KITTELSON & ASSOCIATES
851 SW 6th AVENUE, SUITE 600
PORTLAND, OR 97204
P 503.228.5230 F 503.273.8169

MEMORANDUM

Date:	April 21, 2021	Project #: 23021.35
To:	James Feldmann	
From:	Nick Gross, Camilla Dartnell, Phill Worth, Bincy Koshy, Polina Polikakhina	
Project:	Highway OR 99W South Corvallis Facility Plan	
Subject:	TM #10: Existing Safety and Active Transportation Inventory and Conditions	

TABLE OF CONTENTS

LIST OF FIGURES

PURPOSE

This memorandum documents the existing safety and active transportation inventory and conditions for the Highway OR 99W South Corvallis Facility Plan (Plan). The body of the memorandum focuses on the existing conditions for travel along and across the corridor, and Appendix A provides considerations for potential future stormwater facilities along the corridor.

Project Study Area

The Plan study area covers a 3.9-mile segment of OR 99W between SW Western Boulevard (mile point [MP] 83.93) and the City of Corvallis (City) southern urban growth boundary (UGB) (MP 87.85). The following study intersections will be analyzed as part of the safety and pedestrian and bicycle analysis.

1. SW 4th Street (OR 99W southbound)/SW Western Boulevard
2. SW 3rd Street (OR 99W northbound) /SW Western Boulevard
3. SW 3rd Street (OR 99W northbound) /SW B Avenue
4. OR99W/SW Twin Oaks Circle/SE Chapman Place
5. OR99W/SW Avery Avenue/Crystal Lake Drive
6. OR99W/SE Alexander Avenue
7. OR99W/Viewmont Avenue
8. OR99W/Tunison Avenue
9. OR99W/Park Avenue
10. OR99W/Goodnight Avenue
11. OR99W/Rivergreen Avenue
12. OR99W/Kiger Island Road
13. OR99W/SW Airport Avenue

The project study area for the safety and pedestrian and bicycle analysis also includes 18 public streets that intersect the highway. Based on data provided by ODOT Transportation Planning and Analysis Unit (TPAU), Agency, City, and County, these public streets include:

- SW Western Boulevard
- SW B Avenue
- SW Twin Oaks Circle
- SE Chapman Place
- SW Avery Avenue
- Crystal Lake Drive
- SE Bridgeway Avenue
- SE Lilly Avenue
- SE Alexander Avenue
- SE Viewmont Avenue
- SW Tunison Avenue
- SE Richland Avenue
- SE Park Avenue
- SW Wake Robin Avenue
- SE Goodnight Avenue
- SE Rivergreen Avenue
- SE Kiger Island Drive
- SW Airport Avenue

Figure 1 illustrates the study area extents of OR 99W, study area intersections and study area public streets intersecting the highway.

Figure 1

KITTELSON & ASSOCIATES

Study Area
Corvallis, Oregon

PEDESTRIAN SYSTEM

The pedestrian system within the project study area consists of sidewalks, physical buffers such as curbs, vegetation, trees and grass, as well as shared-use paths. These facilities provide residents the ability to access local retail, commercial centers, recreational areas, and other land uses within South Corvallis and neighboring areas by walking. Figure 2 illustrates the existing pedestrian facility inventory within the project study area.

Pedestrian Facilities

Pedestrian facility data was obtained from ODOT to assess the adequacy of the existing pedestrian facilities within the project study area. The consultant team further verified the data through a comprehensive review of satellite imagery as well as field observations and documentation conducted during the Road Safety Audit (RSA). The data includes the location of existing pedestrian facilities, buffer widths, and current facility conditions for OR99W and abutting roadways to the first intersection.

Sidewalks

North of the interchange, sidewalk is continuous and provided on both sides of SW 4th Street (OR 99W southbound) and SW 3rd Street (OR 99W northbound) to SW C Avenue. In this segment, sidewalks are separated from the back edge of the street curb with a planter strip of varying width and vegetation. Sidewalk is provided on the west side of SW 4th Street (OR 99W) from SW C Avenue along the southbound portion of the couplet through the interchange. Sidewalks are provided on both sides of the road from SW C Avenue through the northbound interchange couplet (SW 3rd Street), but the west sidewalk ends south of the bridge across the Marys River. South of the interchange, sidewalks extend until Kiger Island Drive with the exception of the segment on the east side of 99W from the interchange to SW Crystal Lake Drive that has a shared use path.

Along the abutting public roadways identified as part of the project study area, sidewalks are provided along SW Western Boulevard, SW B Avenue, SW Twin Oak Circle, SE Chapman Place, SW Avery Avenue, Crystal Lake Drive (Eastbound), SE Lilly Avenue, SW Alexander Avenue, SE Alexander Avenue, SE Viewmont Avenue, SW Tunison Avenue, SE Park Avenue, SW Wake Robin Avenue (Westbound), SE Goodnight Avenue and SE Rivergreen Avenue.

Sidewalks are not provided along the north side of SE Crystal Lake Drive from OR 99W to 195 SE Crystal Lake Drive; along both directions of SE Bridgeway Avenue from OR 99W to SE Atwood Avenue; along both directions of SE Richland Avenue from OR 99W to SE Thompson Street; along the south side of SW Wake Robin Avenue from OR 99W to SW Wake Robin Place; along both directions of SE Kiger Island Drive from OR 99W to the eastern project limit; and along both directions of SW Airport Avenue from OR 99W to SW Lowe Street.

Sidewalk Buffers

Physical buffers such as trees, vegetation, and grass are located between the sidewalk and roadway along OR 99W from SW Western Boulevard to the US 20/OR 34 ramps in both directions (SW 3rd Street and SW 4th Street, from SE Alexander Avenue to SE Viewmont Avenue, and from SE Goodnight Avenue to SE Rivergreen Avenue). Buffers are also present on abutting public streets such as SW Western Boulevard from the western project limit to the eastern project limit; SW B Avenue from SW 4th Street to SW 3rd Street and from SW 3rd Street to the eastern project limit; SW Alexander Avenue from the cul-de-sac to OR 99W; SW Wake Robin Avenue from SW Wake Robin Place to OR 99W; SE Goodnight Avenue from OR 99W to SE Steller Drive; and SE Rivergreen Avenue from OR 99W to SE Villa Drive.

