at Pacific Avenue and Sunset Drive, a separation of approximately 1.7 miles. With only two protected crossing locations in the study area, a significant barrier-effect exists for pedestrian and bicycle traffic attempting to cross the highway. The pending roundabout improvement at the intersection of OR 47 at Martin Road will offer an addition crossing when this project is completed in 2022. However, it should be noted that both the Tualatin Valley Scenic Bikeway and the Council Creek Regional Trail Plan both call for a trail crossing of OR 47 at Oak Street which is currently unprotected.

Key destinations for the active bicycle transportation system within and near the study area include various schools, parks, and employment/retail commercial centers located within reasonable proximity. As noted, the study area is also the focus of a significant regional trail system which maximizes proximity to Council Creek and the Tualatin Valley scenic corridor.

5.2 EXISTING TRAILS/BIKEWAYS

The primary bikeway of significance to the Oak Street plan area is the Tualatin Valley Scenic Bikeway (TVSB). Illustrated in **Figure 5-2**, the Oregon State Parks designated trail uses largely existing country roads in the Tualatin Valley for recreational travel between the south side of Hillsboro and Banks with a connection to the Banks-Vernonia State Trail. Through the City of Forest Grove, the TVSB enters town on Porter Road with an at-grade crossing of OR 47 directly onto Oak Street. The trail continues down Oak Street, crosses the railroad tracks, and then turns onto 22nd Avenue to reach other destinations in the City. The TVSB leaves town on Maple Street where it crosses OR 47 and continues into the rural valley.

5.3 PLANNING CONTEXT

Planning for development of a bicycle circulation system in and adjacent to the Oak Street plan area is guided by several documents including the *Forest Grove Transportation System Plan*, the *Washington County TSP* and Road Standards, and the *Council Creek Regional Trail Plan*.

Forest Grove Transportation System Plan – The TSP provides policy guidance on the development of the City’s bicycle circulation system and identifies a specific list of improvements to enhance that system. The goal of the TSP is to fill gaps and develop a more complete bicycling network. That system would include an expanded bike lane network on streets where bicyclists could benefit from delineated separation from motorists, while shoulder bikeways (serving bicyclists and pedestrians) are identified on several roadways at the urban/rural fringe. The TSP Bicycle Plan is illustrated in **Figure 5-3**. As noted in the figure, the extension of Martin Road into the Oak Street planning area is proposed to have bicycle lanes as is Hawthorne Street to the west of the planning area.

Figure 5-2. Tualatin Valley Scenic Bikeway

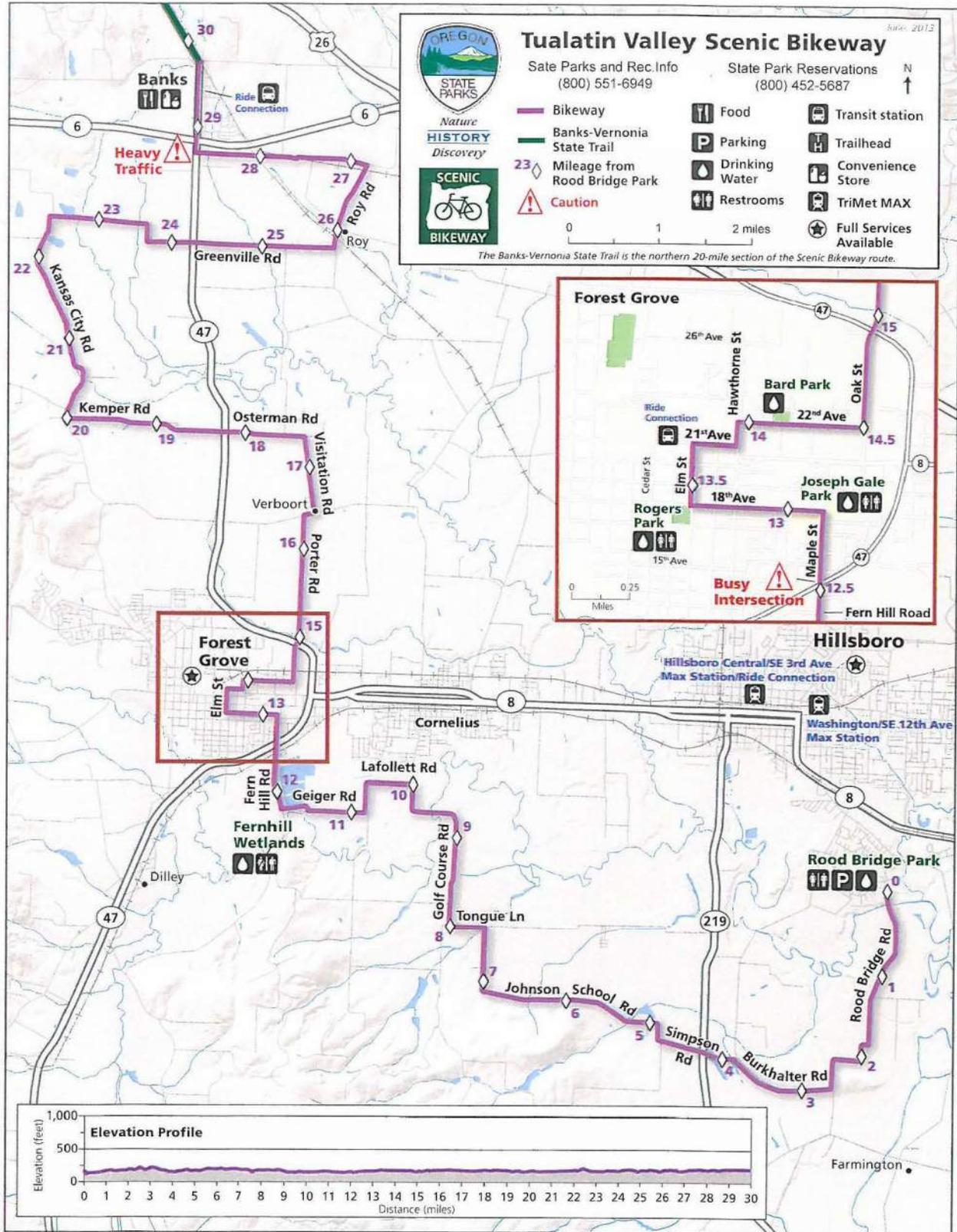


Figure 5-3. Forest Grove Bicycle Plan



Washington County TSP – The Washington County TSP provides guidance on the development of a comprehensive bicycle system along major corridors in the county. In the Forest Grove area, the TSP provides the basis for the pending improvements along Martin Road that would add 10-foot shoulders to accommodate bicycle travel. The TSP also identifies the Council Creek Regional Trail project connecting Banks, Forest Grove and Hillsboro for which a refinement plan has been prepared and phased construction scheduled.

Council Creek Regional Trail Plan – This plan evaluated a series of alignment options for a trail connection linking Banks, Forest Grove and Hillsboro and identified a preferred concept. The proposed trail alignment through Forest Grove is presented in **Figure 5-4**. **Figure 5-5** illustrates selected cross-sections that are pertinent to the Oak Street plan area and includes several photos in the vicinity of the future trail.

5.4 BICYCLE SYSTEM IMPROVEMENTS

Forest Grove has the potential to transform itself into one of the region’s most bikeable communities. The foundations of an excellent system already exist, but challenges will arise while improving it further. The TSP identifies a 20-year Preferred Plan for expanding this system which is also illustrated in Figure 5-3. **Table 5-1** lists bicycle improvement projects in the vicinity of the Oak Street plan area that were excerpted from the TSP. The table identifies projects specifically focusing on bicycle facilities, while the roadway improvement chapter (Chapter 7) identifies street system improvements (e.g., new street corridors) that would also include bike lanes or wide shoulders. Projects that would include joint bicycle/pedestrian improvements (e.g., shared use paths or street improvement projects that would include bike lanes and sidewalks), are listed later in this chapter under the discussion of pedestrian facilities.

Table 5-1. Bicycle System Projects and Programs

Project	Segment	Description
Hawthorne Street	26 th Avenue to Pacific Avenue	Re-stripe roadway to provide bike lanes
Willamina Avenue	Thatcher Road to Sunset Drive	Re-stripe roadway to provide bike lanes
Cedar Street	OR 47 Path to 24th Avenue	Develop Bicycle Boulevard
Council Creek Regional Trail	Three	Construct Council Creek Trail through Forest Grove consistent with the Council Creek Regional Trail Master Plan (August 2015)

5.5 EXISTING PEDESTRIAN FACILITIES

The Oregon Transportation Planning Rule requires adequate pedestrian facilities on all arterials and major collectors in the state. A general inventory of the sidewalk and bike lane network within the project study area was conducted for the City’s 2014 TSP and key features include:

- Provision of sidewalks on both sides of OR 47 north of Pacific Avenue to the railroad track and continuing along the east side of the highway to Martin Road. On the westside of Martin Road is a multi-use path that continues through the study area.
- Provision of sidewalks along both sides of Pacific and 19th Avenues.

Figure 5-4. Council Creek Trail Plan

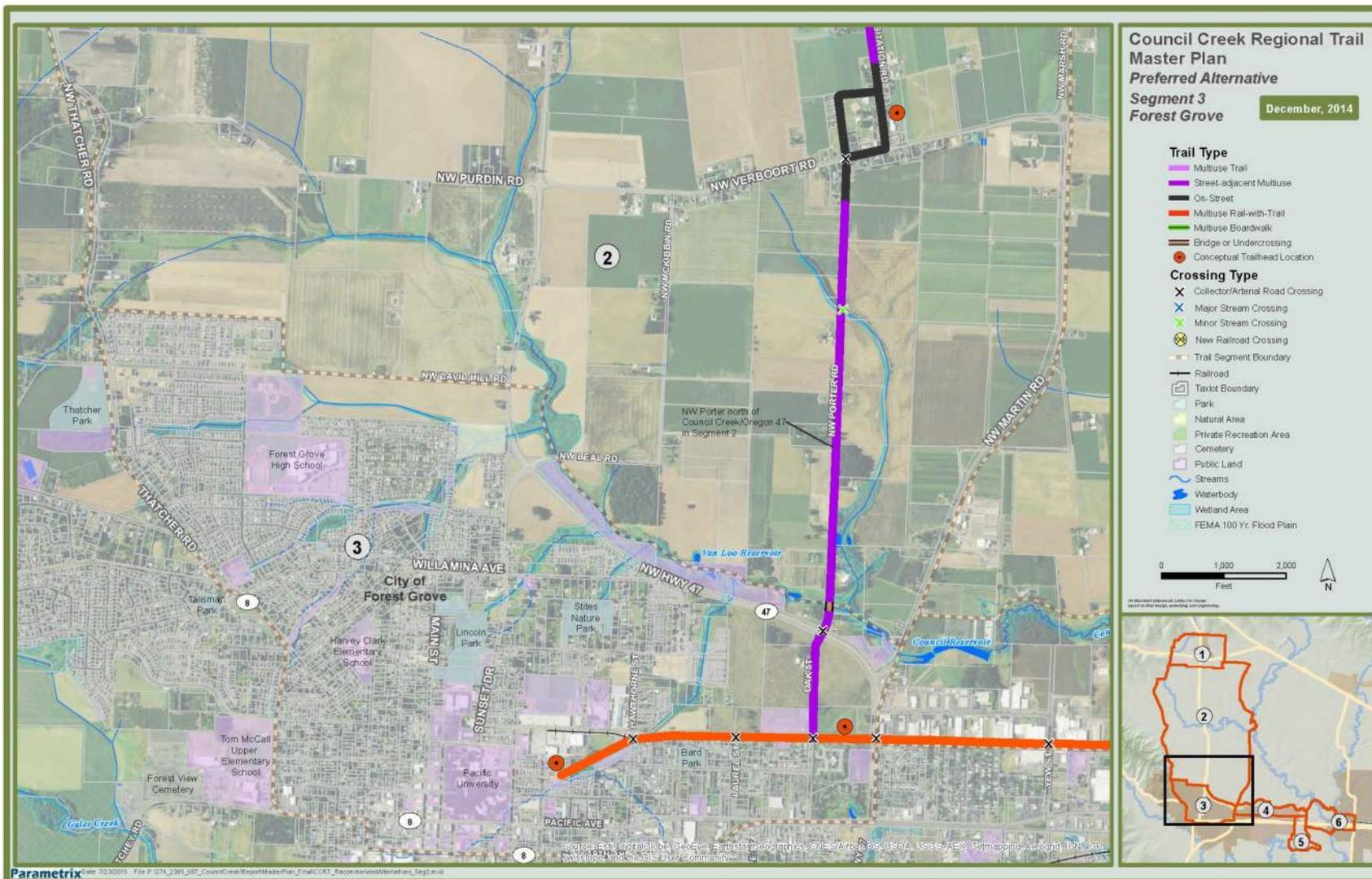
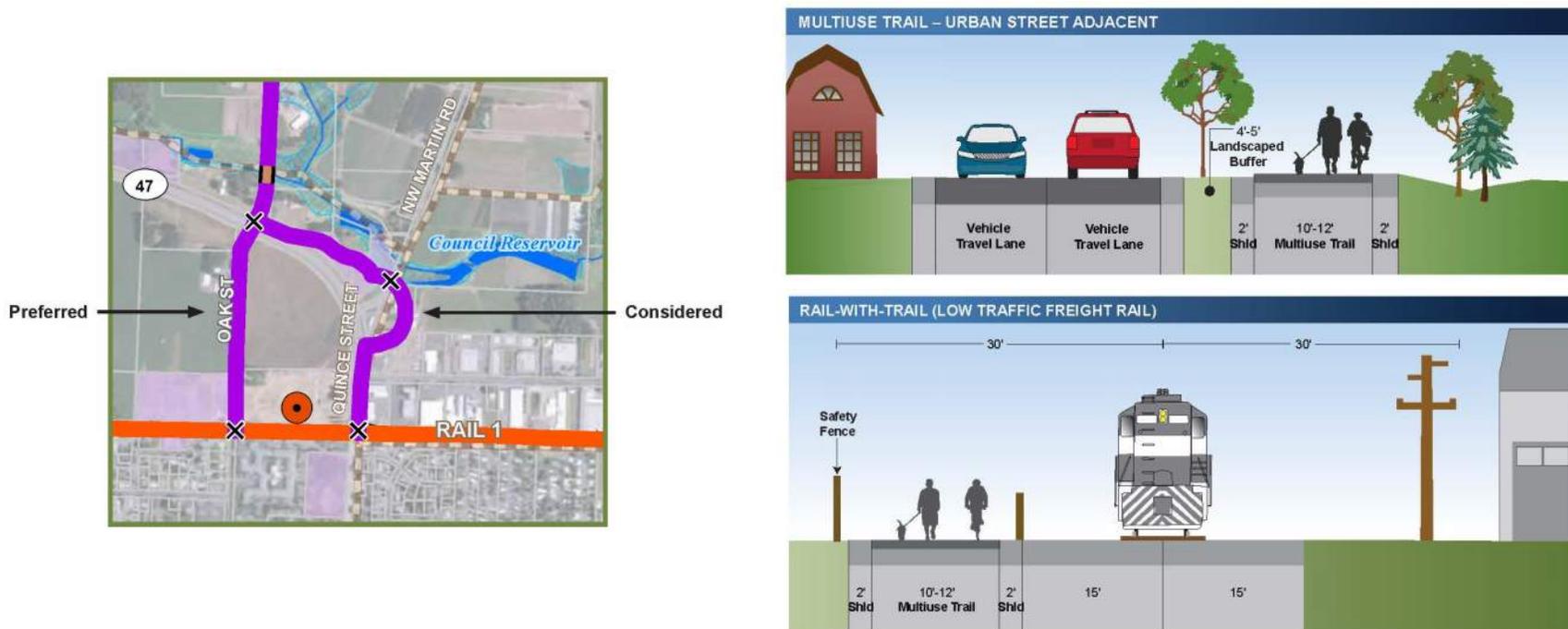
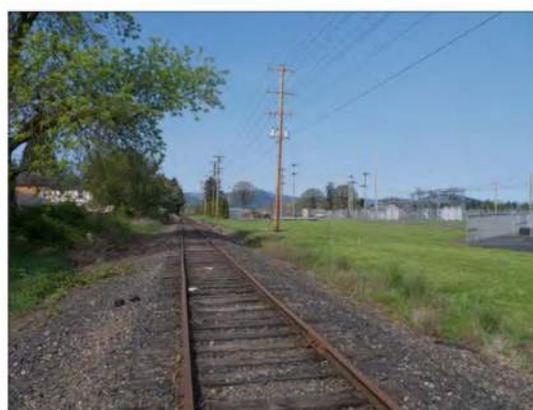


Figure 5-5. Council Creek Trail Design Elements



Oak Street/Oregon 47/Porter Road



Rail corridor near BPA substation



Rail corridor near Hawthorne Street

Source: Council Creek Regional Trail Plan, Metro, 2014

- Provision of sidewalks on both sides of Oak Street from Pacific Avenue to just north of 22nd Avenue, along both sides of 22nd Avenue between Oak and Hawthorne Streets, along the north side of 23rd Avenue west of Hawthorne Street, and along portions of Hawthorne Street south of 22nd Avenue.
- Gaps in the existing sidewalk system in the project study area include along the south side of 23rd Avenue, portions of Hawthorne Street northward from approximately 200 feet north of Pacific Avenue on the east side and 600 feet north of Pacific Avenue on the west side, and along the entire length of 26th Avenue.
- Protected crossing locations along arterial streets existing in only a few locations. Along OR 47, the only existing signalized pedestrian crossings are at Pacific Avenue and Sunset Drive, a separation of approximately 1.7 miles. With only two protected crossing locations in the study area, a significant barrier-effect existing for pedestrian and bicycle traffic attempting to cross the highway. The pending roundabout improvement at the intersection of OR 47 at Martin Road will offer an addition crossing when this project is completed in 2022. However, it should be noted that both the Tualatin Valley Scenic Bikeway and the Council Creek Regional Trail Plan both call for a trail crossing of OR 47 at Oak Street which is currently unprotected.

The existing sidewalk/pedestrian system in the Oak Street plan area is illustrated in **Figure 5-6**.

Figure 5-6. Existing Sidewalks/Highway Shoulders



Source: *Transportation System Plan*, City of Forest Grove, 2014.

5.6 PLANNING CONTEXT

Planning for development of a pedestrian circulation system in and adjacent to the Oak Street plan area is guided by several documents including the Forest Grove *Transportation System Plan* and the *Council Creek Regional Trail Master Plan* (Metro).

Forest Grove Transportation System Plan – The TSP provides policy guidance on the development of the City’s pedestrian circulation system and identifies a specific list of improvements to enhance that system. The goal of the TSP is to fill gaps and develop a more complete walking network including both sidewalks and trails. The TSP Pedestrian Plan is illustrated in **Figure 5-6**. As noted in the figure, the extension of Martin Road into the Oak Street plan area is proposed to have sidewalks, as is Hawthorne Street to the west of the planning area and Laurel Street and 26th Avenue within the Oak Street plan area.