Crosswalks

All signalized intersections within the project area including SW 4th Street/SW Western Boulevard, SW 3rd Street/SW Western Boulevard, SW Avery Street/OR 99W and SE Alexander Avenue/OR 99W are equipped with crosswalks on all legs of the approaches at the intersection. Crosswalks are also provided on the east leg of SE Rivergreen Avenue and the east leg of SE Chapman Place.

Enhanced Crossings

There are four enhanced crossings on the OR 99W corridor. These rectangular rapid flashing beacons (RRFBs) with refuge islands are provided at the following locations:

- 150 feet south of SW Twin Oaks Circle/OR 99W (mile point 84.36);
- 240 feet south of SW Cummings Avenue/OR 99W (mile point 84.73);
- 90 feet south of SE Mayberry Avenue/OR 99W (mile point 84.85);
- 195 feet south of SW Tunison Avenue/OR 99W (mile point 85.12).

Shared-Use Paths

A shared-use path is located approximately 250 feet east of OR 99W between SW B Avenue and the OR34 interchange area, providing a parallel and separated facility for people walking. The shared-use path crosses the Marys River on a separate bridge structure immediately east of the US 20/OR 34 northbound on-ramp. Between SW Twin Oaks Circle/SE Chapman Place and SE Crystal Lake Drive, a shared use path is present as a sidepath on the east side of OR99W.

Figure 2

KITTELSON & ASSOCIATES

Existing Pedestrian Facilities
Corvallis, Oregon

BICYCLE SYSTEM

The bicycle system within the project study area consists of on-street bike lanes, shoulder bikeways, and shared roadways, as well as off-street shared use paths. These facilities provide residents the ability to access local retail, commercial centers, recreational areas, and other land uses within South Corvallis and neighboring areas by bicycle. Figure 3 illustrates the existing bicycle facility inventory within the project study area.

Bicycle Facilities

Bicycle facility data was obtained from ODOT to assess the adequacy of the existing bicycle facilities within the project study area. The consultant team further verified the data through a comprehensive review of satellite imagery as well as field observations and documentation conducted during the RSA. The data includes the location of existing bicycle facilities, facility widths, and facility conditions.

Shared-use Paths – Tier 1 Facility Treatment

A shared-use path is located approximately 250 feet east of OR 99W between SW B Avenue and throughout the OR34 interchange area providing a parallel and separated facility for people biking. The shared-use path crosses the Marys River on a separate bridge structure immediately east of the US 20/OR 34 northbound on-ramp. Between SW Twin Oaks Circle/SE Chapman Place and SE Crystal Lake Drive, a shared use path is present on the east side of OR 99W.

Bike Lanes – Tier 2 Facility Treatment

Bike lanes are provided along OR 99W between SE Chapman Place and SE Kiger Island Drive. Bike lanes are also provided on SW 4th Street (OR 99W southbound) between SW C Avenue and SE Chapman Place; however, no bike lanes are provided on SW 3rd Street (OR 99W northbound) for this segment. Along the abutting public roadways identified as part of the project study area, on-street bike lanes are provided on SW A Avenue, SW Avery Avenue, Crystal Lake Drive, SE Goodnight Avenue, and SE Rivergreen Avenue. A bike lane includes an 8” white stripe between the bike lane and other travel lanes.

Shoulder Bikeways – Tier 2 Facility Treatment

Shoulder bikeways are located along OR 99W south of SE Kiger Island Drive in the southbound direction, and from the southern boundary of the study area to approximately 500 feet south of SE Kiger Island Drive in the northbound direction. Shoulder bikeways are shoulders that can be used for biking and do not hold the same requirements as bike lanes that prohibit motor vehicles from stopping or parking in the space. A shoulder includes a 4” white stripe between the shoulder and travel lanes.