Council Creek Regional Trail Plan – This plan evaluated a series of alignment options for a trail connection linking Banks, Forest Grove and Hillsboro and identified a preferred concept. The proposed trail alignment through Forest Grove is presented in Figure 5-4. Figure 5-5 illustrates selected cross-sections that are pertinent to the Oak Street plan area and includes several photos in the vicinity of the future trail.

5.7 PEDESTRIAN SYSTEM IMPROVEMENTS

The pedestrian network builds upon Forest Grove’s existing system of sidewalks, shared use paths, neighborhood accessways and other pedestrian infrastructure currently in place. Depicted in the TSP’s Pedestrian System Plan (**Figure 5-7**), projects are intended to enhance pedestrian safety and convenience while making walking a more attractive travel mode. These projects include filling gaps in the sidewalk system, developing an interconnected shared use path network, and targeting specific intersections for pedestrian crossing enhancements.

Table 5-2 lists pedestrian improvement projects in the vicinity of the Oak Street plan area that were excerpted from the TSP. The table identifies projects specifically focusing on sidewalks, while the roadway improvement chapter (Chapter 7) identifies street system improvements (e.g., new street corridors) that would also include sidewalks or wide shoulders. Projects that would include joint bicycle/pedestrian improvements (e.g., shared use paths or street improvement projects that would include bike lanes and sidewalks), are listed earlier in this chapter under the discussion of bicycle facilities.

Table 5-2. Pedestrian System Projects and Programs

Project	Segment	Description
Highway 8/Pacific Avenue	Oak Street to Mountain View Lane	Complete sidewalk gaps
Willamina Avenue ³	Gales Creek Road to Sunset Drive	Complete sidewalk gaps
Highway 8/Baseline Street	Mountain View Lane to east city limits	Complete sidewalk gaps
Highway 8/Adair Street	Mountain View Lane to east city limits	Complete sidewalk gaps
21st Avenue	Cedar St. to Douglas Street	Complete sidewalk gaps
23rd Avenue ³	Cedar Street to Sunset Drive	Complete sidewalk gaps

Table 5-2 Continued. Pedestrian System Projects and Programs

Project	Segment	Description
Hawthorne Street	12th Avenue to 26h Avenue	Complete sidewalk gaps
Laurel Street	22 nd Avenue to Pacific Avenue	Complete sidewalk gaps
Highway 8	Mountain View Lane to Highway 47	Pedestrian Crossing (potentially at location of new traffic signal)
Council Creek Regional Trail	Three	Construct Council Creek Trail through Forest Grove consistent with the Council Creek Reginal Trail Master Plan (August 2015)

Figure 5-7. Forest Grove Pedestrian Plan



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6. TRANSIT SYSTEM

6.1 INTRODUCTION

This chapter discusses the availability of existing transit service in the general vicinity of the Oak Street plan area. Included is fixed route bus service offered by TriMet, local transit service within Forest Grove known as GroveLink, and Ride Connection’s WestLink inter-community paratransit service within Washington County.

6.2 FIXED ROUTE BUS SERVICE

Forest Grove is currently served by a single fixed-route TriMet bus line, 57-TV Highway/Forest Grove. The transit line is the principal bus corridor in Washington County, providing frequent service (every 15 minutes or better) every day between Downtown Forest Grove, Cornelius, Hillsboro, Aloha and Beaverton with MAX light rail connections provided at Hillsboro Central and Beaverton Transit Center stations. Transfer to WES commuter rail service is also provided at the latter station. Operating hours of service for Route 57 connecting to Forest Grove are summarized in **Table 6-1**.



Table 6-1. Fixed Route Bus Service in Forest Grove

Route/Service Area	Service Hours and Frequency (Average)		
	Weekday	Saturday	Sunday
Route 57 – Forest Grove to Beaverton Transit Center			
Times Inbound	4:33am-12:00am	5:29am-12:00am	5:29am-12:00am
Times outbound	4:39am –11:39am	5:09am-11:11pm	5:09am-11:11pm
Peak Hours	15 minutes or less	20 minutes or less	20 minutes or less
Off-Peak Hours	20 minutes or less	30 minutes	30 minutes

Source: TriMet Route Schedule, August 2020.

Within Forest Grove, the #57 bus travels along Pacific Avenue and 19th Avenue from the city’s eastern boundary west to B Street where it turns around and heads back towards Hillsboro and Beaverton. Along this route, the transit line serves Pacific University and the Forest Grove town center but does not provide service to residential communities located to the north or west of downtown. Based on ridership data collected for the City’s TSP, the highest levels of transit activity are located near Pacific University and the shopping center near the east end of the 19th/Pacific Avenue couplet. Per the TSP, on an average weekday, route 57 has over 1,000 passenger boardings within the city limits.

Westbound bus stops in the project study area, from east to west, are located at Quince Street (Highway 47), Oak Street, Maple Street, 2900 Block of Pacific Avenue, Hawthorne Street, Elm Street, and Cedar Street. Eastbound bus stops in the project study area, from west to east, are at Cedar Street, Elm Street, Hawthorne Street, 19th Ave/19th Way, Maple Street, and Quince Street (Highway 47). No transit service currently exists in the focus study area. The boundary of the focus study area is approximately 1,300 feet or more from the nearest bus stops on Pacific Avenue, a distance that is close to the one-quarter mile walking distance that is normally considered to be the maximum acceptable walking distance to transit.

The TSP identifies potential actions that could be taken in Forest Grove to improve transit service coverage within the community. For example, as residential areas to the north and west of the city center are developed, demand for future service in these areas will increase. Route 57 may need to be reconfigured to remove service from one side of the 19th Avenue/ Pacific Avenue couplet and add service via another route, such as Thatcher Road or Sunset Drive.

6.3 RIDE CONNECTION

Ride Connection is a non-profit umbrella organization dedicated to providing transportation service in areas and for persons not adequately served by fixed route buses. Ride Connection service is designed primarily for people over the age of 60 and for people with disabilities, although service is available for the general public when traveling in areas not served by public transportation. Ride Connection provides a variety of program options, and most services are available Monday through Friday although hours, availability, and days of service will vary. Service is client-initiated through a phone call or an online request with an advance reservation requirement of four days. Office hours are Monday through Friday between the hours of 7:30 am and 5:00 pm. Service is provided at no charge, although donations are accepted. Two of the key service options serving Forest Grove are GroveLink and WestLink.

6.3.1 GroveLink Service

GroveLink operates public transportation service for the Forest Grove community, building on and expanding the regional services provided by TriMet with Route 57 and Ride Connection’s WestLink intercity service (described below). As illustrated in **Figure 6-1** three route are operated within the City to link residents, employees, and students at Pacific University with downtown destinations and Route 57 on Pacific and 19th Avenues. GroveLink runs Monday through Friday between 6:30 am and 6:50 PM. The services is free and open to the public. Service is offered on an approximate ½ hour basis during peak travel periods, and hourly during off-peak periods. Between designated bus stops flag service is also offered, as is deviated route service. This service is client-initiated one day in advance with pick-ups and drop-offs scheduled within ½ mile of the fixed route system.



Figure 6-1. GroveLink Route Map

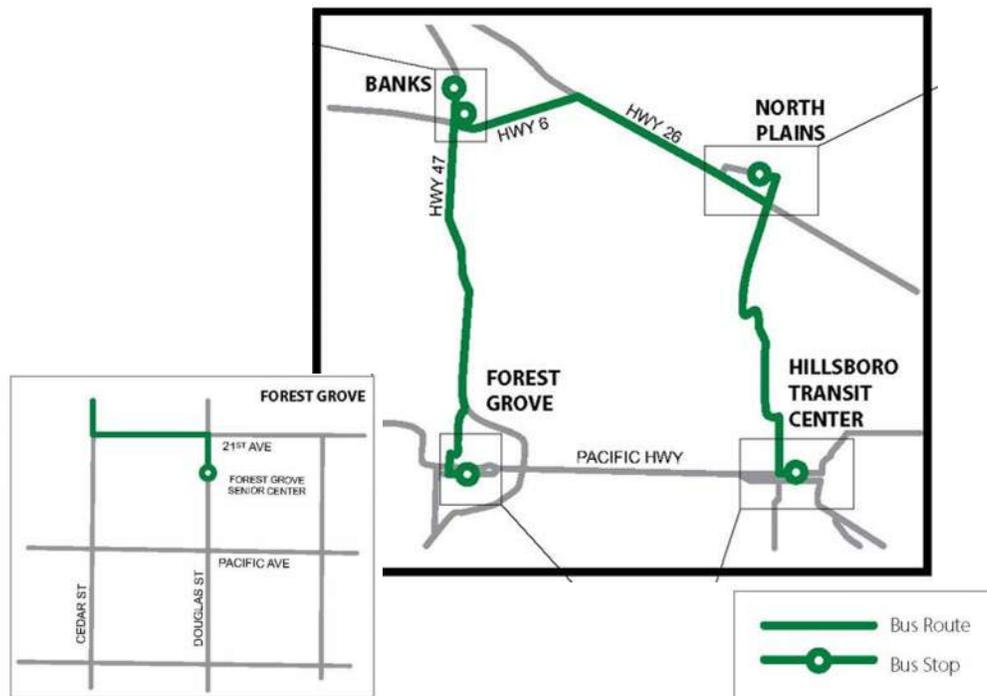


6.3.2 WestLink Service

A service of Ride Connection, WestLink is a free public transit service for people traveling between Forest Grove, North Plains, Banks and the Hillsboro Transit Center. The bus runs Monday through Friday with two daily scheduled trips in both the eastbound and westbound directions. Eastbound trips leave the Forest Grove Senior Center at 6:55 am and 4:35 pm arriving at the Hillsboro at 7:45 am and 5:30 pm, respectively. Westbound trips leave the Hillsboro Transit Center at 8:00 am and 5:45 pm arriving at the Forest Grove Senior Center at 8:55 am and 6:40 pm, respectively. Service is available at designated stops within each community. **Figure 6-2** presents the WestLink route map. As indicated on the Forest Grove map subset, WestLink does not directly serve the Oak Street plan area, requiring nearly a mile walk from the center of the Plan area to the nearest stop at the Forest Grove Senior Center on Douglas Street



Figure 6-2. WestLink Route Map



6.4 PLANNING CONTEXT

The Forest Grove TSP identified several actions to improve transit within the City and to better connect the City with other communities in Washington County and the greater Portland Metropolitan area. Many of the Plan’s recommendations have come to pass including more frequent service on Route 57 and development of the GroveLink community transit system. Transit policy direction in the plan speaks to maintaining and expanding service, particularly as residential and employment densities increase over time. Additionally, improvements to transit accessibility such as sidewalks and/or bicycle lanes are identified as a key measure to encourage transit use and enhance service accessibility.

6.4.1 TriMet's Westside Service Enhancement

The 2018 *Westside Service Enhancement Plan* is a future transit vision for Beaverton, Hillsboro, Cornelius, Forest Grove, and unincorporated Washington County north of Scholls Ferry Road. The plan identifies:

- Near-term service enhancements that can be made with little or no additional cost
- Long-term service improvements and expansion when revenues allow
- Opportunities for partnering with the public and private sectors to improve access to transit including walking and biking to bus, MAX and WES

October 2018 *United Service Enhancement Plan for the Westside* identified several key recommendations that are applicable to Forest Grove including:

- More north/south service to serve the intra-county travel between residents in the south and employment opportunities in the north
- Last mile connections to reach many jobs located just beyond a reasonable walking distance from transit. The Plan identifies specific pedestrian-related improvements within the Oak Street plan area that can better connect it with the larger community and, thus, make local and regional transit service more accessible
- Improved frequency as development on the Westside continues and urban amenities are provided the opportunity to serve more persons with more frequent bus service.

6.4.2 High Capacity Transit

In June 2010, the Portland Metropolitan region adopted the 2035 *Regional Transportation Plan* that included policy guidance for developing high capacity transit (HCT) system expansion which includes Corridor 12 – Hillsboro to Forest Grove Extension. The Washington County TSP identifies HCT Corridor 12 as a “Developing Regional Priority Corridor” where land uses projected to be in place by 2035 and their “*commensurate ridership potential are not expected to be supportive of HCT implementation, but which have long-term potential due to political aspirations to create HCT-supportive built form*”.

In the earlier transit-oriented development planning project that was conducted for the Oak Street plan area, the development of densities sufficient to ultimately warrant extension of HCT to Forest Grove was a major consideration. While extension of HCT along the PNWR corridor may become a long-term vision, there are currently no plans to proceed with this effort.

7. FUTURE STREET AND ROADWAY SYSTEM

This final section moves beyond a discussion of the existing transportation system and its needs and deficiencies. This section addresses future traffic volume forecasts, as well as deficiencies and improvement requirements resulting from future community growth over the 20-year planning horizon to 2040. This chapter also summarizes key transportation improvement projects included in the City's TSP that are relevant to the Oak Street plan area.

7.1 FUTURE (2040) TRAFFIC VOLUMES

Figure 7-1 presents future 2040 PM peak hourly traffic volumes on key roadways in the study area. These volumes were developed using Washington County's 2015 and 2040 Westside transportation model. Model output data for each roadway segment for both years was evaluated and annualized traffic volume growth rates were calculated. In most locations, the methods outlined in NCHRP 765 were used to develop annualized growth increments for each turning movement in an intersection. These growth rates were then applied to the existing 2020 turning movement counts to develop 2040 baseline PM peak hour turning movements projections.

An exception to this approach was at the intersection of OR 47 with Sunset Drive. At this location, there were significant changes made to the modeled transportation network between 2015 and 2040 which required consideration of a different forecasting approach. Specifically, the completion of David Hill Road, including roundabout control at OR 47 and additional roadway connections on Main Street and B Street, resulted in a significant shift in traffic on OR 47 away from the intersection with Sunset Drive in the 2040 projections when compared to 2015 conditions. As this traffic shift was already included in the 2020 PM peak hour traffic counts collected at Sunset Drive, a reasonable estimate of traffic volume growth rates between 2015 and 2040 could not be calculated and then applied to the 2020 counts. For this location, traffic forecasts were prepared by calculating an annual growth rate (1.5%) on Sunset Drive based on model growth south of the David Hill influence area. The growth on OR 47 was then re-estimated to balance with the forecast volumes east of the study intersection including OR 47 at Oak Street and OR 47 at Martin Road. 2040 traffic volume projections are included in **Appendix D**.

To evaluate the overall impact of community growth along OR 47 in the study area, a comparison can be made between the turning movement projections presented in Figure 7-1 with the volumes illustrated in Figure 4-2.

7.2 FUTURE TRAFFIC PERFORMANCE

Table 7-1 presents a summary of 2040 intersection traffic operations in the study area. This analysis is based on the PM peak hour forecasts described above which are illustrated as turning movement projections shown in Figure 7-1. Analysis is also consistent with the assumptions described in Chapter 4. The 2040 analysis assumes peak hour factors (PHFs) of 0.95 in all locations except at Pacific Avenue where the existing PHF is higher.

Figure 7-1. 2040 PM Peak Hour Baseline Traffic Volumes



As indicated in the table, all intersections are projected to operate within their identified mobility targets. The intersection of OR 47 with Martin Road was assumed to operate as a roundabout, which is expected to be constructed in 2022. Intersection operations analysis worksheets are included in **Appendix E**.

Table 7-1. Existing 2040 PM Peak Hour Intersection Level of Service

Intersection	Mobility Target	Level of Service (LOS)	Average Delay (Seconds)	Volume / Capacity (V/C)
<i>Unsignalized Intersections*</i>				
OR Highway 47 @ Oak Street	V/C=0.99	D	26.8	0.31
<i>Signalized Intersection</i>				
OR Highway 47 @ Sunset Drive	V/C=0.99	C	33.8	0.52
OR Highway 47 @ Pacific Avenue	V/C=0.99	E	55.0	0.95
<i>Roundabout Intersection</i>				
OR Highway 47 @ Martin Road	V/C=0.99	B	12.2	0.82

Note: Performance results for the unsignalized intersections represent the worst movement.

Bold text indicates location and year when mobility target is expected to be exceeded.

Source: SCJ Alliance, 2020

As noted in Project #10780, which is included in Metro's 2018 *Regional Transportation Plan*, the intersection of OR 47 with Pacific Avenue is expected to be improved in approximately 2028 by the addition of a second westbound left turn lane and an eastbound right turn lane. The added left turn lane will require installation of a receiving lane on OR 47 for sufficient distance south of the intersection to accommodate merging traffic continuing southbound on the state highway. With the addition of this improvement, intersection operations at OR 47/Pacific Avenue are expected to operate at Level of Service D with 46.2 seconds of average delay and a V/C ratio of 0.89.

7.3 STREET AND ROADWAY PLAN

7.3.1 Planned Projects

Planned roadway improvement projects that will influence traffic performance in the study area are identified in the financially-constrained 2018 *Regional Transportation Plan* and supported by the Washington County TSP. They include:

- Project #11661: **OR 47/Martin Road** – Intersection improvements
- Project #10774: **23rd Avenue Extension** -Intersection improvements with connections to Martin Road intersection improvements
- Project #10780: **OR 47 at Pacific Avenue** – Intersection improvements to add a westbound left turn lane and an eastbound right turn lane
- Project #10795: **Holladay Street Extension West** – Construct new collector
- Project #11380: **Yew Street/Adair Street** – Intersection improvements

The Oregon Department of Transportation's 2021-2024 State Transportation Improvement Program (STIP) identifies one project in the Forest Grove area:

- Council Creek Trail** – Complete project development activities to construct future six-mile trail along the Portland & Western Railroad (PNWR) corridor from Douglas Street in Forest Grove east to Hillsboro Hatfield Government Center Max Station. The trail will provide a safe off-street alternative to the parallel Tualatin Valley Highway. This project is scheduled for 2022 with a \$1,500,000 budget.

The City of Forest Grove's *Transportation System Plan* includes several roadway improvement projects that would benefit the Oak Street plan area. These are outlined in **Table 7-2**.