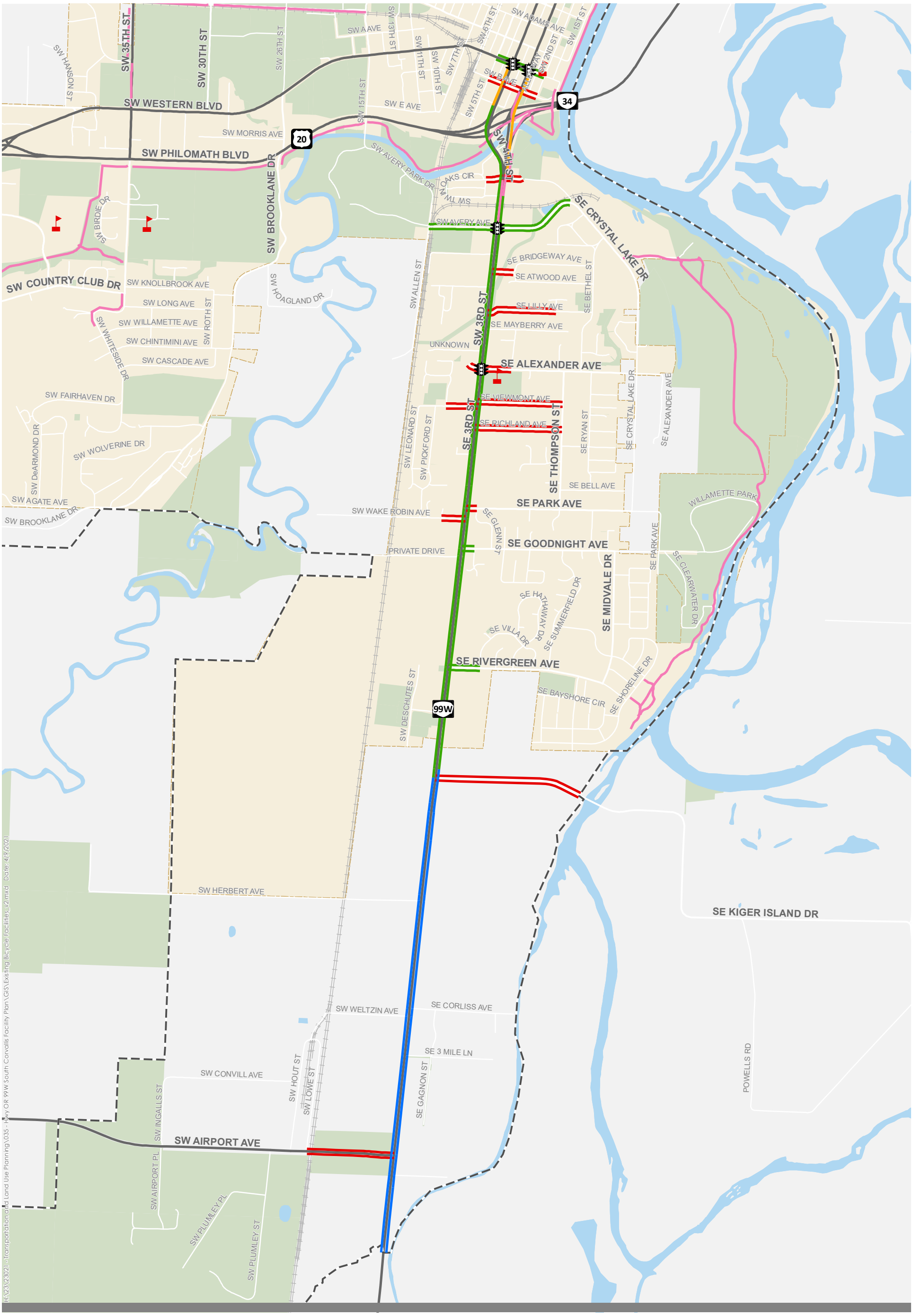


Figure 3

KITTELSON & ASSOCIATES

Existing Bicycle Facilities
Corvallis, Oregon

ACTIVE TRANSPORTATION ANALYSIS

Availability and General Conditions of Facilities

The availability and general condition of facilities for people walking and biking is summarized in detail in the following section as part of the Level of Traffic Stress (LTS) analysis.

Level of Traffic Stress

Existing facilities for people walking and biking within the project study area were evaluated in an effort to identify potential deficiencies that could be addressed as part of the Plan. The Oregon Department of Transportation (ODOT) Analysis Procedures Manual[1] (APM) provides a methodology for evaluating facilities for people walking and biking within urban and rural environments called Pedestrian Level of Traffic Stress (PLTS) and Bicycle Level of Traffic Stress (BLTS)

As applied by ODOT, this methodology classifies four levels of traffic stress that a person walking or biking can experience on the roadway, ranging from LTS 1 (little traffic stress) to LTS 4 (high traffic stress). A road segment that is rated LTS 1 generally has low traffic volumes and travel speeds or is equipped with a physically separated facility for people walking and biking. These segments are generally suitable for all users, including children. A road segment that is rated LTS 4 generally has high traffic volumes and travel speeds and is perceived as unsafe by most adults. Road segments rated LTS 4 also include those lacking walking or biking facilities. Per the APM, LTS 2 is considered a reasonable target for most walking and biking facilities due to its acceptability for the majority of people; however, within ¼-mile of schools, the recommended target is LTS 1.

Pedestrian Level of Traffic Stress

The pedestrian level of traffic stress (PLTS) score is based on four criteria, including sidewalk condition and width, physical buffer type, total buffering width, and general land use. All four criteria are scored from 1 to 4 and the highest score determines the overall score for the road segment.

Figure 4 illustrates the results of the PLTS analysis conducted within the project study area. It is important to note that while some segments are shown as PLTS 3 or 4, they may have shorter segments with lower PLTS scores. Table 1 summarizes the detailed results of the PLTS analysis, which includes the scores for each criterion.

Corridor segments with a PLTS rating of 4 have no sidewalks or are considered to be a freeway interchange or commercial corridor based on land use context. Sidewalk segments that are in fair conditions, namely the OR 99W corridor segment between OR 99W northbound ramp – US 20/OR 34 eastbound ramp to SW Twins Oaks Circle have a PLTS rating of 4 due to more than four travel lanes in

[1] https://www.oregon.gov/odot/Planning/Documents/APMv2.pdf

both directions, resulting in poor conditions for walking and due to its land use context (freeway interchange). In the southern downtown region, most abutting public streets have an LTS of 2 or better primarily due to a posted speed of 25 mph or less, and adequate sidewalk widths when present. Some abutting streets have an LTS of 3 or worse due to no presence of sidewalk or poor conditions of sidewalk; namely, SW Western Boulevard from SW 4th Street to SW 3rd Street (eastbound); Crystal Lake Drive from OR 99W to the east project limit (westbound); SE Bridgeway Avenue from OR 99W to SE Atwood Avenue (both directions); SE Lilly Avenue from OR 99W to SE Lilly Place (westbound); SE Viewmont Avenue from OR 99W to SE Thompson Street (both directions); SW Tunison Avenue from SW Butterfield Drive to OR 99W (eastbound); SE Richland Avenue from OR 99W to SE Thompson Street (both directions); SE Park Avenue from OR 99W to SE Glenn Street (both directions); and SW Wake Robin Avenue from SW Wake Robin Place to OR 99W (eastbound).