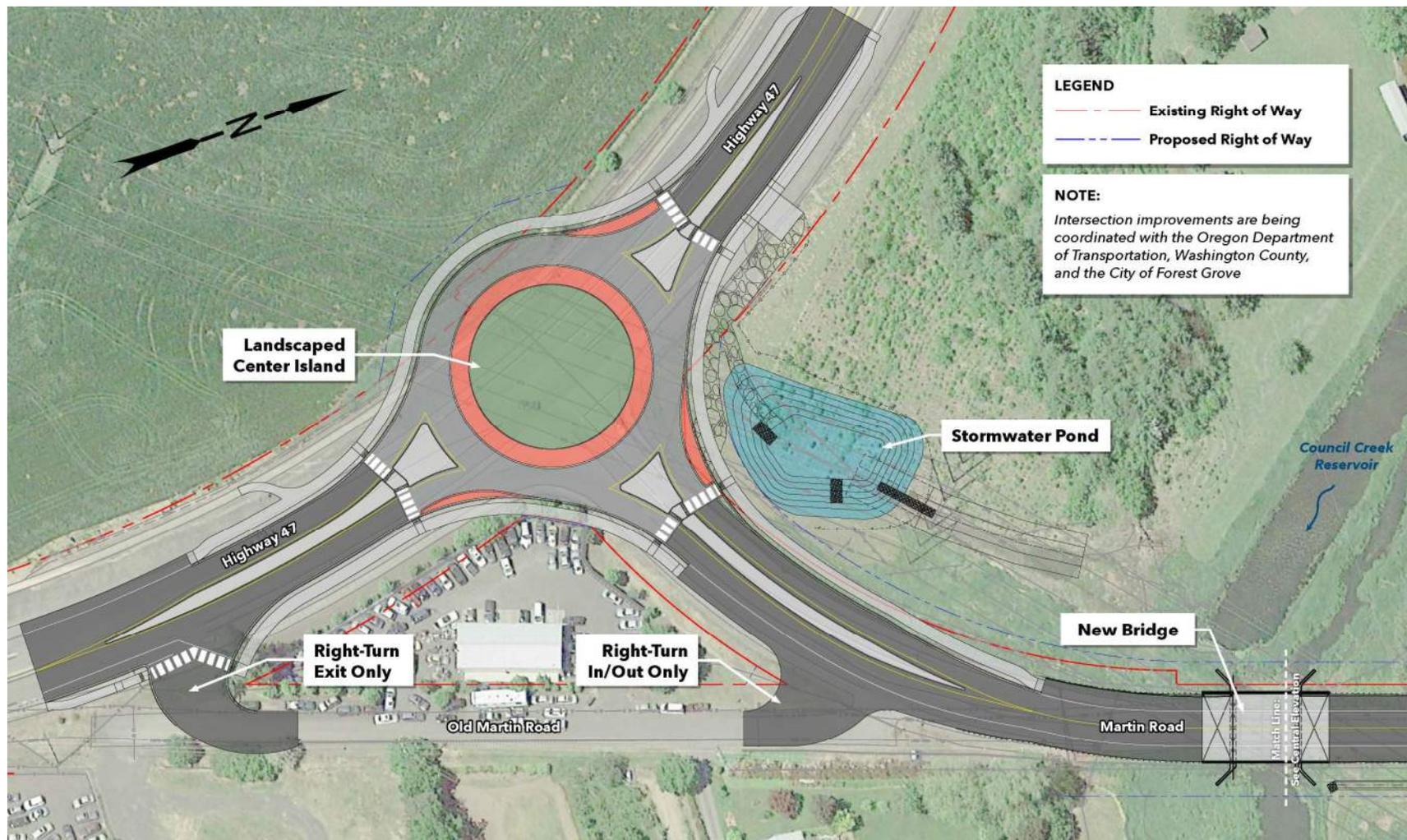
Table 7-2. Planned Roadway Improvements

Description/ Location	Project/Limits	Jurisdiction
23rd Avenue Extension	Construct new 2-lane collector without median and with bike lanes from Hawthorne Avenue east to Highway 47	ODOT/Forest Grove
Holladay Street Extension (West)	Construct new 2-lane industrial collector from City Limit to Martin Road/Highway 47 intersection	Forest Grove
Hawthorne Street Extension	Construct 2-lane collector between Willamina Street and 26 th Avenue	Forest Grove
Highway 8 / Pacific Avenue / 19 th Avenue Improvements	Retrofit street with boulevard design from Highway 47 to B Street. Includes intersection improvements at Yew/Adair/19 th	ODOT/ Forest Grove
25 th Avenue	Construct 2-lane local roadway between Cedar and Hawthorne Streets	Forest Grove
Laurel Street Extension	Construct 2-lane collector between northern terminus of Laurel Street and just south of Hwy 47. Will require railroad crossing.	Forest Grove
26 th Avenue Extension	Construct 2-lane collector between Boyd Lane and Oak Street	Forest Grove

Source: *Transportation System Plan*, City of Forest Grove, 2014.

Because of its significance to street layout in the Oak Street plan area, **Figure 7-2** has been included in this report to illustrate the proposed OR 47/Martin Road roundabout. It is anticipated that the 23rd Avenue Extension identified in Table 7-2 would connect to this roundabout on its west side to form a complete four-legged intersection.

Figure 7-2. OR 47 at Martin Road – Proposed Roundabout Improvement



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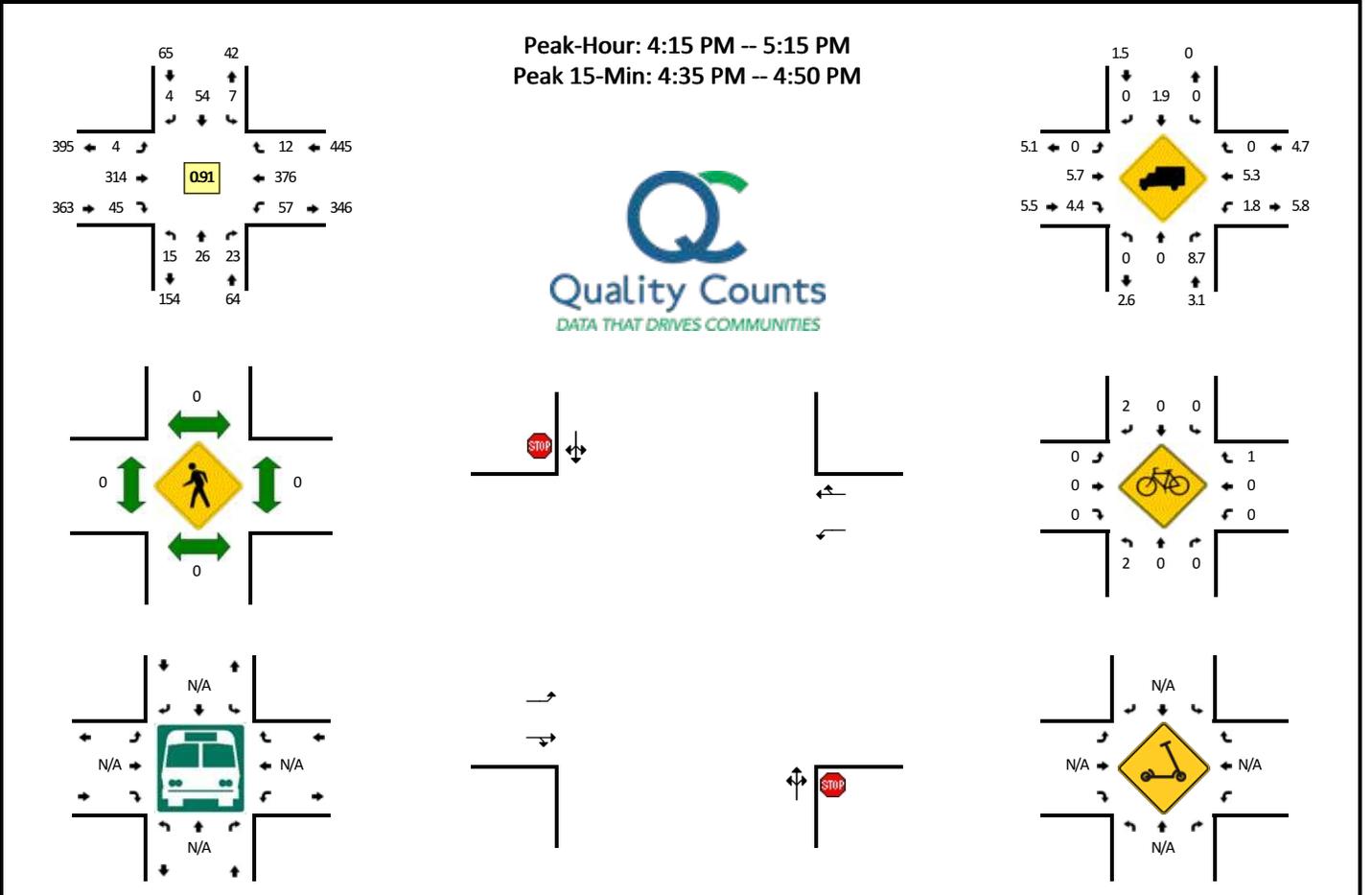
8. RAIL FACILITIES

As noted earlier in this report, the southern edge of the project area is bordered by an existing east/west rail corridor, the Portland & Western Railroad. Active rail operations along the corridor have ceased but the rail line has not been formally abandoned. The line is owned by ODOT and has been identified as the preferred alignment for the Council Creek Regional Trail. Additionally, an earlier study of the project site for transit-oriented development considered this corridor for future expansion of High Capacity Transit between Hillsboro and Forest Grove. There are currently three crossings of the rail line in the study vicinity including OR 47, Oak Street and Maple Street. Only the OR 47 crossing is fully improved.

APPENDIX A
2020 TRAFFIC COUNTS

LOCATION: NW Porter Rd / Oak St -- OR-47
CITY/STATE: Washington, OR

QC JOB #: 15252702
DATE: Tue, Jul 14 2020

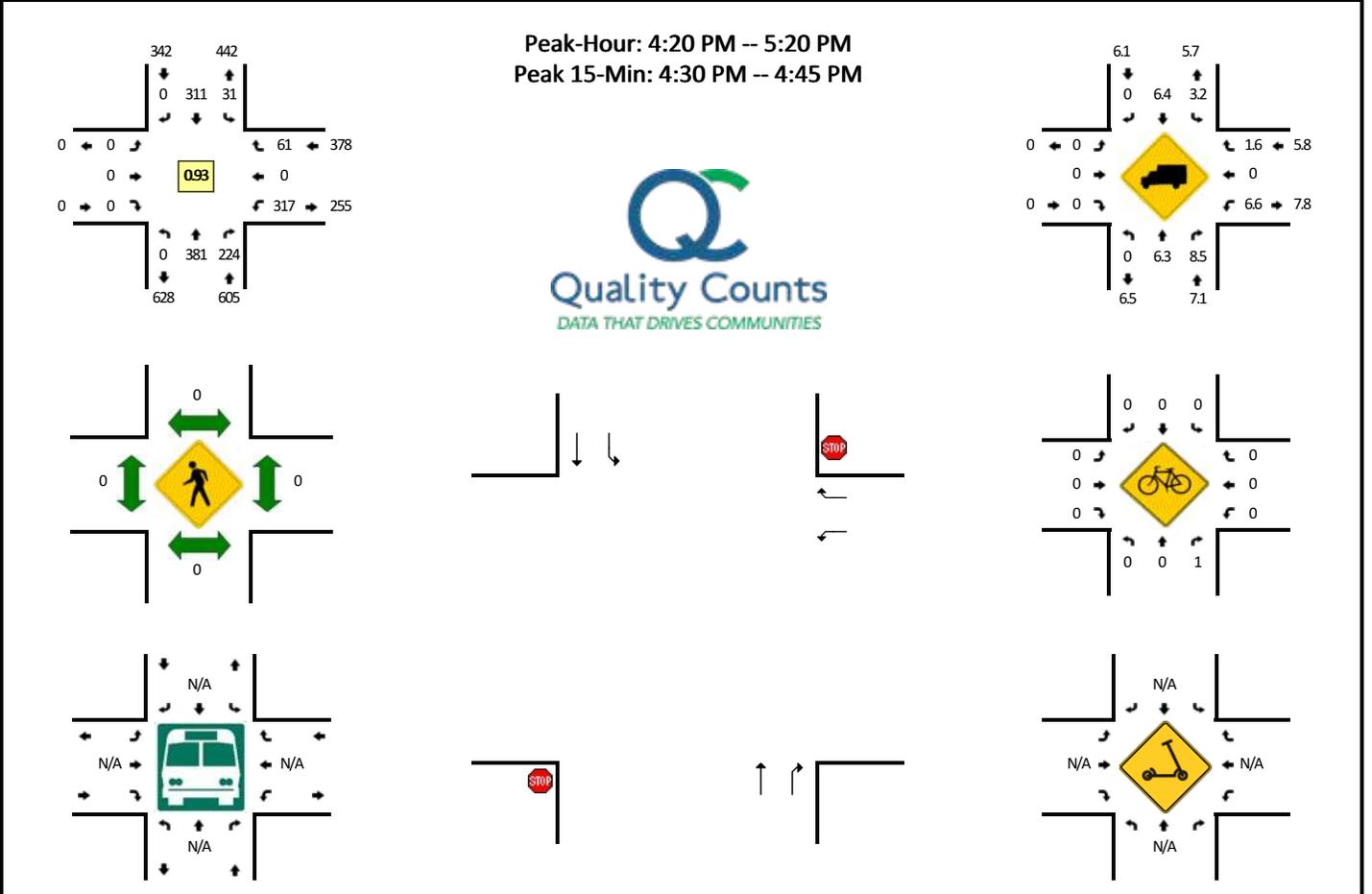


5-Min Count Period Beginning At	NW Porter Rd / Oak St (Northbound)				NW Porter Rd / Oak St (Southbound)				OR-47 (Eastbound)				OR-47 (Westbound)				Total	Hourly Totals	
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U			
4:00 PM	3	2	0	0	0	3	0	0	0	19	2	0	5	37	0	0	71		
4:05 PM	1	5	1	0	0	2	1	0	0	0	26	2	0	1	21	0	0	60	
4:10 PM	1	3	2	0	1	5	0	0	2	21	2	0	3	31	2	0	73		
4:15 PM	0	1	1	0	2	4	1	0	0	31	8	0	2	32	1	1	84		
4:20 PM	2	3	1	0	1	1	0	0	1	27	3	0	6	30	0	0	75		
4:25 PM	0	3	1	0	0	5	1	0	2	32	2	0	5	25	1	0	77		
4:30 PM	0	0	2	0	0	8	0	0	0	23	1	0	4	32	2	0	72		
4:35 PM	1	3	1	0	0	1	0	0	0	31	4	0	7	31	1	0	80		
4:40 PM	1	1	5	0	2	8	0	0	0	36	5	0	8	26	1	0	93		
4:45 PM	1	2	2	0	0	5	1	0	0	26	2	0	4	39	3	0	85		
4:50 PM	2	3	0	0	0	3	0	0	1	19	10	0	6	27	1	0	72		
4:55 PM	1	3	3	0	0	2	1	0	0	28	1	0	5	31	1	0	76	918	
5:00 PM	3	1	1	0	2	4	0	0	0	20	3	0	3	26	0	0	63	910	
5:05 PM	2	6	1	0	0	3	0	0	0	24	5	0	4	37	0	1	83	933	
5:10 PM	2	0	5	0	0	10	0	0	0	17	1	0	1	40	1	0	77	937	
5:15 PM	3	1	3	0	1	3	2	0	0	24	3	0	4	24	1	0	69	922	
5:20 PM	0	4	4	0	0	1	1	0	0	30	0	0	2	23	1	0	66	913	
5:25 PM	2	2	0	0	1	2	0	0	0	15	4	0	2	34	1	0	63	899	
5:30 PM	0	4	4	0	0	2	1	0	1	15	4	0	2	31	2	0	66	893	
5:35 PM	2	1	5	0	0	5	0	0	0	18	2	0	3	28	0	0	64	877	
5:40 PM	2	1	1	0	0	4	0	0	0	24	2	0	9	39	1	0	83	867	
5:45 PM	1	0	0	0	0	5	0	0	0	28	0	0	4	26	1	1	66	848	
5:50 PM	0	1	2	0	1	1	0	0	0	24	7	0	1	28	0	0	65	841	
5:55 PM	2	2	0	0	0	3	1	0	0	19	4	0	0	19	0	0	50	815	
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total		
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U			
All Vehicles	12	24	32	0	8	56	4	0	0	372	44	0	76	384	20	0	1032		
Heavy Trucks	0	0	0		0	0	0		0	24	0		4	36	0		64		
Buses																			
Pedestrians		0				0				0				0			0		
Bicycles	0	0	0		0	0	8		0	0	0		0	0	0		8		
Scoters																			

Comments:

LOCATION: OR-47 -- NW Martin Rd
CITY/STATE: Forest Grove, OR

QC JOB #: 15252703
DATE: Tue, Jul 14 2020

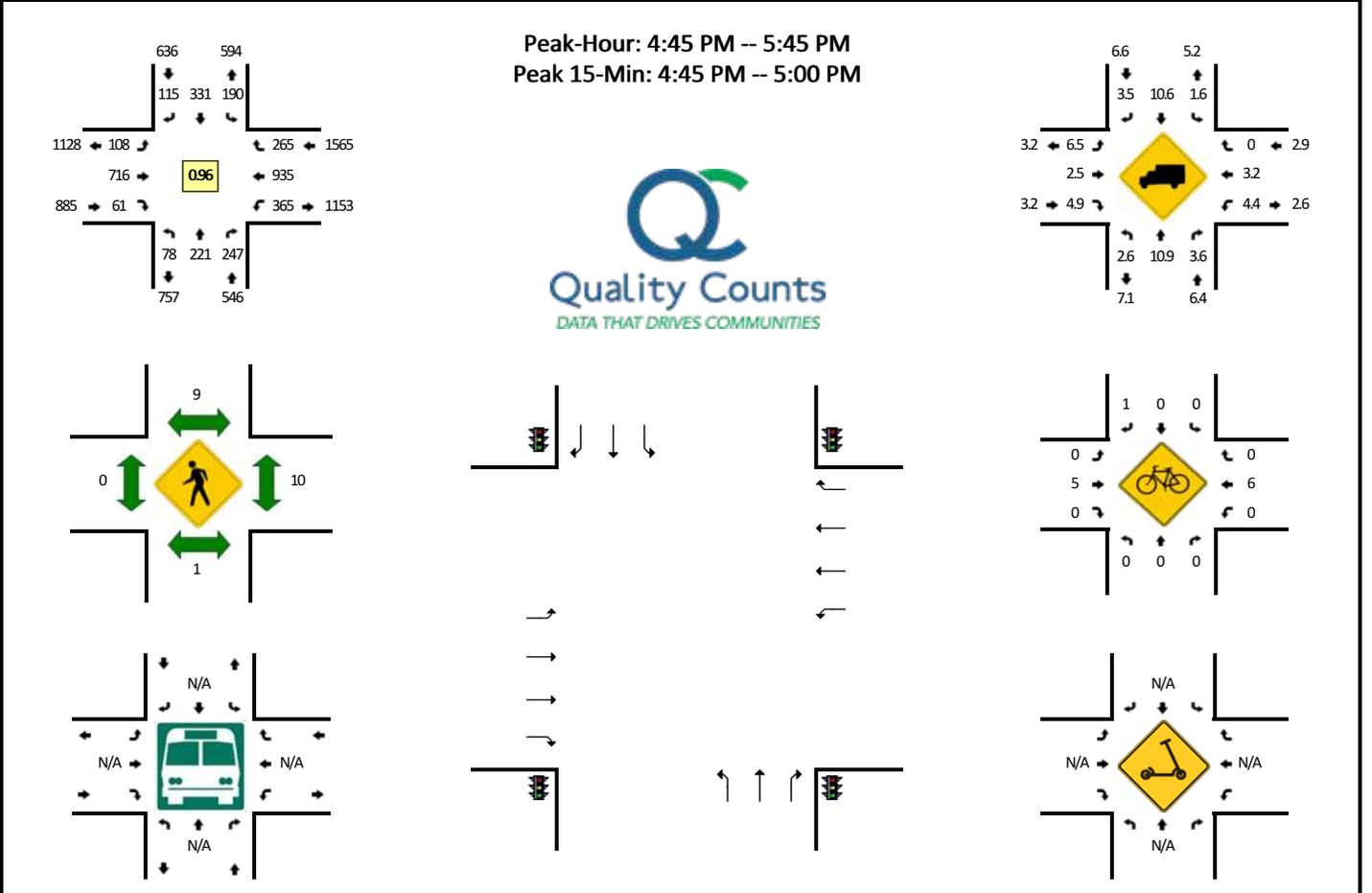


5-Min Count Period Beginning At	OR-47 (Northbound)				OR-47 (Southbound)				NW Martin Rd (Eastbound)				NW Martin Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
4:00 PM	0	31	14	0	1	20	0	0	0	0	0	0	28	0	5	0	99	
4:05 PM	0	21	28	0	2	20	0	0	0	0	0	0	23	0	2	0	96	
4:10 PM	0	38	16	0	2	25	0	0	0	0	0	0	20	0	3	0	104	
4:15 PM	0	27	20	0	1	30	0	0	0	0	0	0	22	0	4	0	104	
4:20 PM	0	29	24	0	3	28	0	0	0	0	0	0	24	0	6	0	114	
4:25 PM	0	30	10	0	2	30	0	0	0	0	0	0	27	0	4	0	103	
4:30 PM	0	35	25	0	2	25	0	0	0	0	0	0	26	0	6	0	119	
4:35 PM	0	28	21	0	1	28	0	0	0	0	0	0	33	0	7	0	118	
4:40 PM	0	28	17	0	6	38	0	0	0	0	0	0	23	0	8	0	120	
4:45 PM	0	40	10	0	2	25	0	0	0	0	0	0	35	0	5	0	117	
4:50 PM	0	30	21	0	1	23	0	0	0	0	0	0	34	0	5	0	114	
4:55 PM	0	29	15	0	1	27	0	0	0	0	0	0	32	0	6	0	110	1318
5:00 PM	0	29	15	0	3	21	0	0	0	0	0	0	17	0	4	0	89	1308
5:05 PM	0	36	20	0	3	22	0	0	0	0	0	0	18	0	4	0	103	1315
5:10 PM	0	40	28	0	4	18	0	0	0	0	0	0	17	0	3	0	110	1321
5:15 PM	0	27	18	0	3	26	0	0	0	0	0	0	31	0	3	0	108	1325
5:20 PM	0	21	15	0	2	31	0	0	0	0	0	0	26	0	1	0	96	1307
5:25 PM	0	36	18	0	1	17	0	0	0	0	0	0	31	0	3	0	106	1310
5:30 PM	0	31	14	0	3	16	0	0	0	0	0	0	27	0	4	0	95	1286
5:35 PM	0	29	22	0	5	18	0	0	0	0	0	0	25	0	1	0	100	1268
5:40 PM	0	45	28	0	2	23	0	0	0	0	0	0	23	0	8	0	129	1277
5:45 PM	0	20	13	0	1	25	0	0	0	0	0	0	34	0	6	0	99	1259
5:50 PM	0	28	20	0	2	26	0	0	0	0	0	0	13	0	2	0	91	1236
5:55 PM	0	20	16	0	1	20	0	0	0	0	0	0	20	0	2	0	79	1205
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total	
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
All Vehicles	0	364	252	0	36	364	0	0	0	0	0	0	328	0	84	0	1428	
Heavy Trucks	0	40	4		0	24	0		0	0	0		28	0	4		100	
Buses																		
Pedestrians		0				0				0				0			0	
Bicycles	0	0	4		0	0	0		0	0	0		0	0	0		4	
Scoters																		

Comments:

LOCATION: OR-47 -- Pacific Ave
CITY/STATE: Forest Grove, OR

QC JOB #: 15252704
DATE: Tue, Jul 14 2020



5-Min Count Period Beginning At	OR-47 (Northbound)				OR-47 (Southbound)				Pacific Ave (Eastbound)				Pacific Ave (Westbound)				Total	Hourly Totals
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4:00 PM	4	28	24	0	14	41	7	0	10	56	7	0	40	55	23	0	309	
4:05 PM	8	12	21	0	14	19	8	0	7	82	5	0	16	90	17	0	299	
4:10 PM	5	23	15	0	13	25	6	0	3	60	9	0	33	73	13	0	278	
4:15 PM	8	22	25	0	21	26	11	0	6	46	6	0	32	58	22	0	283	
4:20 PM	8	14	28	0	24	20	13	0	7	61	9	0	24	60	22	0	290	
4:25 PM	6	11	22	0	19	38	4	0	7	48	7	0	20	68	21	0	271	
4:30 PM	3	18	17	0	21	28	8	0	10	68	4	0	23	73	26	0	299	
4:35 PM	7	22	22	0	17	30	2	0	9	59	6	0	38	64	20	0	296	
4:40 PM	6	19	27	0	18	32	16	0	7	64	10	0	28	70	22	0	319	
4:45 PM	11	22	23	0	28	39	9	0	4	52	1	0	13	74	34	0	310	
4:50 PM	3	15	19	0	14	29	13	0	16	55	2	0	43	86	25	0	320	
4:55 PM	8	19	26	0	17	30	11	0	3	76	9	0	29	74	12	0	314	3588
5:00 PM	4	25	24	0	16	33	9	0	8	48	2	0	29	59	19	0	276	3555
5:05 PM	5	20	25	0	14	18	10	0	11	76	9	0	34	93	23	0	338	3594
5:10 PM	11	25	28	0	7	24	7	0	10	52	4	0	31	71	29	0	299	3615
5:15 PM	3	13	16	0	17	25	15	0	7	68	6	0	33	79	15	0	297	3629
5:20 PM	3	11	20	0	16	34	7	0	13	43	6	0	43	67	20	0	283	3622
5:25 PM	8	10	13	0	16	30	14	0	6	54	5	0	19	83	20	0	278	3629
5:30 PM	5	11	9	0	13	22	6	0	10	60	5	0	30	92	18	0	281	3611
5:35 PM	8	26	22	0	21	26	7	0	9	62	8	0	27	67	25	0	308	3623
5:40 PM	9	24	22	0	11	21	7	0	11	70	4	0	34	90	25	0	328	3632
5:45 PM	8	18	22	0	25	30	14	0	11	38	5	0	30	66	17	0	284	3606
5:50 PM	9	13	17	0	14	21	7	0	6	55	6	0	33	77	17	0	275	3561
5:55 PM	11	11	21	0	14	13	13	0	9	37	3	0	43	65	21	0	261	3508
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total	
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
All Vehicles	88	224	272	0	236	392	132	0	92	732	48	0	340	936	284	0	3776	
Heavy Trucks	4	32	8	0	0	36	4	0	24	12	4	0	24	40	0	0	188	
Buses																		
Pedestrians		0				8				0				12			20	
Bicycles	0	0	0		0	0	0		0	0	0		0	8	0		8	
Scoters																		

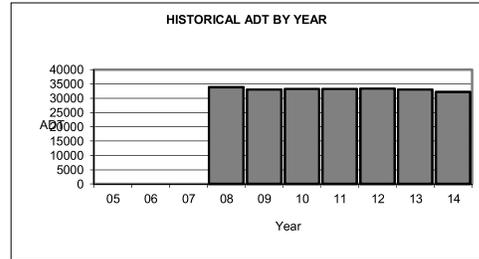
Comments:

Location: OR8; MP 14.84; TUALATIN VALLEY HIGHWAY NO. 29; 0.28 mile west of N.W. 334th Avenue

Site Name: Cornelius (34-009)
Installed: September, 2007

HISTORICAL TRAFFIC DATA

Year	ADT	Percent of ADT				
		Max Day	Max Hour	10TH Hour	20TH Hour	30TH Hour
2005	***	***	***	***	***	***
2006	***	***	***	***	***	***
2007	***	***	***	***	***	***
2008	33838	120	10.2	9.7	9.6	9.5
2009	33042	120	9.8	9.5	9.4	9.3
2010	33237	124	10.2	9.7	9.5	9.4
2011	33248	118	9.9	9.7	9.5	9.4
2012	33333	117	9.8	9.5	9.4	9.4
2013	33000	120	9.9	9.5	9.4	9.2
2014	32198	120	10.0	9.6	9.5	9.4



2014 TRAFFIC DATA

	Average Weekday Traffic	Percent of ADT	Average Daily Traffic	Percent of ADT
January	31327	97	30440	95
February	32837	102	30408	94
March	33405	104	32411	101
April	34015	106	33276	103
May	33609	104	33129	103
June	33934	105	33139	103
July	33740	105	32366	101
August	33523	104	32573	101
September	33080	103	32408	101
October	33170	103	32394	101
November	32601	101	31711	98
December	33230	103	32120	100

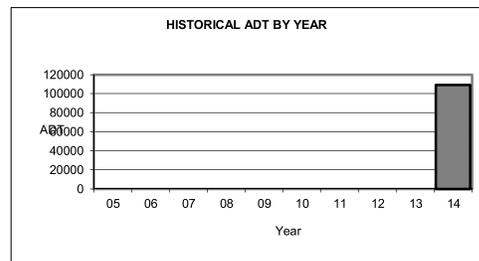
Classification Breakdown	Percent of ADT
Motorcycles	0.1
Passenger cars	79.6
Light Trucks	16.7
Buses	1.1
Single unit trucks (2 axles)	1.3
Single unit trucks (3 axles)	0.4
Single unit trucks (4 or more axles)	0.0
Single trailer trucks (4 or less axles)	0.3
Single trailer trucks (5 axles)	0.4
Single trailer trucks (6 or more axles)	0.1
Multi trailer trucks (5 or less axles)	0.0
Multi trailer trucks (6 axles)	0.0
Multi trailer trucks (7 or more axles)	0.0

Location: US26; MP 65.02; SUNSET HIGHWAY NO. 47; 0.73 mile east of 185th Avenue overcrossing

Site Name: Beaverton-Bethany (34-010)
Installed: February, 2013

HISTORICAL TRAFFIC DATA

Year	ADT	Percent of ADT				
		Max Day	Max Hour	10TH Hour	20TH Hour	30TH Hour
2005	***	***	***	***	***	***
2006	***	***	***	***	***	***
2007	***	***	***	***	***	***
2008	***	***	***	***	***	***
2009	***	***	***	***	***	***
2010	***	***	***	***	***	***
2011	***	***	***	***	***	***
2012	***	***	***	***	***	***
2013	***	***	***	***	***	***
2014	109193	120	8.6	8.5	8.5	8.4



2014 TRAFFIC DATA

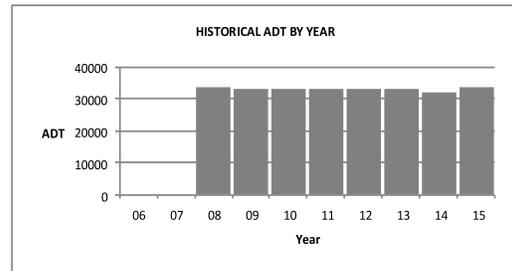
	Average Weekday Traffic	Percent of ADT	Average Daily Traffic	Percent of ADT
January	109925	101	101983	93
February	107292	98	94516	87
March	116283	106	108151	99
April	120198	110	112382	103
May	119863	110	112114	103
June	122969	113	115669	106
July	125654	115	116320	107
August	124885	114	118000	108
September	117581	108	113666	104
October	119000	109	115000	105
November	110249	101	100390	92
December	108662	100	102125	94

Classification Breakdown	Percent of ADT
Motorcycles	0.1
Passenger cars	52.5
Light Trucks	43.0
Buses	0.2
Single unit trucks (2 axles)	2.3
Single unit trucks (3 axles)	0.4
Single unit trucks (4 or more axles)	0.1
Single trailer trucks (4 or less axles)	0.2
Single trailer trucks (5 axles)	0.8
Single trailer trucks (6 or more axles)	0.2
Multi trailer trucks (5 or less axles)	0.0
Multi trailer trucks (6 axles)	0.0
Multi trailer trucks (7 or more axles)	0.1

Location:	OR8; MP 14.84; TUALATIN VALLEY HIGHWAY NO. 29; 0.28 mile west of N.W. 334th Avenue	Site Name:	Cornelius (34-009)
		Installed:	September, 2007

HISTORICAL TRAFFIC DATA

Year	ADT	Percent of ADT				
		Max Day	Max Hour	10TH Hour	20TH Hour	30TH Hour
2006	***	***	***	***	***	***
2007	***	***	***	***	***	***
2008	33838	120	10.2	9.7	9.6	9.5
2009	33043	120	14.0	9.6	9.4	9.3
2010	33237	124	10.2	9.7	9.5	9.4
2011	33248	118	9.9	9.7	9.5	9.4
2012	33333	117	9.8	9.5	9.4	9.4
2013	33000	120	9.9	9.5	9.4	9.2
2014	32198	120	10.0	9.6	9.5	9.4
2015	33905	127	10.2	9.6	9.4	9.3



2015 TRAFFIC DATA

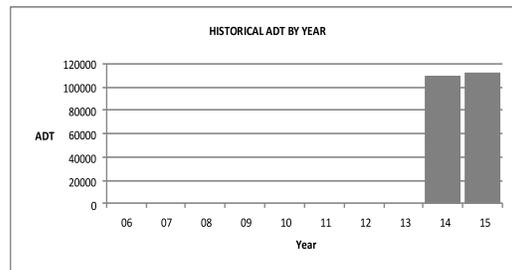
	Average Weekday Traffic	Percent of ADT	Average Daily Traffic	Percent of ADT
January	32443	96	31323	92
February	34522	102	33594	99
March	34753	103	33690	99
April	35181	104	34438	102
May	35006	103	34660	102
June	35430	104	34500	102
July	35432	105	33940	100
August	35240	104	34140	101
September	35196	104	34187	101
October	35221	104	34180	101
November	34334	101	33159	98
December	37136	110	35048	103

For Vehicle Classification data near this ATR, please go to the following web page:
<https://gis.odot.state.or.us/TransGIS/>

Location:	US26; MP 65.02; SUNSET HIGHWAY NO. 47; 0.73 mile east of 185th Avenue overcrossing	Site Name:	Beaverton-Bethany (34-010)
		Installed:	February, 2013

HISTORICAL TRAFFIC DATA

Year	ADT	Percent of ADT				
		Max Day	Max Hour	10TH Hour	20TH Hour	30TH Hour
2006	***	***	***	***	***	***
2007	***	***	***	***	***	***
2008	***	***	***	***	***	***
2009	***	***	***	***	***	***
2010	***	***	***	***	***	***
2011	***	***	***	***	***	***
2012	***	***	***	***	***	***
2013	***	***	***	***	***	***
2014	109193	120	8.6	8.5	8.5	8.4
2015	112772	117	8.4	8.3	8.3	8.2



2015 TRAFFIC DATA

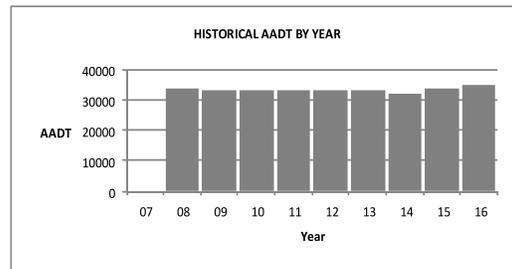
	Average Weekday Traffic	Percent of ADT	Average Daily Traffic	Percent of ADT
January	112212	100	103917	92
February	116492	103	109708	97
March	119301	106	111740	99
April	121800	108	114601	102
May	120607	107	114717	102
June	125110	111	119197	106
July	127552	113	118924	105
August	126785	112	119896	106
September	121420	108	115686	103
October	122064	108	114871	102
November	114487	102	107160	95
December	111533	99	102851	91

For Vehicle Classification data near this ATR, please go to the following web page:
<https://gis.odot.state.or.us/TransGIS/>

Location:	OR8; MP 14.84; TUALATIN VALLEY HIGHWAY NO. 29; 0.28 mile west of N.W. 334th Avenue	Site Name:	Cornelius (34-009)
		Installed:	September, 2007

HISTORICAL TRAFFIC DATA

Year	AADT	Percent of AADT				
		Max Day	Max Hour	10TH Hour	20TH Hour	30TH Hour
2007	***	***	***	***	***	***
2008	33838	120	10.2	9.7	9.6	9.5
2009	33043	120	14.0	9.6	9.4	9.3
2010	33237	124	10.2	9.7	9.5	9.4
2011	33248	118	9.9	9.7	9.5	9.4
2012	33333	117	9.8	9.5	9.4	9.4
2013	33000	120	9.9	9.5	9.4	9.2
2014	32198	120	10.0	9.6	9.5	9.4
2015	33905	127	10.2	9.6	9.4	9.3
2016	34836	119	9.5	9.3	9.2	9.1



2016 TRAFFIC DATA

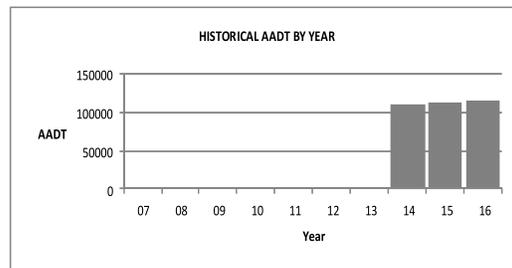
	Average Weekday Traffic	Percent of AADT	Average Daily Traffic	Percent of AADT
January	34425	99	32417	93
February	35602	102	34525	99
March	36257	104	34874	100
April	37194	107	36267	104
May	37042	106	36265	104
June	37066	106	36145	104
July	36114	104	35350	101
August	36701	105	35497	102
September	36125	104	35096	101
October	35949	103	34598	99
November	35451	102	34085	98
December	33912	97	32907	94

For Vehicle Classification data near your project, please go to the following web page:
<https://gis.odot.state.or.us/TransGIS/>

Location:	US26; MP 65.02; SUNSET HIGHWAY NO. 47; 0.73 mile east of 185th Avenue overcrossing	Site Name:	Beaverton-Bethany (34-010)
		Installed:	February, 2013

HISTORICAL TRAFFIC DATA

Year	AADT	Percent of AADT				
		Max Day	Max Hour	10TH Hour	20TH Hour	30TH Hour
2007	***	***	***	***	***	***
2008	***	***	***	***	***	***
2009	***	***	***	***	***	***
2010	***	***	***	***	***	***
2011	***	***	***	***	***	***
2012	***	***	***	***	***	***
2013	***	***	***	***	***	***
2014	109193	120	8.6	8.5	8.5	8.4
2015	112772	117	8.4	8.3	8.3	8.2
2016	114746	119	8.3	8.2	8.2	8.2



2016 TRAFFIC DATA

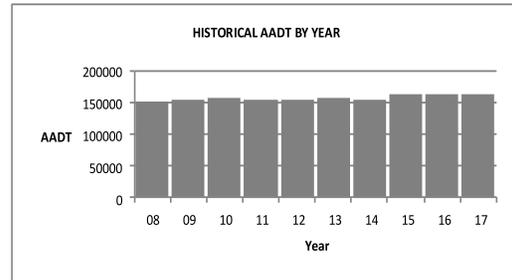
	Average Weekday Traffic	Percent of AADT	Average Daily Traffic	Percent of AADT
January	112343	98	102939	90
February	119751	104	112280	98
March	121293	106	113237	99
April	126371	110	120223	105
May	126041	110	118948	104
June	130048	113	123356	108
July	127050	111	120923	105
August	130224	113	123997	108
September	124504	109	118443	103
October	121466	106	114387	100
November	117599	102	110082	96
December	104814	91	98140	86