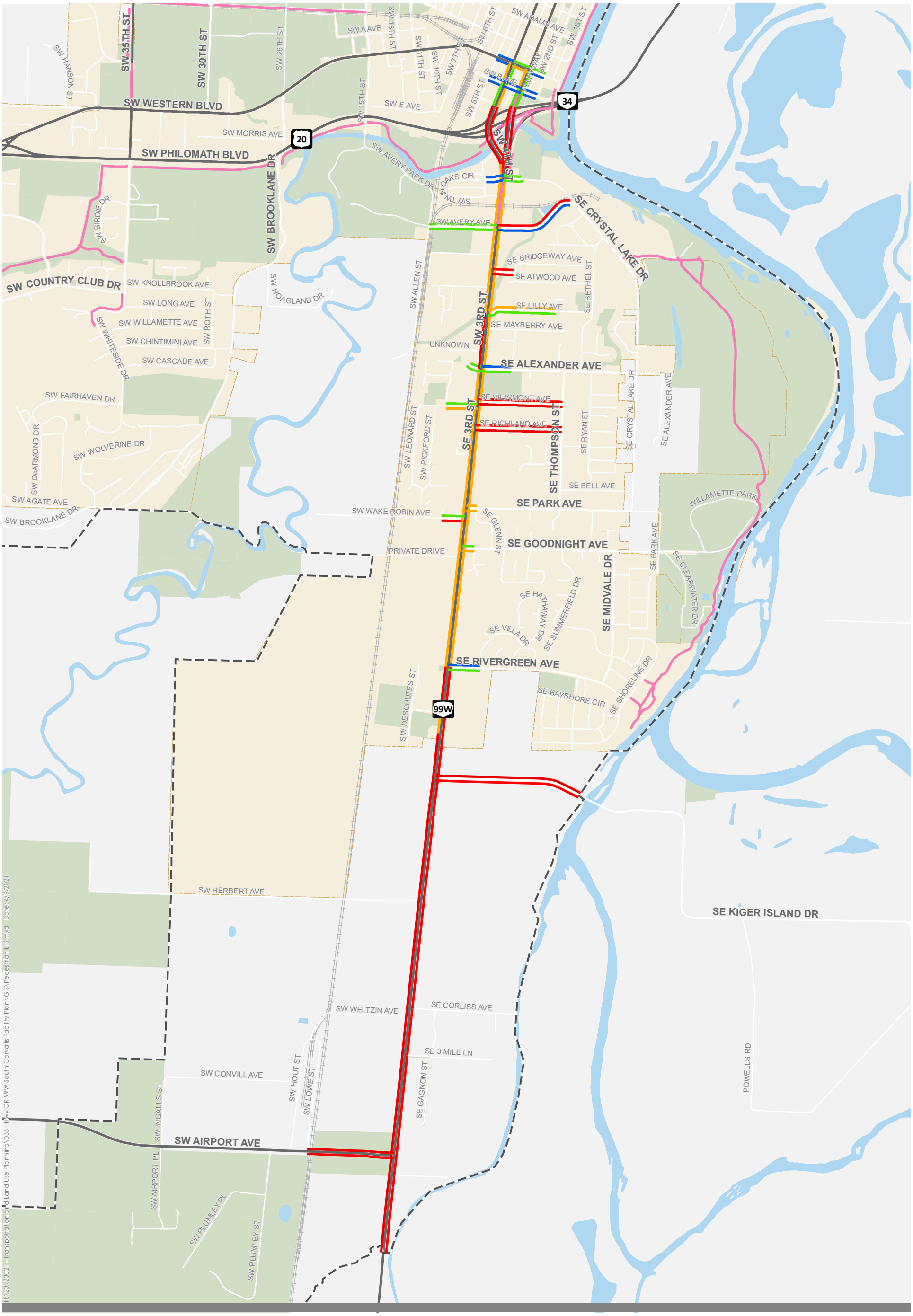


Figure 4

Pedestrian Level of Traffic Stress
Corvallis, Oregon

KITTELSON & ASSOCIATES

Table 1: Pedestrian Level of Traffic Stress Summary

Street	From	To	Direction	Pedestrian LTS Criteria Scores					Pedestrian LTS[1]
				Sidewalk Condition	Sidewalk Width (Feet)	Physical Buffer Type	Total Buffering Width (Feet)	Land Use Context	
Highway (OR 99W)									
OR 99W	SW Western Boulevard	SW B Avenue (Westside)	Southbound	Poor	5	Grass, Sparse Trees	16	Urban Mix	3
	SW Western Boulevard	SW B Avenue (Eastside)	Southbound	Fair	5	Grass, Sparse Trees	16	Urban Mix	2
	SW Western Boulevard (Westside)	SW B Avenue	Northbound	Poor	5	Vegetation	9	Urban Mix	3
	SW Western Boulevard (Eastside)	SW B Avenue	Northbound	Good	5	Paved/Trees	9	Urban Mix	2
	SW B Avenue	Ramp OR 99W Southbound to US20/OR34 Westbound (Westside)	Southbound	Good	5	Grass, Sparse Trees	16	Freeway Interchange	4
	SW B Avenue	Ramp OR 99W Southbound to US20/OR34 Westbound (Eastside)	Southbound	Poor	5	Grass, Sparse Trees	16	Freeway Interchange	4
	SW B Avenue (Westside)	Ramp US20/OR34 Eastbound to OR 99W Northbound	Northbound	Good[2]	5	Grass	9	Freeway Interchange	4
	SW B Avenue (Eastside)	Ramp US20/OR34 Eastbound to OR 99W Northbound	Northbound	Good[2]	5	Grass, Sparse Trees	20	Freeway Interchange	4
	Ramp OR 99W Southbound to US20/OR34 Westbound	Ramp US20/OR34 Westbound to OR99W Southbound (Westside)	Southbound	No Sidewalk	N/A	None	N/A	Freeway Interchange	4
	Ramp OR 99W Southbound to US20/OR34 Westbound	Ramp US20/OR34 Westbound to OR99W Southbound (Eastside)	Southbound	No Sidewalk	N/A	None	N/A	Freeway Interchange	4
	Ramp US20/OR34 Eastbound to OR 99W Northbound (Westside)	Ramp OR99W Northbound to US20/OR34 Eastbound	Northbound	Good[2]	5	Railing	1.5	Freeway Interchange	4
	Ramp US20/OR34 Eastbound to OR 99W Northbound (Eastside)	Ramp OR99W Northbound to US20/OR34 Eastbound	Northbound	Good[2]	5	Railing	1.5	Freeway Interchange	4

Street	From	To	Direction	Pedestrian LTS Criteria Scores					Pedestrian LTS[1]
				Sidewalk Condition	Sidewalk Width (Feet)	Physical Buffer Type	Total Buffering Width (Feet)	Land Use Context	
OR 99W	Ramp US20/OR34 Westbound to OR 99W Southbound	Couplet Termination (Westside)	Southbound	Good	5.5	None	N/A	Freeway Interchange	4
	Ramp US20/OR34 Westbound to OR 99W Southbound	Couplet Termination (Eastside)	Southbound	No Sidewalk	N/A	None	N/A	Freeway Interchange	4
	Ramp OR 99W Northbound to US20/OR34 Eastbound (Westside)	Couplet Termination	Northbound	No Sidewalk[2]	N/A	None	N/A	Freeway Interchange	4
	Ramp OR 99W Northbound to US20/OR34 Eastbound (Eastside)	Couplet Termination	Northbound	Fair[2]	10	None	N/A	Freeway Interchange	4
	Couplet Termination	SW Twin Oaks Cir/SE Chapman Pl	Southbound	Fair	5	None	N/A	Commercial Corridor	4
	Couplet Termination	SW Twin Oaks Cir/SE Chapman Pl	Northbound	No Sidewalk	N/A	None	N/A	Commercial Corridor	4
	SW Twin Oaks Cir/SE Chapman Pl	SW Avery Ave/Crystal Dr	Southbound	Good (Flashing Pedestrian Beacon @ MP 84.36)	5	None	N/A	Commercial Corridor	3
	SW Twin Oaks Cir/SE Chapman Pl	SW Avery Ave/Crystal Dr	Northbound	Fair (Flashing Pedestrian Beacon @ MP 84.36)	13	None	N/A	Commercial Corridor	3
	SW Avery Ave/Crystal Dr	SE Bridgeway Ave	Southbound	Poor	5	None	N/A	Commercial Corridor	3
	SW Avery Ave/Crystal Dr	SE Bridgeway Ave	Northbound	Good	5	None	N/A	Commercial Corridor	3
	SE Bridgeway Ave	SE Lilly Ave	Southbound	Good (Flashing Pedestrian Beacon @ MP 84.73)	5	None	N/A	Commercial Corridor	3
	SE Bridgeway Ave	SE Lilly Ave	Northbound	Poor (Flashing Pedestrian Beacon @ MP 84.73)	5	None	N/A	Commercial Corridor	3
	SE Lilly Ave	SE Alexander Ave	Southbound	Fair (Flashing Pedestrian Beacon @ MP 85.45)	3.5	None	N/A	Commercial Corridor	4

Street	From	To	Direction	Pedestrian LTS Criteria Scores					Pedestrian LTS[1]
				Sidewalk Condition	Sidewalk Width (Feet)	Physical Buffer Type	Total Buffering Width (Feet)	Land Use Context	
OR 99W	SE Lilly Ave	SE Alexander Ave	Northbound	Poor (Flashing Pedestrian Beacon @ MP 85.45)	5	None	N/A	Commercial Corridor	3
	SE Alexander Ave	SE Viewmont Ave	Southbound	Good	5	grass with widely spaced trees	14	Commercial Corridor	3
	SE Alexander Ave	SE Viewmont Ave	Northbound	Poor	5	None	N/A	Commercial Corridor	3
	SE Viewmont Ave	SW Tunison Ave	Southbound	Good	5	None	N/A	Commercial Corridor	3
	SE Viewmont Ave	SW Tunison Ave	Northbound	Poor	5	None	N/A	Commercial Corridor	3
	SW Tunison Ave	SE Richland Ave	Southbound	Fair (Flashing Pedestrian Beacon @ MP 85.12)	5	None	N/A	Commercial Corridor	3
	SW Tunison Ave	SE Richland Ave	Northbound	Good (Flashing Pedestrian Beacon @ MP 85.12)	5	None	N/A	Commercial Corridor	3
	SE Richland Ave	SE Park Ave	Southbound	Poor	5	None	N/A	Commercial Corridor	3
	SE Richland Ave	SE Park Ave	Northbound	Poor	5	None	N/A	Commercial Corridor	3
	SE Park Ave	SW Wake Robin Ave	Southbound	Poor	5	None	N/A	Commercial Corridor	3
	SE Park Ave	SW Wake Robin Ave	Northbound	Poor	5	None	N/A	Commercial Corridor	3
	SW Wake Robin Ave	SE Goodnight Ave	Southbound	Fair	5	None	N/A	Commercial Corridor	3
	SW Wake Robin Ave	SE Goodnight Ave	Northbound	Good	5	None	N/A	Commercial Corridor	3
	SE Goodnight Ave	SE Rivergreen Ave	Southbound	Good	7	Grass	12	Commercial Corridor	3
	SE Goodnight Ave	SE Rivergreen Ave	Northbound	Fair	6	None	N/A	Commercial Corridor	3
	SE Rivergreen Ave	SE Kiger Island Dr	Southbound	Paved, becomes gravel just north	5 (when paved)	None	N/A	Suburban Fringe/Residential Corridor	4

Street	From	To	Direction	Pedestrian LTS Criteria Scores					Pedestrian LTS[1]
				Sidewalk Condition	Sidewalk Width (Feet)	Physical Buffer Type	Total Buffering Width (Feet)	Land Use Context	
OR 99W				of city limit, MP 86.15					
	SE Rivergreen Ave	SE Kiger Island Dr	Northbound	Paved, becomes gravel just north of city limit, MP 86.15	5 (when paved)	None	N/A	Suburban Fringe/Residential Corridor	4
	SE Kiger Island Dr	SW Airport Ave	Southbound	No Sidewalk	N/A	None	N/A	Suburban Fringe/Residential Corridor	4
	SE Kiger Island Dr	SW Airport Ave	Northbound	No Sidewalk	N/A	None	N/A	Suburban Fringe/Residential Corridor	4
	SW Airport Ave	South Project Limit	Southbound	No Sidewalk	N/A	None	N/A	Suburban Fringe/Residential Corridor	4
	SW Airport Ave	South Project Limit	Northbound	No Sidewalk	N/A	None	N/A	Suburban Fringe/Residential Corridor	4
Abutting Public Streets									
SW Western Boulevard	West Project Limit	SW 4th Street	Eastbound	Good	6	Vegetation/ Trees	7	Urban Mix	2
	West Project Limit	SW 4th Street	Westbound	Good	6	Vegetation/ Trees	16	Urban Mix	1
	SW 4th Street	SW 3rd Street	Eastbound	Poor	5	Vegetation/ Trees	7	Urban Mix	3
	SW 4th Street	SW 3rd Street	Westbound	Good	5	Paved/Two Trees	9	Urban Mix	2
	SW 3rd Street	East Project Limit	Eastbound	Good	6	Paved/One Tree	6	Urban Mix	2
	SW 3rd Street	East Project Limit	Westbound	Good	5.5	Vegetation/ Trees	8	Urban Mix	2
SW B Avenue	West Project Limit	SW 4th Street	Eastbound	Good	6	None	N/A	Urban Mix	2
	West Project Limit	SW 4th Street	Westbound	Fair	6.5	None	N/A	Urban Mix	2
	SW 4th Street	SW 3rd Street	Eastbound	Good	6.5	Vegetation/Trees	16	Urban Mix	1
	SW 4th Street	SW 3rd Street	Westbound	Fair	6.5	Vegetation	16	Urban Mix	1
	SW 3rd Street	East Project Limit	Eastbound	Good	6	None	N/A	Urban Mix	2
	SW 3rd Street	East Project Limit	Westbound	Fair	6	Vegetation/Trees	16	Urban Mix	1