For Vehicle Classification data near your project, please go to the following web page:
<https://gis.odot.state.or.us/TransGIS/>

Location:	I-5; MP 290.14; PACIFIC HIGHWAY NO. 1; 0.34 mile south of Boones Ferry Road Interchange	Site Name:	Tigard (34-008)
		Installed:	September, 2007

HISTORICAL TRAFFIC DATA

Year	AADT	Percent of AADT				
		Max Day	Max Hour	10TH Hour	20TH Hour	30TH Hour
2008	151707	120	8.6	8.5	8.5	8.4
2009	153545	118	8.6	8.5	8.4	8.3
2010	155956	117	8.6	8.4	8.3	8.3
2011	154847	117	8.6	8.4	8.4	8.4
2012	153197	117	8.5	8.3	8.3	8.2
2013	157538	117	8.4	8.2	8.2	8.1
2014	154594	119	9.6	8.1	8.0	8.0
2015	164156	114	8.0	7.8	7.7	7.7
2016	164465	114	7.8	7.7	7.6	7.6
2017	164338	114	7.9	7.7	7.6	7.6



2017 TRAFFIC DATA

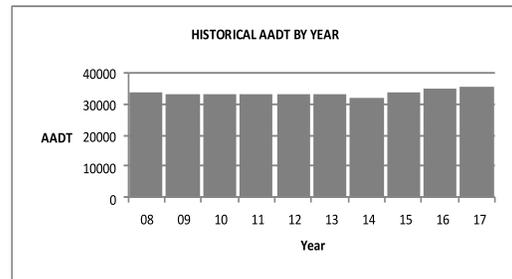
	Average Weekday Traffic	Percent of AADT	Average Daily Traffic	Percent of AADT
January	145287	88	136629	83
February	169310	103	159842	97
March	171599	104	163785	100
April	178351	109	170457	104
May	176763	108	169059	103
June	181971	111	174091	106
July	176466	107	170442	104
August	178294	108	171288	104
September	172248	105	167129	102
October	173827	106	168228	102
November	169223	103	161762	98
December	166325	101	159347	97

For Vehicle Classification data near your project, please go to the following web page:
https://www.oregon.gov/ODOT/Data/Documents/TVT_2017.xlsx

Location:	OR8; MP 14.84; TUALATIN VALLEY HIGHWAY NO. 29; 0.28 mile west of N.W. 334th Avenue	Site Name:	Cornelius (34-009)
		Installed:	September, 2007

HISTORICAL TRAFFIC DATA

Year	AADT	Percent of AADT				
		Max Day	Max Hour	10TH Hour	20TH Hour	30TH Hour
2008	33838	120	10.2	9.7	9.6	9.5
2009	33043	120	14.0	9.6	9.4	9.3
2010	33237	124	10.2	9.7	9.5	9.4
2011	33248	118	9.9	9.7	9.5	9.4
2012	33333	117	9.8	9.5	9.4	9.4
2013	33000	120	9.9	9.5	9.4	9.2
2014	32198	120	10.0	9.6	9.5	9.4
2015	33905	127	10.2	9.6	9.4	9.3
2016	34836	119	9.5	9.3	9.2	9.1
2017	35234	119	9.7	9.3	9.1	9.1



2017 TRAFFIC DATA

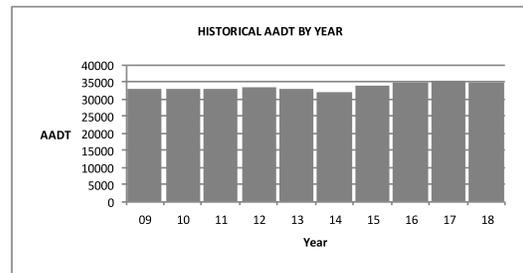
	Average Weekday Traffic	Percent of AADT	Average Daily Traffic	Percent of AADT
January	32382	92	31043	88
February	37311	106	35882	102
March	36642	104	35548	101
April	37406	106	36380	103
May	37392	106	36672	104
June	37651	107	36619	104
July	36564	104	35754	101
August	36754	104	35721	101
September	36432	103	35431	101
October	36448	103	35349	100
November	35932	102	34447	98
December	34676	98	33960	96

For Vehicle Classification data near your project, please go to the following web page:
https://www.oregon.gov/ODOT/Data/Documents/TVT_2017.xlsx

Location:	OR8; MP 14.84; TUALATIN VALLEY HIGHWAY NO. 29; 0.28 mile west of N.W. 334th Avenue	Site Name:	Cornelius (34-009)
		Installed:	September, 2007

HISTORICAL TRAFFIC DATA

Year	AADT	Percent of AADT				
		Max Day	Max Hour	10TH Hour	20TH Hour	30TH Hour
2009	33043	120	14.0	9.6	9.4	9.3
2010	33237	124	10.2	9.7	9.5	9.4
2011	33248	118	9.9	9.7	9.5	9.4
2012	33333	117	9.8	9.5	9.4	9.4
2013	33000	120	9.9	9.5	9.4	9.2
2014	32198	120	10.0	9.6	9.5	9.4
2015	33905	127	10.2	9.6	9.4	9.3
2016	34836	119	9.5	9.3	9.2	9.1
2017	35234	119	9.7	9.3	9.1	9.1
2018	35151	116	9.3	9.1	9.0	9.0



2018 TRAFFIC DATA

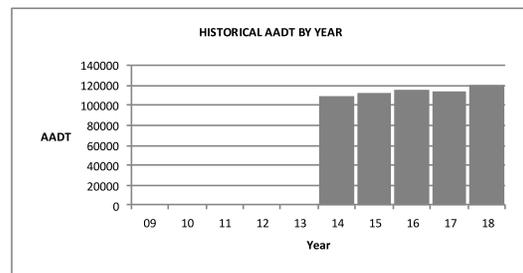
	Average Weekday Traffic	Percent of AADT	Average Daily Traffic	Percent of AADT
January	34292	98	33189	94
February	35397	101	34349	98
March	36552	104	35413	101
April	37159	106	35895	102
May	37111	106	36372	103
June	37289	106	36214	103
July	36516	104	35460	101
August	37064	105	35934	102
September	36225	103	35172	100
October	36510	104	35314	100
November	35748	102	34434	98
December	34801	99	34067	97

For Vehicle Classification data near your project, please go to the following web page:
https://www.oregon.gov/ODOT/Data/Documents/TVT_2018.xlsx

Location:	US26; MP 65.02; SUNSET HIGHWAY NO. 47; 0.73 mile east of 185th Avenue overcrossing	Site Name:	Beaverton-Bethany (34-010)
		Installed:	February, 2013

HISTORICAL TRAFFIC DATA

Year	AADT	Percent of AADT				
		Max Day	Max Hour	10TH Hour	20TH Hour	30TH Hour
2009	***	***	***	***	***	***
2010	***	***	***	***	***	***
2011	***	***	***	***	***	***
2012	***	***	***	***	***	***
2013	***	***	***	***	***	***
2014	109193	120	8.6	8.5	8.5	8.4
2015	112772	117	8.4	8.3	8.3	8.2
2016	114746	119	8.3	8.2	8.2	8.2
2017	114408	117	8.2	8.0	8.0	8.0
2018	119946	117	8.2	8.1	8.0	8.0



2018 TRAFFIC DATA

	Average Weekday Traffic	Percent of AADT	Average Daily Traffic	Percent of AADT
January	115892	97	110068	92
February	115773	97	110737	92
March	125827	105	118828	99
April	128500	107	120907	101
May	126538	105	122263	102
June	134167	112	126918	106
July	131620	110	126612	106
August	135108	113	128445	107
September	129188	108	123330	103
October	129463	108	122995	103
November	123983	103	116436	97
December	117819	98	111814	93

For Vehicle Classification data near your project, please go to the following web page:
https://www.oregon.gov/ODOT/Data/Documents/TVT_2018.xlsx

Table 1 Cont'd. Observed Year-Over-Year Difference in Traffic Volumes by Corridor

Date	Corridor	2020 Volumes		2019 Volumes		Weekday Diff	Weekend Diff
		Average Weekday	Average Weekend	Average Weekday	Average Weekend		
July 13 - 19, 2020	I-5	603,427	524,989	704,810	618,763	(0.14)	(0.15)
	I-205	235,331	190,976	274,042	241,057	(0.14)	(0.21)
	I-405	117,208	86,980	139,519	118,180	(0.16)	(0.26)
	I-84	353,115	312,130	384,614	370,703	(0.08)	(0.16)
	US 97	159,311	133,893	178,186	149,450	(0.11)	(0.10)
	US197	3,697	3,643	3,921	3,847	(0.06)	(0.05)
	US20	26,911	27,909	27,408	28,308	(0.02)	(0.01)
	US26	53,882	61,871	55,579	64,006	(0.03)	(0.03)
	US30	12,401	14,303	12,775	14,025	(0.03)	0.02
	US395	25,784	19,834			July 2019 data missing	
	OR18	19,088	25,878	19,500	26,912	(0.02)	(0.04)
	OR22	32,319	30,607	33,054	31,112	(0.02)	(0.02)
	US101	84,500	82,382	94,428	90,318	(0.11)	(0.09)
Statewide Average		353,082	305,635	405,300	362,554	(0.13)	(0.16)
July 20 - 22, 2020 (partial week Mon-Wed)	I-5	590,460	NA	685,848	NA	(0.14)	NA
	I-205	231,280	NA	271,902	NA	(0.15)	NA
	I-405	116,056	NA	138,701	NA	(0.16)	NA
	I-84	346,540	NA	369,920	NA	(0.06)	NA
	US 97	156,349	NA	166,774	NA	(0.06)	NA
	US197	3,427	NA	3,860	NA	(0.11)	NA
	US20	26,736	NA	26,916	NA	(0.01)	NA
	US26	53,513	NA	54,129	NA	(0.01)	NA
	US30	12,340	NA	12,743	NA	(0.03)	NA
	US395	24,855	NA		NA	July 2019 data missing	
	OR18	18,960	NA	18,939	NA	0.00	NA
	OR22	31,879	NA	32,642	NA	(0.02)	NA
	US101	84,795	NA	95,466	NA	(0.11)	NA
Statewide Average		346,107	NA	394,158	NA	(0.12)	NA

Figure 2 presents weekday and weekend average volumes by week for 2020 compared to the previous year for each corridor, graphically representing the data provided in **Table 1**. Traffic volumes on every corridor have reached levels closest to 2019 values since COVID-19 quarantine restrictions began. The most extreme traffic volume reductions occurred directly after the Stay-Home Executive Order. For the week of March 30-April 5 statewide average weekday traffic hit a low 43% below 2019 levels and the week of March 23-29 statewide average weekend traffic hit a low of 61% below 2019 levels. For the last full week of July 13-19, notable patterns include:

- Statewide weekday average volumes have been pretty steady being about 13% below 2019 levels, with the exception of the week containing the July 4th holiday.
- I-405 currently has the lowest relative traffic volumes on weekends - 26% below 2019 levels and on weekdays – 16% below 2019 levels.

APPENDIX B
2020 PM PEAK HOUR INTERSECTION OPERATIONS ANALYSIS
WORKSHEETS

Lanes, Volumes, Timings
1: Sunset Dr/ Bend Rd & Hwy 47

Existing 2020
PM Peak Hour

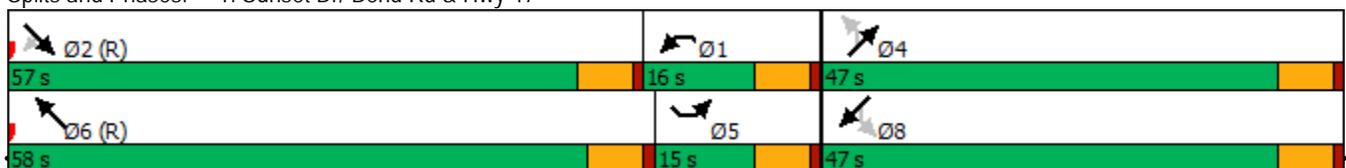


Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations	↖	↑	↗	↖	↗		↖	↗		↖	↗	
Traffic Volume (vph)	1	271	200	125	280	3	145	2	93	2	1	1
Future Volume (vph)	1	271	200	125	280	3	145	2	93	2	1	1
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Storage Length (ft)	135		440	480		0	100		0	100		0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (ft)	25			25			25			25		
Right Turn on Red			Yes			Yes			Yes			Yes
Link Speed (mph)		50			50			35				35
Link Distance (ft)		731			1293			886				1099
Travel Time (s)		10.0			17.6			17.3				21.4
Turn Type	Prot	NA	Perm	Prot	NA		Perm	NA		Perm	NA	
Protected Phases	5	2		1	6			4				8
Permitted Phases			2				4	4		8		
Detector Phase	5	2	2	1	6		4	4		8		8
Switch Phase												
Minimum Initial (s)	4.0	15.0	15.0	4.0	15.0		6.0	6.0		6.0		6.0
Minimum Split (s)	15.0	26.0	26.0	15.0	29.0		19.0	19.0		19.0		19.0
Total Split (s)	15.0	57.0	57.0	16.0	58.0		47.0	47.0		47.0		47.0
Total Split (%)	12.5%	47.5%	47.5%	13.3%	48.3%		39.2%	39.2%		39.2%		39.2%
Maximum Green (s)	9.0	51.0	51.0	10.0	52.0		41.0	41.0		41.0		41.0
Yellow Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0		5.0		5.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0		1.0	1.0		1.0		1.0
Lost Time Adjust (s)	-1.0	-2.0	-2.0	0.0	-2.0		-0.5	-0.5		-0.5		-0.5
Total Lost Time (s)	5.0	4.0	4.0	6.0	4.0		5.5	5.5		5.5		5.5
Lead/Lag	Lag	Lead	Lead	Lag	Lead							
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes							
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0		3.0
Minimum Gap (s)	0.5	2.9	2.9	0.5	2.9		0.5	0.5		0.5		0.5
Time Before Reduce (s)	8.0	10.0	10.0	8.0	10.0		8.0	8.0		8.0		8.0
Time To Reduce (s)	3.0	20.0	20.0	3.0	20.0		3.0	3.0		3.0		3.0
Recall Mode	None	C-Max	C-Max	None	C-Max		None	None		None		None
Walk Time (s)		5.0	5.0		5.0		5.0	5.0		5.0		5.0
Flash Dont Walk (s)		13.0	13.0		18.0		14.0	14.0		14.0		14.0
Pedestrian Calls (#/hr)		0	0		0		0	0		0		0

Intersection Summary

Area Type: Other
 Cycle Length: 120
 Actuated Cycle Length: 120
 Offset: 40 (33%), Referenced to phase 2:SET and 6:NWT, Start of Green
 Natural Cycle: 65
 Control Type: Actuated-Coordinated

Splits and Phases: 1: Sunset Dr/ Bend Rd & Hwy 47



HCM 6th Signalized Intersection Summary
 1: Sunset Dr/ Bend Rd & Hwy 47

Existing 2020
 PM Peak Hour



Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (veh/h)	1	271	200	125	280	3	145	2	93	2	1	1
Future Volume (veh/h)	1	271	200	125	280	3	145	2	93	2	1	1
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	0.99		0.99	0.99		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1750	1641	1709	1709	1654	1654	1709	1750	1750	1750	1750	1750
Adj Flow Rate, veh/h	1	285	0	132	295	3	153	2	98	2	1	1
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	0	8	3	3	7	7	3	0	0	0	0	0
Cap, veh/h	484	725		472	736	7	252	4	200	159	111	111
Arrive On Green	0.29	0.44	0.00	0.29	0.45	0.43	0.14	0.14	0.13	0.14	0.14	0.13
Sat Flow, veh/h	1667	1641	1448	1628	1635	17	1394	29	1437	1303	800	800
Grp Volume(v), veh/h	1	285	0	132	0	298	153	0	100	2	0	2
Grp Sat Flow(s),veh/h/ln	1667	1641	1448	1628	0	1651	1394	0	1466	1303	0	1599
Q Serve(g_s), s	0.1	14.1	0.0	7.5	0.0	14.5	12.8	0.0	7.6	0.2	0.0	0.1
Cycle Q Clear(g_c), s	0.1	14.1	0.0	7.5	0.0	14.5	12.9	0.0	7.6	7.8	0.0	0.1
Prop In Lane	1.00		1.00	1.00		0.01	1.00		0.98	1.00		0.50
Lane Grp Cap(c), veh/h	484	725		472	0	743	252	0	204	159	0	222
V/C Ratio(X)	0.00	0.39		0.28	0.00	0.40	0.61	0.00	0.49	0.01	0.00	0.01
Avail Cap(c_a), veh/h	484	725		472	0	743	540	0	507	428	0	553
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	30.2	22.6	0.0	32.9	0.0	22.2	50.1	0.0	48.0	51.3	0.0	44.6
Incr Delay (d2), s/veh	0.0	1.6	0.0	0.3	0.0	1.6	2.3	0.0	1.8	0.0	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	5.4	0.0	2.9	0.0	5.6	4.6	0.0	2.9	0.1	0.0	0.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	30.3	24.2	0.0	33.2	0.0	23.8	52.4	0.0	49.8	51.4	0.0	44.7
LnGrp LOS	C	C		C	A	C	D	A	D	D	A	D
Approach Vol, veh/h		286	A		430			253				4
Approach Delay, s/veh		24.3			26.7			51.4				48.0
Approach LOS		C			C			D				D
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	40.8	57.0		22.2	39.8	58.0		22.2				
Change Period (Y+Rc), s	6.0	6.0		6.0	6.0	6.0		6.0				
Max Green Setting (Gmax), s	10.0	51.0		41.0	9.0	52.0		41.0				
Max Q Clear Time (g_c+I1), s	9.5	16.1		14.9	2.1	16.5		9.8				
Green Ext Time (p_c), s	0.0	1.0		1.0	0.0	1.1		0.0				

Intersection Summary

HCM 6th Ctrl Delay	32.5
HCM 6th LOS	C

Notes

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

Intersection												
Int Delay, s/veh	4.2											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗			↕			↕	
Traffic Vol, veh/h	4	320	42	61	384	13	19	27	26	6	55	5
Future Vol, veh/h	4	320	42	61	384	13	19	27	26	6	55	5
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None									
Storage Length	200	-	-	200	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	89	89	89	89	89	89	89	89	89	89	89	89
Heavy Vehicles, %	0	6	5	2	5	0	0	0	8	0	2	0
Mvmt Flow	4	360	47	69	431	15	21	30	29	7	62	6