Street	From	To	Direction	Pedestrian LTS Criteria Scores					Pedestrian LTS[1]
				Sidewalk Condition	Sidewalk Width (Feet)	Physical Buffer Type	Total Buffering Width (Feet)	Land Use Context	
SW Twin Oak Circle	SW Mobile Place	OR 99W	Both	Good	6	None	N/A	Commercial	2
SE Chapman Place	OR 99W	East Project Limit	Eastbound	Good	5	None	N/A	Commercial	2
	OR 99W	East Project Limit	Westbound	Fair	5	None	N/A	Commercial	2
SW Avery Avenue	SW Avery Park Road	OR 99W	Both	Fair	5.5 (eastbound); 5 (westbound)	None	N/A	Commercial	2
Crystal Lake Drive	OR 99W	East Project Limit	Eastbound	Fair	6	None	N/A	Commercial	2
	OR 99W	East Project Limit	Westbound	No Sidewalk	N/A	None	N/A	Commercial	4
SE Bridgeway Avenue	OR 99W	SE Atwood Avenue	Both	No Sidewalk	N/A	None	N/A	Residential	4
SE Lilly Avenue	OR 99W	SE Lilly Place	Eastbound	Good	5	None	N/A	Residential	2
	OR 99W	SE Lilly Place	Westbound	Poor	5	None	N/A	Residential	3
SW Alexander Avenue	Cul-de-sac	OR 99W	Eastbound	Good	5	Vegetation/Trees	5.5	Commercial	2
	Cul-de-sac	OR 99W	Westbound	Good	5.5	Vegetation/Trees	6	Commercial	2
SE Alexander Avenue	OR 99W	SE Debord Street	Eastbound	Fair	5.5	Grass	6	Residential	2
	OR 99W	SE Debord Street	Westbound	Fair	6	None	N/A	Residential	2
SE Viewmont Avenue	OR 99W	SE Thompson Street	Both	Poor	4	None	N/A	Residential	4
SW Tunison Avenue	SW Butterfield Drive	OR 99W	Eastbound	Poor	5	None	N/A	Residential	3
	SW Butterfield Drive	OR 99W	Westbound	Fair	6	None	N/A	Residential	2
SE Richland Avenue	OR 99W	SE Thompson Street	Both	No Sidewalk	N/A	None	N/A	Residential	4
SE Park Avenue	OR 99W	SE Glenn Street	Both	Poor	5.5	None	N/A	Residential	3
SW Wake Robin Avenue	SW Wake Robin Place	OR 99W	Eastbound	No Sidewalk	N/A	None	N/A	Residential	4
	SW Wake Robin Place	OR 99W	Westbound	Fair	5	Vegetation/Trees	8.5	Residential	2
SE Goodnight Avenue	OR 99W	SE Steller Drive	Eastbound	Poor	5.5	Vegetation/Trees	8	Residential	3
	OR 99W	SE Steller Drive	Westbound	Good	5	Vegetation	12.5	Residential	2
SE Rivergreen Avenue	OR 99W	SE Villa Drive	Eastbound	Good	5	Vegetation/Trees	12	Residential	2
	OR 99W	SE Villa Drive	Westbound	Good	6	Vegetation/Trees	5.5	Residential	2
SE Kiger Island Drive	OR 99W	East Project Limit	Both	No Sidewalk	N/A	None	N/A	Suburban Fringe	4
SW Airport Avenue	SW Lowe Street	OR 99W	Both	No Sidewalk	N/A	None	N/A	Suburban Fringe	4

[1]Shaded cells segments exceed the LTS 2 target.
[2]Shared-use Path

Bicyclist Level of Traffic Stress

The BLTS score is determined based on the speed of the roadway, the number of travel lanes per direction, the presence and width of an on-street bike lane and/or adjacent parking lane, and several other factors such as the presence of a centerline. Figure 5 illustrates the recommended facility treatments (Tier 1 – Tier 3) necessary to achieve a low-stress experience for someone biking based on posted speed and average daily traffic (ADT).

Figure 5: Bicycle Facility Tier Identification Matrix

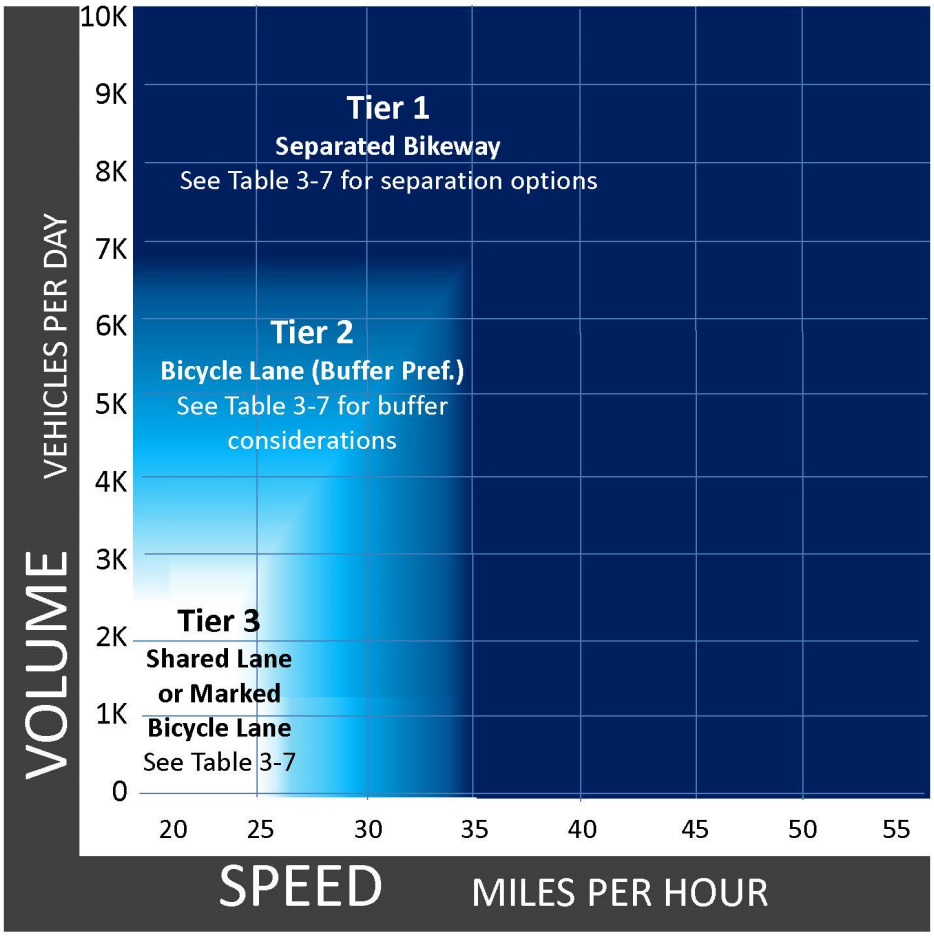


Figure 6 illustrates the results of the BLTS analysis conducted within the project study area. It is important to note that while some segments are shown as BLTS 3 or 4, these may contain shorter segments with better BLTS scores. Table 2 summarizes the detailed results of the BLTS analysis. As shown, there are seven segments rated BLTS 3 and three segments rated BLTS 4.