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	446	0	0	407	0	0	1003	976	384	998	992	439
Stage 1	-	-	-	-	-	-	392	392	-	577	577	-
Stage 2	-	-	-	-	-	-	611	584	-	421	415	-
Critical Hdwy	4.1	-	-	4.12	-	-	7.1	6.5	6.28	7.1	6.52	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.52	-
Follow-up Hdwy	2.2	-	-	2.218	-	-	3.5	4	3.372	3.5	4.018	3.3
Pot Cap-1 Maneuver	1125	-	-	1152	-	-	223	253	651	224	246	622
Stage 1	-	-	-	-	-	-	637	610	-	506	502	-
Stage 2	-	-	-	-	-	-	484	501	-	614	592	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1125	-	-	1152	-	-	167	237	651	184	230	622
Mov Cap-2 Maneuver	-	-	-	-	-	-	167	237	-	184	230	-
Stage 1	-	-	-	-	-	-	634	608	-	504	472	-
Stage 2	-	-	-	-	-	-	392	471	-	555	590	-

Approach	EB			WB			NB			SB		
HCM Control Delay, s	0.1			1.1			24			27.1		
HCM LOS							C			D		

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	269	1125	-	-	1152	-	-	236
HCM Lane V/C Ratio	0.301	0.004	-	-	0.059	-	-	0.314
HCM Control Delay (s)	24	8.2	-	-	8.3	-	-	27.1
HCM Lane LOS	C	A	-	-	A	-	-	D
HCM 95th %tile Q(veh)	1.2	0	-	-	0.2	-	-	1.3

Intersection						
Int Delay, s/veh	31.2					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↘	↗	↑	↗	↘	↑
Traffic Vol, veh/h	331	64	398	234	32	325
Future Vol, veh/h	331	64	398	234	32	325
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	280	-	220	200	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	7	2	6	8	3	6
Mvmt Flow	356	69	428	252	34	349

Major/Minor	Minor1	Major1	Major2			
Conflicting Flow All	845	428	0	0	680	0
Stage 1	428	-	-	-	-	-
Stage 2	417	-	-	-	-	-
Critical Hdwy	6.47	6.22	-	-	4.13	-
Critical Hdwy Stg 1	5.47	-	-	-	-	-
Critical Hdwy Stg 2	5.47	-	-	-	-	-
Follow-up Hdwy	3.563	3.318	-	-	2.227	-
Pot Cap-1 Maneuver	~ 327	627	-	-	908	-
Stage 1	647	-	-	-	-	-
Stage 2	654	-	-	-	-	-
Platoon blocked, %			-	-		
Mov Cap-1 Maneuver	~ 315	627	-	-	908	-
Mov Cap-2 Maneuver	~ 315	-	-	-	-	-
Stage 1	647	-	-	-	-	-
Stage 2	630	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	108.5	0	0.8
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	WBLn2	SBL	SBT	
Capacity (veh/h)	-	-	315	627	908	-
HCM Lane V/C Ratio	-	-	1.13	0.11	0.038	-
HCM Control Delay (s)	-	-	127.3	11.4	9.1	-
HCM Lane LOS	-	-	F	B	A	-
HCM 95th %tile Q(veh)	-	-	14.4	0.4	0.1	-

Notes
 -: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Lanes, Volumes, Timings

4: Hwy 47 & Pacific Ave

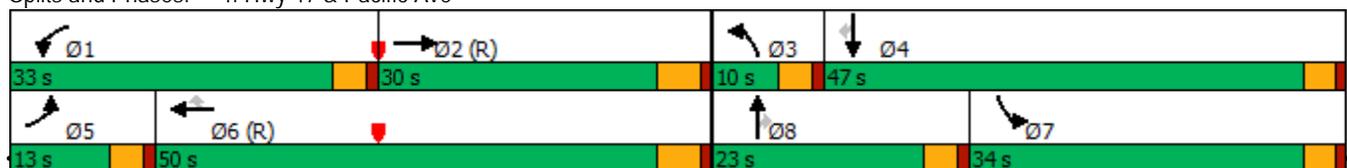
Existing 2020
PM Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	103	759	72	360	909	280	78	233	289	221	361	122
Future Volume (vph)	103	759	72	360	909	280	78	233	289	221	361	122
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	150		120	250		265	300		310	250		225
Storage Lanes	1		0	1		1	1		1	1		1
Taper Length (ft)	25			25			25			25		
Right Turn on Red			Yes			Yes			Yes			Yes
Link Speed (mph)		30			40			45			25	
Link Distance (ft)		898			1068			715			1796	
Travel Time (s)		20.4			18.2			10.8			49.0	
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases						6			8			4
Detector Phase	5	2		1	6	6	3	8	8	7	4	4
Switch Phase												
Minimum Initial (s)	4.0	10.0		4.0	10.0	10.0	4.0	6.0	6.0	4.0	4.0	4.0
Minimum Split (s)	9.0	29.0		9.0	28.0	28.0	9.0	20.0	20.0	20.0	34.0	34.0
Total Split (s)	13.0	30.0		33.0	50.0	50.0	10.0	23.0	23.0	34.0	47.0	47.0
Total Split (%)	10.8%	25.0%		27.5%	41.7%	41.7%	8.3%	19.2%	19.2%	28.3%	39.2%	39.2%
Maximum Green (s)	9.0	25.0		29.0	45.0	45.0	6.0	19.0	19.0	30.0	43.0	43.0
Yellow Time (s)	3.0	4.0		3.0	4.0	4.0	3.0	3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	1.0	1.0		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	-1.0		0.0	-1.0	-1.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead	Lag		Lead	Lag	Lag	Lead	Lead	Lead	Lag	Lag	Lag
Lead-Lag Optimize?	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
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
Minimum Gap (s)	0.5	2.1		0.5	2.1	2.1	0.5	0.5	0.5	0.5	0.2	0.2
Time Before Reduce (s)	8.0	10.0		8.0	10.0	10.0	8.0	8.0	8.0	8.0	8.0	8.0
Time To Reduce (s)	3.0	20.0		3.0	20.0	20.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	C-Max		None	C-Max	C-Max	None	None	None	None	None	None
Walk Time (s)		5.0			10.0	10.0					7.0	7.0
Flash Dont Walk (s)		18.0			12.0	12.0					26.0	26.0
Pedestrian Calls (#/hr)		0			0	0					0	0

Intersection Summary

Area Type: Other
 Cycle Length: 120
 Actuated Cycle Length: 120
 Offset: 36 (30%), Referenced to phase 2:EBT and 6:WBT, Start of Green
 Natural Cycle: 95
 Control Type: Actuated-Coordinated

Splits and Phases: 4: Hwy 47 & Pacific Ave



HCM 6th Signalized Intersection Summary
4: Hwy 47 & Pacific Ave

Existing 2020
PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	103	759	72	360	909	280	78	233	289	221	361	122
Future Volume (veh/h)	103	759	72	360	909	280	78	233	289	221	361	122
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1811	1870	1870	1811	1841	1885	1841	1752	1811	1870	1781	1811
Adj Flow Rate, veh/h	107	791	0	375	947	0	81	243	0	230	376	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	6	2	2	6	4	1	4	10	6	2	8	6
Cap, veh/h	129	1181		400	1711		88	269		265	450	
Arrive On Green	0.08	0.33	0.00	0.23	0.49	0.00	0.05	0.15	0.00	0.15	0.25	0.00
Sat Flow, veh/h	1725	3647	0	1725	3497	1598	1753	1752	1535	1781	1781	1535
Grp Volume(v), veh/h	107	791	0	375	947	0	81	243	0	230	376	0
Grp Sat Flow(s),veh/h/ln	1725	1777	0	1725	1749	1598	1753	1752	1535	1781	1781	1535
Q Serve(g_s), s	7.3	22.9	0.0	25.6	22.8	0.0	5.5	16.4	0.0	15.1	24.0	0.0
Cycle Q Clear(g_c), s	7.3	22.9	0.0	25.6	22.8	0.0	5.5	16.4	0.0	15.1	24.0	0.0
Prop In Lane	1.00		0.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	129	1181		400	1711		88	269		265	450	
V/C Ratio(X)	0.83	0.67		0.94	0.55		0.92	0.90		0.87	0.84	
Avail Cap(c_a), veh/h	129	1181		417	1711		88	277		445	638	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	54.7	34.4	0.0	45.2	21.5	0.0	56.8	49.9	0.0	49.9	42.5	0.0
Incr Delay (d2), s/veh	33.8	3.0	0.0	28.3	1.3	0.0	71.3	30.0	0.0	9.3	6.7	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.4	10.4	0.0	13.8	9.2	0.0	4.1	9.2	0.0	7.5	11.4	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	88.6	37.4	0.0	73.5	22.8	0.0	128.1	79.9	0.0	59.2	49.2	0.0
LnGrp LOS	F	D		E	C		F	E		E	D	
Approach Vol, veh/h		898	A		1322	A		324	A		606	A
Approach Delay, s/veh		43.5			37.1			91.9			53.0	
Approach LOS		D			D			F			D	
Timer - Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	31.8	43.9	10.0	34.3	13.0	62.7	21.9	22.4				
Change Period (Y+Rc), s	4.0	5.0	4.0	4.0	4.0	5.0	4.0	4.0				
Max Green Setting (Gmax), s	29.0	25.0	6.0	43.0	9.0	45.0	30.0	19.0				
Max Q Clear Time (g_c+I1), s	27.6	24.9	7.5	26.0	9.3	24.8	17.1	18.4				
Green Ext Time (p_c), s	0.2	0.0	0.0	1.5	0.0	4.5	0.7	0.1				

Intersection Summary

HCM 6th Ctrl Delay	47.6
HCM 6th LOS	D

Notes

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

Existing 2020 Critical V/C Ratio Calculations

Sunset - 2020			
Approach	Saturation Flow		v/c ratio
	adjusted	total	
EB	285	1641	0.17
WB	132	1628	0.08
NB	153	1394	0.11
Total			0.36
<u>Traffic Signal Details</u>			
Cycle Legnth:	120		
Lost time:	19		
Critical V/C:	0.43		

Pacific - 2020			
Approach	Saturation Flow		v/c ratio
	adjusted	total	
EB	791	3647	0.22
WB	375	1725	0.22
NB	243	1752	0.14
SB	376	1781	0.21
Total			0.78
<u>Traffic Signal Details</u>			
Cycle Legnth:	120		
Lost time:	16		
Critical V/C:	0.90		

APPENDIX C
CRASH DATA

Appendix C

Crash Records and Crash Rate Calculations

Forest Grove, OR
01/01/2014 - 12/31/2018

Variables	
Peak hour to ADT factor:	10.9
ADT to annual traffic factor:	365

Sorted by Crash Rate
2014-2018 Crashes

Study Area Intersections	5-year Crash	Volumes		5-year Crash
	Total	TOTAL	ADT	Rate
OR Highway 47 @ Sunset Drive	10	1124	12251.6	0.45
OR Highway 47 @ Oak Street	12	962	10485.8	0.63
OR Highway 47 @ Martin Road	33	1383	15074.7	1.20
OR Highway 47/Quince Street @ Pacific Avenue	40	3788	41289.2	0.53

Study Area Street Segments	5-year Crash	Crashes per Year	Volumes			Weighted Average	Segment Length (miles)
	Total		Dir 1	Dir 2	Total		
OR Hwy 47, Sunset Drive to Oak street	28	5.6	409	365	774	805	1.04
OR Hwy 47, Oak Street to Martin Road	31	6.2	461	357	818	172	0.21
OR Hwy 47, Martin Road to Pacific Avenue	31	6.2	616	705	1321	581	0.44
Total	90	18	1486	1427	2913	1558	1.69

Roadway Segment Crash Rate	5-year Crash	Crashes per Year	Volumes		Segment Length (miles)	Vehicle Miles Traveled	5-year Crash Rate
	Total		Weighted Average	ADT Volume			
OR Hwy 47, Sunset Drive to Pacific Avenue	90	18	922	10049.8	1.69	16,984	2.90

CITY OF FOREST GROVE, WASHINGTON COUNTY

QUINCE ST at MARTIN RD, City of Forest Grove, Washington County, 01/01/2014 to 12/31/2018

23 - 24 of 24 Crash records shown.

SER#	P	R	J	S	W	DATE	CLASS	CITY STREET	INT-TYPE	SPCL USE	A	S																		
INVEST	E	A	U	I	C	O	DAY	DIST	FIRST STREET	RD CHAR	(MEDIAN)	INT-REL	OFFRD	WTHR	CRASH	TRLR QTY	MOVE													
RD DPT	E	L	G	N	H	R	TIME	FROM	SECOND STREET	DIRECT	LEGS	TRAF-	RNDBT	SURF	COLL	OWNER	FROM	PRTC	INJ	G	E	LICNS	PED							
UNLOC?	D	C	S	V	L	K	LAT	LONG	LRS	LOCTN	(#LANES)	CONTL	DRVWY	LIGHT	SVRTY	V#	TYPE	TO	P#	TYPE	SVRTY	E	X	RES	LOC	ERROR	ACT	EVENT	CAUSE	
03326	N	N	N	N	N	06/28/2018	14	MARTIN RD	INTER	3-LEG	N	N	N	CLR	ANGL-OTH	01	NONE	9	STRGHT											
COUNTY						TH		QUINCE ST	CN			STOP SIGN	N	DRY	TURN	N/A	S	-N									000		00	
N						3P			02	0			N	DAY	PDO	PSNGR	CAR		01	DRVR	NONE	00	Unk	UNK		000	000		00	
N						45 31 35.76 -123 5 3.29		010200100S00																						
																02	NONE	9	TURN-L											
																N/A	E	-S									015		00	
																PSNGR	CAR		01	DRVR	NONE	00	Unk	UNK		000	000		00	
06552	N	N	N	N	N	11/30/2018	14	MARTIN RD	INTER	3-LEG	N	N	N	RAIN	ANGL-OTH	01	NONE	9	TURN-L											
COUNTY						FR		QUINCE ST	CN			STOP SIGN	N	WET	TURN	N/A	NE-SE										000		00	
N						4P			01	0			N	DAY	PDO	PSNGR	CAR		01	DRVR	NONE	00	Unk	UNK		000	000		00	
N						45 31 35.76 -123 5 3.29		010200100S00																						
																02	NONE	9	STRGHT											
																N/A	SE-NW										000		00	
																PSNGR	CAR		01	DRVR	NONE	00	Unk	UNK		000	000		00	

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102: NEHALEM

Highway 102 ALL ROAD TYPES, MP 88.0 to 91.50 01/01/2010 to 05/31/2019, Both Add and Non-Add mileage

123 - 127 of 147 Crash records shown.

SER#	P	R	J	S	W	DATE	COUNTY	RD#	FC	CONN#	RD CHAR	INT-TYPE	SPCL USE	TRLR	QTY	MOVE	A	S	INJ	G	E	LICNS	PED	ERROR	ACT	EVENT	CAUSE						
INVEST	E	A	U	I	C	O	CITY	COMPNT	FIRST	STREET	DIRECT	(MEDIAN)	INT-REL	OFFRD	WTHR	CRASH	OWNER	FROM	PRTC	INJ	G	E	LICNS	PED	ERROR	ACT	EVENT	CAUSE					
RD DPT	E	L	G	N	H	R	URBAN AREA	MLG	TYP	SECOND	STREET	LOCTN	LEGS	TRAF-	RNDBT	SURF	COLL	OWNER	FROM	PRTC	INJ	G	E	LICNS	PED	ERROR	ACT	EVENT	CAUSE				
UNLOC?	D	C	S	V	L	K	LONG	MILEPNT	LRS			(#LANES)	CONTL	DRVWY	LIGHT	SVRTY	V#	TYPE	TO	P#	TYPE	SVRTY	E	X	RES	LOC	ERROR	ACT	EVENT	CAUSE			
														02	NONE	9	STRGHT																
														N/A			STRGHT																
														PSNGR	CAR				01	DRVR	NONE	00	Unk	UNK		000	000			00			
05551	N	N	N	N	N	10/18/2018	WASHINGTON	1	14		STRGHT	N		N	CLR	S-STRGHT	01	NONE	0										035	07			
CITY						TH	FOREST GROVE	MN	0	QUINCE ST	N	(NONE)	UNKNOWN	N	DRY	REAR		PRVTE									000		00				
N						10A	PORTLAND UA	90.54		TUALATIN VLY HY	03			N	DAY	INJ		PSNGR	CAR		01	DRVR	INJB	70	F	OR-Y		043,042	000	07			
N						45 31 18.17	-123 5 2.89			010200100S00		(02)																					
														02	NONE	0	STRGHT																
														PRVTE			STRGHT																
														PSNGR	CAR				01	DRVR	NONE	83	F	OR-Y		000	000	035		00			
04803	N	N	N	N	N	09/13/2018	WASHINGTON	1	14		STRGHT	Y		N	CLR	S-1STOP	01	NONE	0										013	32,29			
CITY						TH	FOREST GROVE	MN	0	QUINCE ST	N	(NONE)	UNKNOWN	N	DRY	REAR		PRVTE									000		00				
N						5P	PORTLAND UA	90.57		PACIFIC AVE	03			N	DAY	INJ		PSNGR	CAR		01	DRVR	NONE	36	M	OR-Y		052,026	000	32,29			
N						45 31 16.51	-123 5 2.92			010200100S00		(02)																					
														02	NONE	0	STOP																
														PRVTE			STOP																
														PSNGR	CAR				01	DRVR	INJC	48	F	OR-Y		000	022	013		00			
														03	NONE	0	STOP																
														PRVTE			STOP																
														PSNGR	CAR				01	DRVR	NONE	51	F	OTH-Y		000	000			00			
07444	N	N	N	N	N	11/22/2017	WASHINGTON	1	14		ALLEY	N		N	CLD	ANGL-OTH	01	NONE	0											02			
CITY						WE	FOREST GROVE	MN	0	QUINCE ST	N	(NONE)	UNKNOWN	N	WET	TURN		PRVTE									000		00				
N						1P	PORTLAND UA	90.57		TUALATIN VLY HY	04			N	DAY	INJ		PSNGR	CAR		01	DRVR	NONE	23	M	OTH-Y		000	000	00			
N						45 31 16.53	-123 5 2.91			010200100S00		(02)																					
														02	NONE	0	TURN-L																
														PRVTE			TURN-L																
														PSNGR	CAR				01	DRVR	INJB	71	M	OR-Y		028	000			02			
01789	N	N	N	N		04/06/2015	WASHINGTON	1	14		STRGHT	N		N	CLR	S-1TURN	01	NONE	0											08			
NONE						MO	FOREST GROVE	MN	0	QUINCE ST	N	(NONE)	UNKNOWN	N	DRY	TURN		PRVTE									000		00				
N						9A	PORTLAND UA	90.60		PACIFIC AVE	04			N	DAY	PDO		PSNGR	CAR		01	DRVR	NONE	68	F	OR-Y		008	000	08			
N						45 31 14.89	-123 5 2.98			010200100S00		(02)																					
														02	NONE	0	STRGHT																
														PRVTE			STRGHT																
														PSNGR	CAR				01	DRVR	NONE	00	F	OR-Y		000	000			00			

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TRANSPORTATION DATA SECTION - CRASH ANALYSIS AND REPORTING UNIT

CONTINUOUS SYSTEM CRASH LISTING

Highway 102 ALL ROAD TYPES, MP 88.0 to 91.50 01/01/2010 to 05/31/2019, Both Add and Non-Add mileage

102: NEHALEM

132 - 135 of 147 Crash records shown.

SER#	P	R	J	S	W	DATE	COUNTY	RD#	FC	CONN#	RD CHAR	INT-TYPE	SPCL USE	TRLR	QTY	MOVE	A	S	INJ	G	E	LICNS	PED	ERROR	ACT	EVENT	CAUSE											
INVEST	E	A	U	I	C	O	CITY	COMPNT	FIRST	STREET	DIRECT	(MEDIAN)	INT-REL	OFFRD	WTHR	CRASH	OWNER	FROM	PRTC	INJ	G	E	LICNS	PED	ERROR	ACT	EVENT	CAUSE										
RD DPT	E	L	G	N	H	R	URBAN AREA	MLG	TYP	SECOND	STREET	LOCTN	LEGS	TRAF-	RNDBT	SURF	COLL	OWNER	FROM	PRTC	INJ	G	E	LICNS	PED	ERROR	ACT	EVENT	CAUSE									
UNLOC?	D	C	S	V	L	K	LONG	MILEPNT	LRS			(#LANES)	CONTL	DRVWY	LIGHT	SVRTY	V#	TYPE	TO	P#	TYPE	SVRTY	E	X	RES	LOC	ERROR	ACT	EVENT	CAUSE								
														02	NONE	1	STOP																					
06997	N	N	N	N	N	10/15/2016	WASHINGTON	1	14		STRGHT	Y		N	RAIN	S-1STOP	01	NONE	0	STRGHT																		
CITY						SA	FOREST GROVE	MN	0	QUINCE ST	N	(NONE)	TRF SIGNAL	N	WET	REAR		UNKN		N	-S																	
N						8P	PORTLAND UA	90.62		PACIFIC AVE	06			N	DLIT	INJ		PSNGR	CAR																			
N						45 31 13.8	-123 5 3.04			010200100S00		(02)																										
														02	NONE	0	STOP																					
05236	N	N	N	N	N	09/26/2011	WASHINGTON	1	14		INTER	CROSS	N		CLR	S-1STOP	01	UNKN	0	STRGHT																		
NO RPT						MO	FOREST GROVE	MN	0	PACIFIC AVE	N		TRF SIGNAL	N	DRY	REAR		UNKN		S	-N																	
N						4P	PORTLAND UA	90.64		QUINCE ST	05	1		N	DAY	INJ		PSNGR	CAR																			
N						45 31 12.7122984	-123 5 3.0974198			010200100S00																												
														02	NONE	0	STOP																					
														02	NONE	0	STOP																					
03333	N	N	N	N	N	06/25/2011	WASHINGTON	1	14		INTER	CROSS	N		CLR	S-1STOP	01	NONE	0	STRGHT																		
NO RPT						SA	FOREST GROVE	MN	0	PACIFIC AVE	N		TRF SIGNAL	N	DRY	REAR		PRVTE		N	-S																	
N						7P	PORTLAND UA	90.64		QUINCE ST	06	1		N	DAY	PDO		PSNGR	CAR																			
N						45 31 12.7122984	-123 5 3.0974198			010200100S00																												
														02	NONE	0	STOP																					

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TRANSPORTATION DATA SECTION - CRASH ANALYSIS AND REPORTING UNIT

CONTINUOUS SYSTEM CRASH LISTING

102: NEHALEM

Highway 102 ALL ROAD TYPES, MP 88.0 to 91.50 01/01/2010 to 05/31/2019, Both Add and Non-Add mileage

145 - 147 of 147 Crash records shown.

SER#	P	R	J	S	W	DATE	COUNTY	RD#	FC	CONN#	RD CHAR	INT-TYPE	SPCL USE	TRLR	QTY	MOVE	A	S	ACT	EVENT	CAUSE										
INVEST	E	A	U	I	C	O	DAY	CITY	COMPNT	FIRST STREET	DIRECT	(MEDIAN)	INT-REL	OFFRD	WTHR	CRASH	OWNER	FROM	PRTC	INJ	G	E	LICNS	PED	ERROR	ACT	EVENT	CAUSE			
RD DPT	E	L	G	N	H	R	TIME	URBAN AREA	MLG	TYP	SECOND STREET	LOCTN	LEGS	TRAF-	RNDBT	SURF	COLL	OWNER	FROM	PRTC	INJ	G	E	LICNS	PED	ERROR	ACT	EVENT	CAUSE		
UNLOC?	D	C	S	V	L	K	LAT	LONG	MILEPNT	LRS	(#LANES)	CONTL	DRVWY	LIGHT	SVRTY	V#	TYPE	TO	P#	TYPE	SVRTY	E	X	RES	LOC	ERROR	ACT	EVENT	CAUSE		
														02	NONE	0	STRGHT														
																	PRVTE	W	-E								000	052	00		
																	PSNGR	CAR	01	DRVR	INJC	53	F	OR-Y		000	000		00		
														02	NONE	0	STRGHT														
																	PRVTE	W	-E								000	052	00		
																	PSNGR	CAR	02	PSNG	INJC	17	F			000	000		00		
06439	N	N	N	N		11/26/2018	WASHINGTON	2	02		STRGHT	N		N	RAIN	O-STRGHT	01	NONE	0	STRGHT										05	
COUNTY						MO		MN	0		UN	(RSDMD)	UNKNOWN	N	WET	SS-M	UNKN			N	-S							000	00		
Y						8P		88.10			04			N	DLIT	INJ	PSNGR	CAR			01	DRVR	NONE	00	Unk	UNK		046	000	05	
N						45 32 50.28	-123 6 20.58			010200200S00		(02)																			
														02	NONE	0	STRGHT														
																	PRVTE	S	-N									000	00		
																	PSNGR	CAR	01	DRVR	INJC	28	M	OR-Y		000	000		00		
00312	Y	N	N	N	N	01/19/2018	WASHINGTON	2	02		INTER	3-LEG	N	N	RAIN	ANGL-OTH	01	NONE	9	STRGHT										01,02	
COUNTY						FR		MN	0		CN		YIELD	Y	WET	ANGL	N/A			S	-N							000	00		
N						6A		88.69			04	0		N	DLIT	PDO	PSNGR	CAR			01	DRVR	NONE	00	Unk	UNK		000	000	00	
N						45 32 19.6	-123 6 25.5			010200200S00																					
														02	NONE	9	STRGHT														
																	N/A			W	-E							000	00		
																	SEMI	TOW	01	DRVR	NONE	00	Unk	UNK		000	000		00		

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APPENDIX D
TRAFFIC FORECASTING WORKSHEETS



Traffic Volume Calculation Worksheet

Forest Grove Oak Street Land Use Refinement

PM Peak Hour Volumes

Statewide

OR-18

COVID-19 Adjustment: 0.88
 Seasonal Adjustment: 1.023

0.98

Sunset Growth Rates

Sunset: 1.50%
 EB OR 47: 1.00%
 WB OR 47: 1.25%

Intersection	Movement		Existing Volume Calculations					No Build Model Growth Calculation				No Build			
			Existing	Previous	Count	COVID-19	COVID-19	Seasonal	Percent	Annual	Volume	Annual	Future NB	Volume	Future NB
			2020	2017		State Adjusted	OR-18 Adjusted	Adjusted	Of	Growth	Adjustment	Growth	2040		2040
		Volumes	Volumes	Delta	Volumes	Volumes	Volumes	Approach	Volume		Total	Growth	Balance	Volumes	
3 OR 47 NW Martin Road TMC Date: 07/14/2020 PHF: 0.93		L	0	0	0	0	0	0		0	0	0	0		0
	EB	T	0	0	0	0	0	0		0	8	8	160		160
		R	0	0	0	0	0	0		0	6	6	120		120
		L	317	340	-17	360	323	331	84%	9	-13	-4	-76	1	256
	WB	T	0	0	0	0	0	0	0%	0	15	15	300	-5	295
		R	61	107	-45	69	62	64	16%	2	-2	0	-4	5	64
		L	0	0	0	0	0	0	0%	0	6	6	120		120
	NB	T	381	339	50	433	389	398	63%	6	-5	1	13		411
		R	224	217	12	255	229	234	37%	3	-1	2	47		280
		L	31	39	-7	35	32	32	9%	0	0	0	0		32
SB	T	311	219	98	353	317	325	91%	-2	-1	-3	-56		268	
	R	0	0	0	0	0	0	0%	0	1	1	20		20	
			1,325	1,261	2.4%	1,506	1,352								
4 OR 47 Pacific Avenue TMC Date: 07/14/2020 PHF: 0.96		L	99			113	101	103	11%	0	0	0	4		108
	EB	T	727			826	742	759	81%	2	0	2	32		791
		R	69			78	70	72	8%	0	0	0	3		75
		L	345			392	352	360	23%	2	0	2	46		407
	WB	T	871			990	889	909	59%	6	-2	4	77		987
		R	268			305	273	280	18%	2	-1	1	20		300
		L	75			85	77	78	13%	1	3	4	89		167
	NB	T	223			253	228	233	39%	4	-4	0	5		238
		R	277			315	283	289	48%	5	1	6	126		415
		L	212			241	216	221	31%	0	0	0	0		221
SB	T	346			393	353	361	51%	0	0	0	0		361	
	R	117			133	119	122	17%	0	0	0	0		122	
			3,629					3,788							

Percent of Average Weekday Traffic, ATR 34-009					
Year	2014	2015	2016	2017	2018
Peak Month (June)	103	102	104	106	103
Count Month (July)	101	100	101	104	101

Peak Month Average: 103.33333

Count Month Average: 101.0000

30th Hour Factor: 1.0231

APPENDIX E
2040 PM PEAK HOUR INTERSECTION OPERATIONS ANALYSIS
WORKSHEETS

Lanes, Volumes, Timings
1: Sunset Dr/ Bend Rd & Hwy 47

2040 Baseline
PM Peak Hour

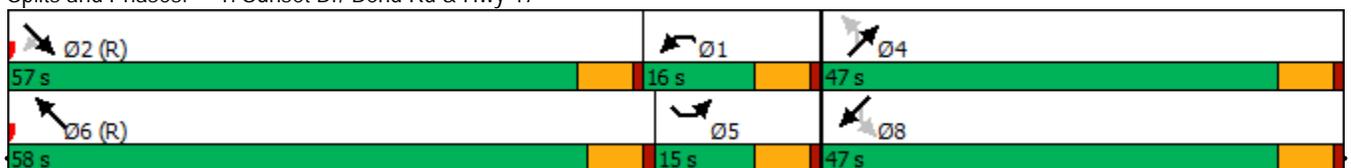


Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations	↖	↑	↗	↖	↗		↖	↗		↖	↗	
Traffic Volume (vph)	1	305	240	155	345	5	190	5	120	1	1	1
Future Volume (vph)	1	305	240	155	345	5	190	5	120	1	1	1
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Storage Length (ft)	135		440	480		0	100		0	100		0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (ft)	25			25			25			25		
Right Turn on Red			Yes			Yes			Yes			Yes
Link Speed (mph)		50			50			35				35
Link Distance (ft)		731			1293			886				1099
Travel Time (s)		10.0			17.6			17.3				21.4
Turn Type	Prot	NA	Perm	Prot	NA		Perm	NA		Perm	NA	
Protected Phases	5	2		1	6			4				8
Permitted Phases			2				4	4		8		
Detector Phase	5	2	2	1	6		4	4		8		8
Switch Phase												
Minimum Initial (s)	4.0	15.0	15.0	4.0	15.0		6.0	6.0		6.0		6.0
Minimum Split (s)	15.0	26.0	26.0	15.0	29.0		19.0	19.0		19.0		19.0
Total Split (s)	15.0	57.0	57.0	16.0	58.0		47.0	47.0		47.0		47.0
Total Split (%)	12.5%	47.5%	47.5%	13.3%	48.3%		39.2%	39.2%		39.2%		39.2%
Maximum Green (s)	9.0	51.0	51.0	10.0	52.0		41.0	41.0		41.0		41.0
Yellow Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0		5.0		5.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0		1.0	1.0		1.0		1.0
Lost Time Adjust (s)	-1.0	-2.0	-2.0	0.0	-2.0		-0.5	-0.5		-0.5		-0.5
Total Lost Time (s)	5.0	4.0	4.0	6.0	4.0		5.5	5.5		5.5		5.5
Lead/Lag	Lag	Lead	Lead	Lag	Lead							
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes							
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0		3.0
Minimum Gap (s)	0.5	2.9	2.9	0.5	2.9		0.5	0.5		0.5		0.5
Time Before Reduce (s)	8.0	10.0	10.0	8.0	10.0		8.0	8.0		8.0		8.0
Time To Reduce (s)	3.0	20.0	20.0	3.0	20.0		3.0	3.0		3.0		3.0
Recall Mode	None	C-Max	C-Max	None	C-Max		None	None		None		None
Walk Time (s)		5.0	5.0		5.0		5.0	5.0		5.0		5.0
Flash Dont Walk (s)		13.0	13.0		18.0		14.0	14.0		14.0		14.0
Pedestrian Calls (#/hr)		0	0		0		0	0		0		0

Intersection Summary

Area Type: Other
 Cycle Length: 120
 Actuated Cycle Length: 120
 Offset: 40 (33%), Referenced to phase 2:SET and 6:NWT, Start of Green
 Natural Cycle: 65
 Control Type: Actuated-Coordinated

Splits and Phases: 1: Sunset Dr/ Bend Rd & Hwy 47



HCM 6th Signalized Intersection Summary
 1: Sunset Dr/ Bend Rd & Hwy 47

2040 Baseline
 PM Peak Hour



Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (veh/h)	1	305	240	155	345	5	190	5	120	1	1	1
Future Volume (veh/h)	1	305	240	155	345	5	190	5	120	1	1	1
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	0.99		0.99	0.99		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1750	1641	1709	1709	1654	1654	1709	1750	1750	1750	1750	1750
Adj Flow Rate, veh/h	1	321	0	163	363	5	200	5	126	1	1	1
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	0	8	3	3	7	7	3	0	0	0	0	0
Cap, veh/h	430	725		419	733	10	298	10	243	175	137	137
Arrive On Green	0.26	0.44	0.00	0.26	0.45	0.43	0.17	0.17	0.17	0.17	0.17	0.17
Sat Flow, veh/h	1667	1641	1448	1628	1628	22	1396	56	1418	1270	800	800
Grp Volume(v), veh/h	1	321	0	163	0	368	200	0	131	1	0	2
Grp Sat Flow(s),veh/h/ln	1667	1641	1448	1628	0	1650	1396	0	1474	1270	0	1600
Q Serve(g_s), s	0.1	16.3	0.0	9.9	0.0	18.9	16.7	0.0	9.7	0.1	0.0	0.1
Cycle Q Clear(g_c), s	0.1	16.3	0.0	9.9	0.0	18.9	16.8	0.0	9.7	9.8	0.0	0.1
Prop In Lane	1.00		1.00	1.00		0.01	1.00		0.96	1.00		0.50
Lane Grp Cap(c), veh/h	430	725		419	0	743	298	0	253	175	0	274
V/C Ratio(X)	0.00	0.44		0.39	0.00	0.50	0.67	0.00	0.52	0.01	0.00	0.01
Avail Cap(c_a), veh/h	430	725		419	0	743	541	0	510	396	0	553
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	33.1	23.3	0.0	36.7	0.0	23.4	48.2	0.0	45.4	49.7	0.0	41.4
Incr Delay (d2), s/veh	0.0	2.0	0.0	0.6	0.0	2.4	2.6	0.0	1.6	0.0	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	6.3	0.0	3.9	0.0	7.4	5.9	0.0	3.7	0.0	0.0	0.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	33.1	25.2	0.0	37.3	0.0	25.7	50.8	0.0	47.1	49.7	0.0	41.4
LnGrp LOS	C	C		D	A	C	D	A	D	D	A	D
Approach Vol, veh/h		322	A		531			331				3
Approach Delay, s/veh		25.2			29.3			49.3				44.1
Approach LOS		C			C			D				D
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	36.9	57.0		26.1	35.9	58.0		26.1				
Change Period (Y+Rc), s	6.0	6.0		6.0	6.0	6.0		6.0				
Max Green Setting (Gmax), s	10.0	51.0		41.0	9.0	52.0		41.0				
Max Q Clear Time (g_c+I1), s	11.9	18.3		18.8	2.1	20.9		11.8				
Green Ext Time (p_c), s	0.0	1.2		1.3	0.0	1.3		0.0				

Intersection Summary

HCM 6th Ctrl Delay	33.8
HCM 6th LOS	C

Notes

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

Intersection

Int Delay, s/veh 3.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗			↕			↕	
Traffic Vol, veh/h	5	310	110	5	460	15	40	25	5	5	55	5
Future Vol, veh/h	5	310	110	5	460	15	40	25	5	5	55	5
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None									
Storage Length	200	-	-	200	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	0	6	5	2	5	0	0	0	8	0	2	0
Mvmt Flow	5	326	116	5	484	16	42	26	5	5	58	5

Major/Minor	Major1	Major2	Minor1	Minor2
Conflicting Flow All	500	0	0	442
Stage 1	-	-	-	-
Stage 2	-	-	-	-
Critical Hdwy	4.1	-	-	4.12
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-
Follow-up Hdwy	2.2	-	-	2.218
Pot Cap-1 Maneuver	1075	-	-	1118
Stage 1	-	-	-	-
Stage 2	-	-	-	-
Platoon blocked, %	-	-	-	-
Mov Cap-1 Maneuver	1075	-	-	1118
Mov Cap-2 Maneuver	-	-	-	-
Stage 1	-	-	-	-
Stage 2	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	0.1	26.8	23.1
HCM LOS			D	C