Most of the segments rated BLTS 3 have striped bike lanes, however they are too narrow for roadway conditions (less than 6 feet). For these segments to be rated BLTS 2, the combination of the striped bike lane and additional buffer space would need to achieve a minimum width of 7 feet. Other segments rated BLTS 3 were evaluated as shared roadways. For these segments to be rated BLTS 2, a similar treatment of buffered bike lanes would be needed.

It is worth noting that all abutting City owned streets achieve a LTS 2 or better. This is primarily due to a posted speed of 25 mph or less, and adequate bike lane widths when present. On public streets with no bike lanes, LTS 2 or better is achieved due to a combination of posted speeds of 25 mph or less and no center line striping.

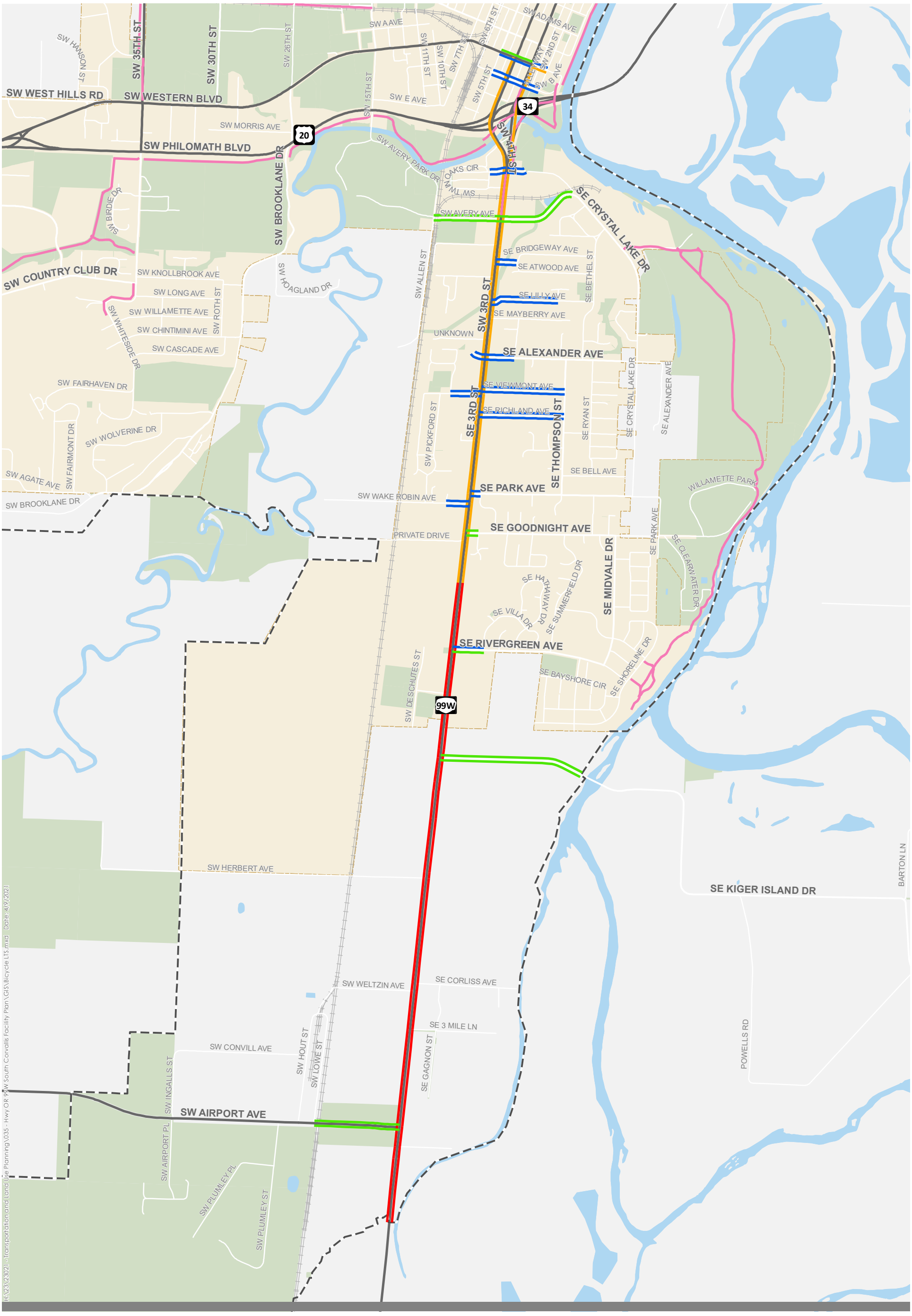


Figure 6

KITTELSON & ASSOCIATES

Bicycle Level of Traffic Stress
Corvallis, Oregon

Table 2: Bicycle Level of Traffic Stress Summary Table

Street	From	To	Direction	Facility Type	LTS Criteria					Bicycle LTS
					Speed (MPH)	Lanes per Direction	Bike Lane Width (feet)	Parking	Frequent Blockage	
Highway (OR 99W)										
OR 99W	SW Western Boulevard	SW C Avenue	Southbound	None	25	3	N/A	N/A	N/A	3
	SW C Avenue	SE Chapman Place	Southbound	Bike Lane	25	2-3	5	N/A	N/A	3
	SW Western Boulevard	SW C Avenue	Northbound	None	25	3	N/A	Parallel	N/A	3
	SW C Avenue	SE Chapman Place	Northbound	None	25	3	N/A	N/A	N/A	3
	SE Chapman Place	Crystal Lake Drive	Northbound	Shared Use Path	25	2	10	N/A	N/A	1
	SE Chapman Place	Crystal Lake Drive	Southbound	Bike Lane	25	2	5	N/A	N/A	3
	Crystal Lake Drive	SE Bridgeway Avenue	Both	Bike Lane	25	2	5	N/A	N/A	3
	SE Bridgeway Avenue	SE Richland Avenue	Both	Bike Lane	30	2	5	N/A	N/A	3
	SE Richland Avenue	~880' south of SE Goodnight Avenue	Both	Bike Lane	35	2	5	N/A	N/A	3
	~880' south of SE Goodnight Avenue	SE Kiger Island Drive	Both	Bike Lane	50	2	5	N/A	N/A	4
	SE Kiger Island Drive	SW Herbert Avenue	Both	Shoulder Bikeway	50	2-1	5-shoulder	N/A	N/A	4
	SW Herbert Avenue	Southern Urban Growth Boundary	Both	None	50	1	5- shoulder	N/A	N/A	4
Abutting Public Streets										
SW Western Boulevard	SW 5th Street	SW 3rd Street	Eastbound	Bike Lanes	30	1	5	N/A	N/A	2
SW Western Boulevard	SW 5th Street	SW 3rd Street	Westbound	Bike Lanes	30	1	6	N/A	N/A	1
SW Western Boulevard	SW 3rd Street	SW 2nd Street	Eastbound	Bike Lanes	25	1	6	Parallel	No	2
SW Western Boulevard	SW 3rd Street	SW 2nd Street	Westbound	Bike Lanes	25	1	6	N/A	N/A	1
SW B Avenue	SW 5th Street	SW 3rd Street	Both	None	25	1	NA	Parallel	No	1
SW B Avenue	SW 3rd Street	SW 2nd Street	Eastbound	None[1]	25	1	NA	Front End	No	1
SW B Avenue	SW 3rd Street	SW 2nd Street	Westbound	None[1]	25	1	NA	Parallel	No	1
SW Twin Oak Circle	SW Mobile Place	OR 99W	Both	None[1]	25[2]	1	NA	Parallel	No	1