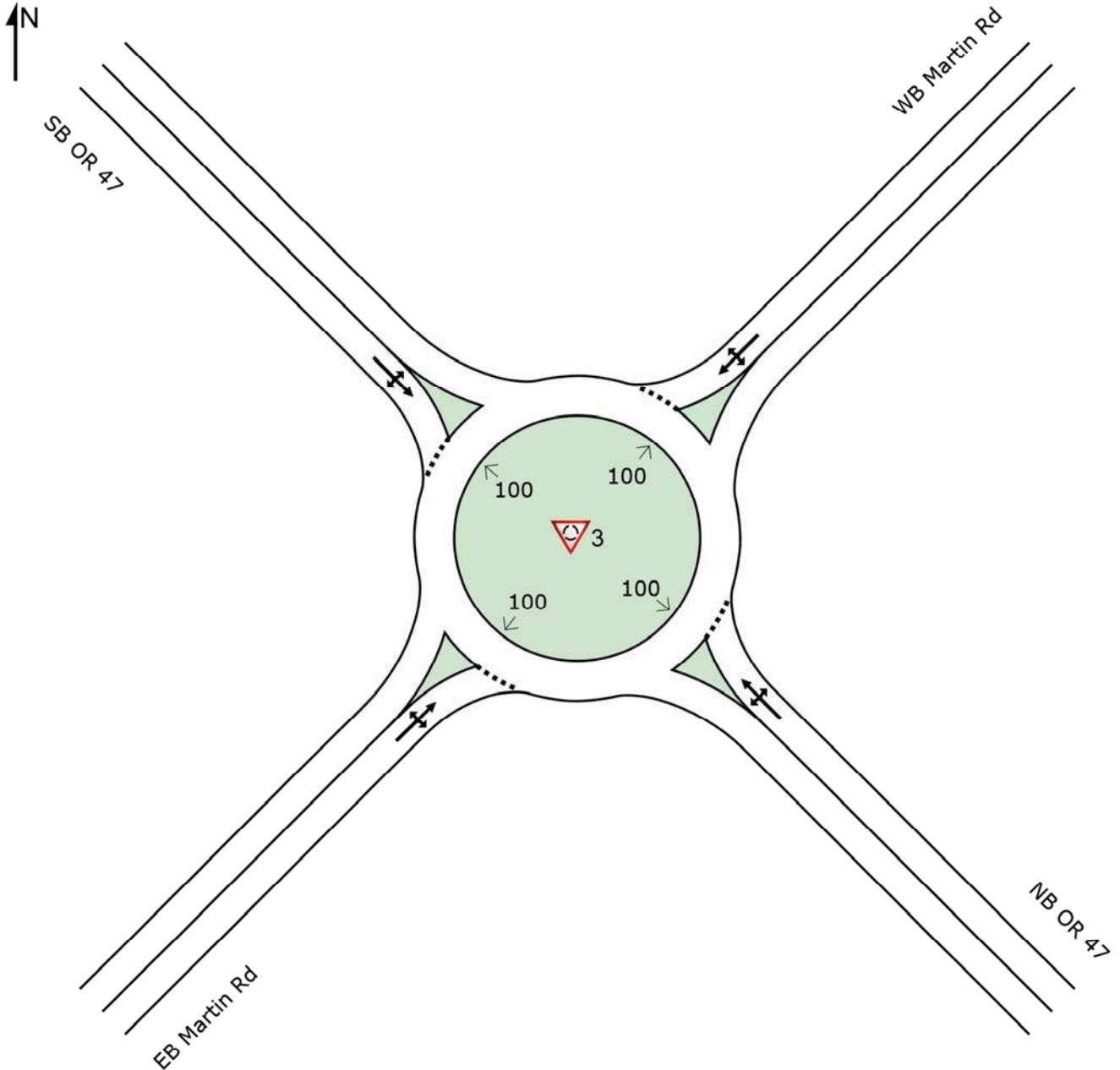
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	238	1075	-	-	1118	-	-	267
HCM Lane V/C Ratio	0.31	0.005	-	-	0.005	-	-	0.256
HCM Control Delay (s)	26.8	8.4	-	-	8.2	-	-	23.1
HCM Lane LOS	D	A	-	-	A	-	-	C
HCM 95th %tile Q(veh)	1.3	0	-	-	0	-	-	1

SITE LAYOUT

Site: 3 [OR 47 at Martin Rd (Site Folder: General)]

2040 Baseline
PM Peak Hour
Site Category: (None)
Roundabout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



MOVEMENT SUMMARY

 Site: 3 [OR 47 at Martin Rd (Site Folder: General)]

2040 Baseline
 PM Peak Hour
 Site Category: (None)
 Roundabout

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[Total veh/h	HV %	[Total veh/h	HV %				[Veh. veh	Dist] ft				
SouthEast: NB OR 47														
3x	L2	120	2.0	126	2.0	0.724	12.4	LOS B	9.0	235.9	0.78	0.68	0.82	35.3
8x	T1	410	6.0	432	6.0	0.724	6.7	LOS A	9.0	235.9	0.78	0.68	0.82	35.2
18x	R2	280	9.0	295	9.0	0.724	6.9	LOS A	9.0	235.9	0.78	0.68	0.82	34.0
Approach		810	6.4	853	6.4	0.724	7.6	LOS A	9.0	235.9	0.78	0.68	0.82	34.8
NorthEast: WB Martin Rd														
1x	L2	255	7.0	268	7.0	0.824	24.2	LOS C	13.3	343.9	1.00	1.22	1.62	29.9
6x	T1	295	2.0	311	2.0	0.824	17.8	LOS B	13.3	343.9	1.00	1.22	1.62	30.0
16x	R2	65	2.0	68	2.0	0.824	17.8	LOS B	13.3	343.9	1.00	1.22	1.62	29.2
Approach		615	4.1	647	4.1	0.824	20.5	LOS C	13.3	343.9	1.00	1.22	1.62	29.9
NorthWest: SB OR 47														
7x	L2	30	3.0	32	3.0	0.521	17.0	LOS B	4.7	122.5	0.94	0.99	1.10	33.7
4x	T1	270	6.0	284	6.0	0.521	11.3	LOS B	4.7	122.5	0.94	0.99	1.10	33.6
14x	R2	20	2.0	21	2.0	0.521	11.0	LOS B	4.7	122.5	0.94	0.99	1.10	32.7
Approach		320	5.5	337	5.5	0.521	11.9	LOS B	4.7	122.5	0.94	0.99	1.10	33.6
SouthWest: EB Martin Rd														
5x	L2	5	2.0	5	2.0	0.363	13.8	LOS B	2.5	64.2	0.78	0.78	0.78	35.5
2x	T1	160	2.0	168	2.0	0.363	7.8	LOS A	2.5	64.2	0.78	0.78	0.78	35.4
12x	R2	120	2.0	126	2.0	0.363	7.9	LOS A	2.5	64.2	0.78	0.78	0.78	34.4
Approach		285	2.0	300	2.0	0.363	7.9	LOS A	2.5	64.2	0.78	0.78	0.78	35.0
All Vehicles		2030	4.9	2137	4.9	0.824	12.2	LOS B	13.3	343.9	0.87	0.91	1.10	33.0

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Roundabout LOS Method: SIDRA Roundabout LOS.

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Geometric Delay is included).

Queue Model: HCM Queue Formula.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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Project: N:\Projects\1902 3J Consulting, Inc\1902.01 Forest Grove Oak Street Area Land Use Refinement\03-Analysis\Operations\Sidra\2040 Baseline.sip9

Lanes, Volumes, Timings
4: Hwy 47 & Pacific Ave

2040 Baseline
PM Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	110	790	75	405	985	300	165	240	415	220	360	120
Future Volume (vph)	110	790	75	405	985	300	165	240	415	220	360	120
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	150		120	250		265	300		310	250		225
Storage Lanes	1		0	1		1	1		1	1		1
Taper Length (ft)	25			25			25			25		
Right Turn on Red			Yes			Yes			Yes			Yes
Link Speed (mph)		30			40			45			25	
Link Distance (ft)		898			1068			715			1796	
Travel Time (s)		20.4			18.2			10.8			49.0	
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases						6			8			4
Detector Phase	5	2		1	6	6	3	8	8	7	4	4
Switch Phase												
Minimum Initial (s)	4.0	10.0		4.0	10.0	10.0	4.0	6.0	6.0	4.0	4.0	4.0
Minimum Split (s)	9.0	29.0		9.0	28.0	28.0	9.0	20.0	20.0	20.0	37.0	37.0
Total Split (s)	15.0	34.0		33.0	52.0	52.0	16.0	30.0	30.0	23.0	37.0	37.0
Total Split (%)	12.5%	28.3%		27.5%	43.3%	43.3%	13.3%	25.0%	25.0%	19.2%	30.8%	30.8%
Maximum Green (s)	11.0	29.0		29.0	47.0	47.0	12.0	26.0	26.0	19.0	33.0	33.0
Yellow Time (s)	3.0	4.0		3.0	4.0	4.0	3.0	3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	1.0	1.0		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	-1.0		0.0	-1.0	-1.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead	Lag		Lead	Lag	Lag	Lead	Lead	Lead	Lag	Lag	Lag
Lead-Lag Optimize?	Yes	Yes		Yes								
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
Minimum Gap (s)	0.5	2.1		0.5	2.1	2.1	0.5	0.5	0.5	0.5	0.2	0.2
Time Before Reduce (s)	8.0	10.0		8.0	10.0	10.0	8.0	8.0	8.0	8.0	8.0	8.0
Time To Reduce (s)	3.0	20.0		3.0	20.0	20.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	C-Max		None	C-Max	C-Max	None	None	None	None	None	None
Walk Time (s)		5.0			10.0	10.0					7.0	7.0
Flash Dont Walk (s)		18.0			12.0	12.0					26.0	26.0
Pedestrian Calls (#/hr)		0			0	0					0	0

Intersection Summary

Area Type: Other
 Cycle Length: 120
 Actuated Cycle Length: 120
 Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Green
 Natural Cycle: 115
 Control Type: Actuated-Coordinated

Splits and Phases: 4: Hwy 47 & Pacific Ave



HCM 6th Signalized Intersection Summary
4: Hwy 47 & Pacific Ave

2040 Baseline
PM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	110	790	75	405	985	300	165	240	415	220	360	120
Future Volume (veh/h)	110	790	75	405	985	300	165	240	415	220	360	120
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1811	1870	1870	1811	1841	1885	1841	1752	1811	1870	1781	1811
Adj Flow Rate, veh/h	115	823	0	422	1026	0	172	250	0	229	375	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	6	2	2	6	4	1	4	10	6	2	8	6
Cap, veh/h	139	989		417	1536		175	281		331	439	
Arrive On Green	0.08	0.28	0.00	0.24	0.44	0.00	0.10	0.16	0.00	0.19	0.25	0.00
Sat Flow, veh/h	1725	3647	0	1725	3497	1598	1753	1752	1535	1781	1781	1535
Grp Volume(v), veh/h	115	823	0	422	1026	0	172	250	0	229	375	0
Grp Sat Flow(s),veh/h/ln	1725	1777	0	1725	1749	1598	1753	1752	1535	1781	1781	1535
Q Serve(g_s), s	7.9	26.1	0.0	29.0	27.9	0.0	11.7	16.8	0.0	14.4	24.1	0.0
Cycle Q Clear(g_c), s	7.9	26.1	0.0	29.0	27.9	0.0	11.7	16.8	0.0	14.4	24.1	0.0
Prop In Lane	1.00		0.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	139	989		417	1536		175	281		331	439	
V/C Ratio(X)	0.82	0.83		1.01	0.67		0.98	0.89		0.69	0.85	
Avail Cap(c_a), veh/h	158	989		417	1536		175	380		331	490	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	54.3	40.7	0.0	45.5	26.7	0.0	53.9	49.3	0.0	45.6	43.1	0.0
Incr Delay (d2), s/veh	26.1	8.1	0.0	47.2	2.3	0.0	62.2	17.6	0.0	6.0	12.7	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.4	12.4	0.0	17.5	11.6	0.0	8.1	8.5	0.0	7.0	12.2	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	80.4	48.8	0.0	92.7	29.0	0.0	116.1	67.0	0.0	51.6	55.8	0.0
LnGrp LOS	F	D		F	C		F	E		D	E	
Approach Vol, veh/h		938	A		1448	A		422	A		604	A
Approach Delay, s/veh		52.7			47.6			87.0			54.2	
Approach LOS		D			D			F			D	
Timer - Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	33.0	37.4	16.0	33.6	13.7	56.7	26.3	23.3				
Change Period (Y+Rc), s	4.0	5.0	4.0	4.0	4.0	5.0	4.0	4.0				
Max Green Setting (Gmax), s	29.0	29.0	12.0	33.0	11.0	47.0	19.0	26.0				
Max Q Clear Time (g_c+I1), s	31.0	28.1	13.7	26.1	9.9	29.9	16.4	18.8				
Green Ext Time (p_c), s	0.0	0.4	0.0	0.9	0.0	4.7	0.2	0.5				

Intersection Summary

HCM 6th Ctrl Delay	55.0
HCM 6th LOS	E

Notes

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

Lanes, Volumes, Timings
4: Hwy 47 & Pacific Ave

2040 Baseline with Improvement

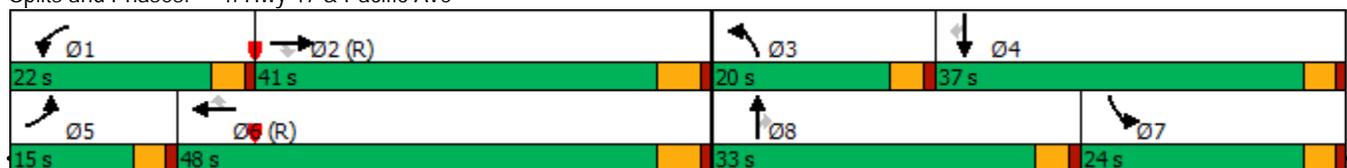
PM Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	110	790	75	405	985	300	165	240	415	220	360	120
Future Volume (vph)	110	790	75	405	985	300	165	240	415	220	360	120
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	150		120	250		265	300		310	250		225
Storage Lanes	1		1	2		1	1		1	1		1
Taper Length (ft)	25			25			25			25		
Right Turn on Red			Yes			Yes			Yes			Yes
Link Speed (mph)		30			40			45			25	
Link Distance (ft)		898			1068			715			1796	
Travel Time (s)		20.4			18.2			10.8			49.0	
Turn Type	Prot	NA	Perm									
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6			8			4
Detector Phase	5	2	2	1	6	6	3	8	8	7	4	4
Switch Phase												
Minimum Initial (s)	4.0	10.0	10.0	4.0	10.0	10.0	4.0	6.0	6.0	4.0	4.0	4.0
Minimum Split (s)	9.0	29.0	29.0	9.0	28.0	28.0	9.0	20.0	20.0	20.0	37.0	37.0
Total Split (s)	15.0	41.0	41.0	22.0	48.0	48.0	20.0	33.0	33.0	24.0	37.0	37.0
Total Split (%)	12.5%	34.2%	34.2%	18.3%	40.0%	40.0%	16.7%	27.5%	27.5%	20.0%	30.8%	30.8%
Maximum Green (s)	11.0	36.0	36.0	18.0	43.0	43.0	16.0	29.0	29.0	20.0	33.0	33.0
Yellow Time (s)	3.0	4.0	4.0	3.0	4.0	4.0	3.0	3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	-1.0	-1.0	0.0	-1.0	-1.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lead	Lead	Lag	Lag	Lag
Lead-Lag Optimize?	Yes											
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
Minimum Gap (s)	0.5	2.1	2.1	0.5	2.1	2.1	0.5	0.5	0.5	0.5	0.2	0.2
Time Before Reduce (s)	8.0	10.0	10.0	8.0	10.0	10.0	8.0	8.0	8.0	8.0	8.0	8.0
Time To Reduce (s)	3.0	20.0	20.0	3.0	20.0	20.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	None	None	None	None	None
Walk Time (s)		5.0	5.0		10.0	10.0					7.0	7.0
Flash Dont Walk (s)		18.0	18.0		12.0	12.0					26.0	26.0
Pedestrian Calls (#/hr)		0	0		0	0					0	0

Intersection Summary

Area Type: Other
 Cycle Length: 120
 Actuated Cycle Length: 120
 Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Green
 Natural Cycle: 85
 Control Type: Actuated-Coordinated

Splits and Phases: 4: Hwy 47 & Pacific Ave



HCM 6th Signalized Intersection Summary

4: Hwy 47 & Pacific Ave

2040 Baseline with Improvement

PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	110	790	75	405	985	300	165	240	415	220	360	120
Future Volume (veh/h)	110	790	75	405	985	300	165	240	415	220	360	120
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1811	1870	1811	1811	1841	1885	1841	1752	1811	1870	1781	1811
Adj Flow Rate, veh/h	115	823	0	422	1026	0	172	250	0	229	375	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	6	2	6	6	4	1	4	10	6	2	8	6
Cap, veh/h	139	1293		477	1488		199	283		354	439	
Arrive On Green	0.08	0.36	0.00	0.14	0.43	0.00	0.11	0.16	0.00	0.20	0.25	0.00
Sat Flow, veh/h	1725	3554	1535	3346	3497	1598	1753	1752	1535	1781	1781	1535
Grp Volume(v), veh/h	115	823	0	422	1026	0	172	250	0	229	375	0
Grp Sat Flow(s),veh/h/ln	1725	1777	1535	1673	1749	1598	1753	1752	1535	1781	1781	1535
Q Serve(g_s), s	7.9	23.0	0.0	14.9	28.6	0.0	11.6	16.8	0.0	14.2	24.1	0.0
Cycle Q Clear(g_c), s	7.9	23.0	0.0	14.9	28.6	0.0	11.6	16.8	0.0	14.2	24.1	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	139	1293		477	1488		199	283		354	439	
V/C Ratio(X)	0.82	0.64		0.89	0.69		0.86	0.88		0.65	0.85	
Avail Cap(c_a), veh/h	158	1293		502	1488		234	423		354	490	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	54.3	31.6	0.0	50.5	28.0	0.0	52.3	49.2	0.0	44.2	43.1	0.0
Incr Delay (d2), s/veh	26.1	2.4	0.0	16.5	2.6	0.0	23.9	13.8	0.0	4.0	12.7	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.4	10.2	0.0	7.2	12.0	0.0	6.3	8.2	0.0	6.7	12.2	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	80.4	34.0	0.0	67.0	30.7	0.0	76.2	63.0	0.0	48.2	55.8	0.0
LnGrp LOS	F	C		E	C		E	E		D	E	
Approach Vol, veh/h		938	A		1448	A		422	A		604	A
Approach Delay, s/veh		39.7			41.3			68.4			52.9	
Approach LOS		D			D			E			D	
Timer - Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	21.1	47.7	17.6	33.6	13.7	55.1	27.9	23.4				
Change Period (Y+Rc), s	4.0	5.0	4.0	4.0	4.0	5.0	4.0	4.0				
Max Green Setting (Gmax), s	18.0	36.0	16.0	33.0	11.0	43.0	20.0	29.0				
Max Q Clear Time (g_c+I1), s	16.9	25.0	13.6	26.1	9.9	30.6	16.2	18.8				
Green Ext Time (p_c), s	0.2	3.2	0.1	0.9	0.0	4.1	0.3	0.6				

Intersection Summary

HCM 6th Ctrl Delay	46.2
HCM 6th LOS	D

Notes

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

2040 Critical V/C Ratio Calculations

Sunset - 2040			
Approach	Saturation Flow		v/c ratio
	adjusted	total	
EB	321	1641	0.20
WB	163	1628	0.10
NB	200	1396	0.14
Total			0.44
<u>Traffic Signal Details</u>			
Cycle Length:	120		
Lost time:	19		
Critical V/C:			0.52

Pacific - 2040			
Approach	Saturation Flow		v/c ratio
	adjusted	total	
EB	823	3647	0.23
WB	422	1725	0.24
NB	250	1752	0.14
SB	375	1781	0.21
Total			0.82
<u>Traffic Signal Details</u>			
Cycle Length:	120		
Lost time:	16		
Critical V/C:			0.95

Pacific - 2040 with Improvements			
Approach	Saturation Flow		v/c ratio
	adjusted	total	
WB L	422	3346	0.13
WB T	1026	3497	0.29
NB	250	1752	0.14
SB	375	1781	0.21
Total			0.77
<u>Traffic Signal Details</u>			
Cycle Length:	120		
Lost time:	16		
Critical V/C:			0.89