Street	From	To	Direction	Facility Type	LTS Criteria					Bicycle LTS
					Speed (MPH)	Lanes per Direction	Bike Lane Width (feet)	Parking	Frequent Blockage	
SE Chapman Place	OR 99W	Cul-de-sac	Both	None[1]	25[2]	1	NA	Parallel	No	1
SW Avery Avenue	SW Avery Park Drive	OR 99W	Both	Bike Lanes	25[2]	1	5	None	NA	2
Crystal Lake Drive	OR 99W	SE Crystal Lake Drive	Both	Bike Lanes	25[2]	1	5.5	None	NA	2
SE Bridgeway Avenue	OR 99W	SE Atwood Avenue	Both	None[1]	25[2]	1	N/A	Parallel	No	1
SE Lilly Avenue	OR 99W	SE Lilly Place	Both	None[1]	25[2]	1	N/A	Parallel	No	1
SW Alexander Avenue	Cul-de-sac	OR 99W	Both	None[1]	25[2]	1	N/A	Parallel	No	1
SE Alexander Avenue	OR 99W	SE Debord Street	Both	None	25[2]	1	N/A	Parallel	No	2
SE Viewmont Avenue	OR 99W	SE Thompson Street	Both	None[1]	25[2]	1	N/A	Parallel	No	1
SW Tunison Avenue	SW Butterfield Drive	OR 99W	Both	None[1]	25[2]	1	N/A	Parallel	No	1
SE Richland Avenue	OR 99W	SE Thompson Street	Both	None[1]	25[2]	1	N/A	Parallel	No	1
SE Park Avenue	OR 99W	SE Glenn Street	Both	None[1]	25[2]	1	N/A	Parallel	No	1
SW Wake Robin Avenue	SW Wake Robin Place	OR 99W	Both	None[1]	25[2]	1	N/A	Parallel	No	1
SE Goodnight Avenue	OR 99W	SE Steller Drive	Both	Bike Lane	25[2]	1	5	NA	N/A	2
SE Rivergreen Avenue	OR 99W	SE Villa Drive	Eastbound	Bike Lane	25[2]	1	6	Parallel	N/A	2
SE Rivergreen Avenue	OR 99W	SE Villa Drive	Westbound	Bike Lane	25[2]	1	6	Na	N/A	1
SE Kiger Island Drive	OR 99W	Eastern Urban Growth Boundary	Both	None	25[2]	1	N/A	NA	N/A	2
SW Airport Avenue	SW Lowe Street	OR 99W	Both	None	25[2]	1	N/A	NA	N/A	2

[1] Unmarked Centerline
[2] Basic Rule Speed

TRANSIT ANALYSIS

The following section summarizes the transit analysis conducted for the project area.

Transit Facilities

Transit facilities data was obtained from ODOT to assess the adequacy of the existing transit facilities within the project study area. The consultant team further verified the data through a comprehensive review of satellite imagery as well as field observations and documentation conducted during the RSA. The data includes the presence of shelters, benches, and lighting at each stop location for the Corvallis Transit System (CTS) route along OR 99W (referred to as SW 3rd Street by CTS). Figure 7 displays the transit route and stop locations of CTS service along OR 99W.

Routes and Stops

Route 6 travels from the Downtown Transit Center (DTC) to SE Rivergreen Avenue, running every 30 minutes during weekdays (buses depart from the DTC from 6:15 AM to 8:45 PM) and Saturdays (buses depart from 7:15 AM to 7:15 PM) and serves the South Corvallis area. On Sundays, the route runs every 60 minutes and departs the DTC at 10:15 AM, 11:15 AM, 12:15 AM, 1:15 PM, 2:15 PM, 3:15 PM, 4:15 PM and 5:15 PM. During the peak PM service, there is an additional run departing the DTC at 3:10 PM; this peak service does not operate during Oregon State University's Winter, Spring and Summer breaks. The route length is 7.82 miles. Within a 0.25-mile buffer area from stops, 9,739 people and 4,138 jobs are served. The Night Owl, operated by CTS in partnership with Associated Students of Oregon State University, is a late-night bus service that is open to the general public and serves South Corvallis on Thursdays, Fridays and Saturdays. This route departs DTC hourly from 9:15 PM to 2:15 AM. The route does not operate during Oregon State University's (OSU) winter and summer breaks. Both Route 6 (all CTS routes) and the Night Owl are fareless to everyone.

Quality of Service Transit Measures

The transit analysis includes four quality of service measures for transit users within the OR 99W study area. The team assessed the data for transit stops for CTS Route 6 and the Night Owl route along OR 99W. To determine the service measures to be considered, the team reviewed ODOT's APM and the City of Corvallis' Transit Development Plan (TDP). The following four quality of service measures were selected and mentioned in *Memorandum 7B: Analysis Methodology and Assumptions for Safety and Multimodal Analysis:*

- Percentage of transit stops with shelters, benches, and lighting
- Frequency and on-time reliability of transit routes
- Number of transit stops connected to pedestrian and bicycle routes with an LTS of 2 or lower
- Average stop spacing

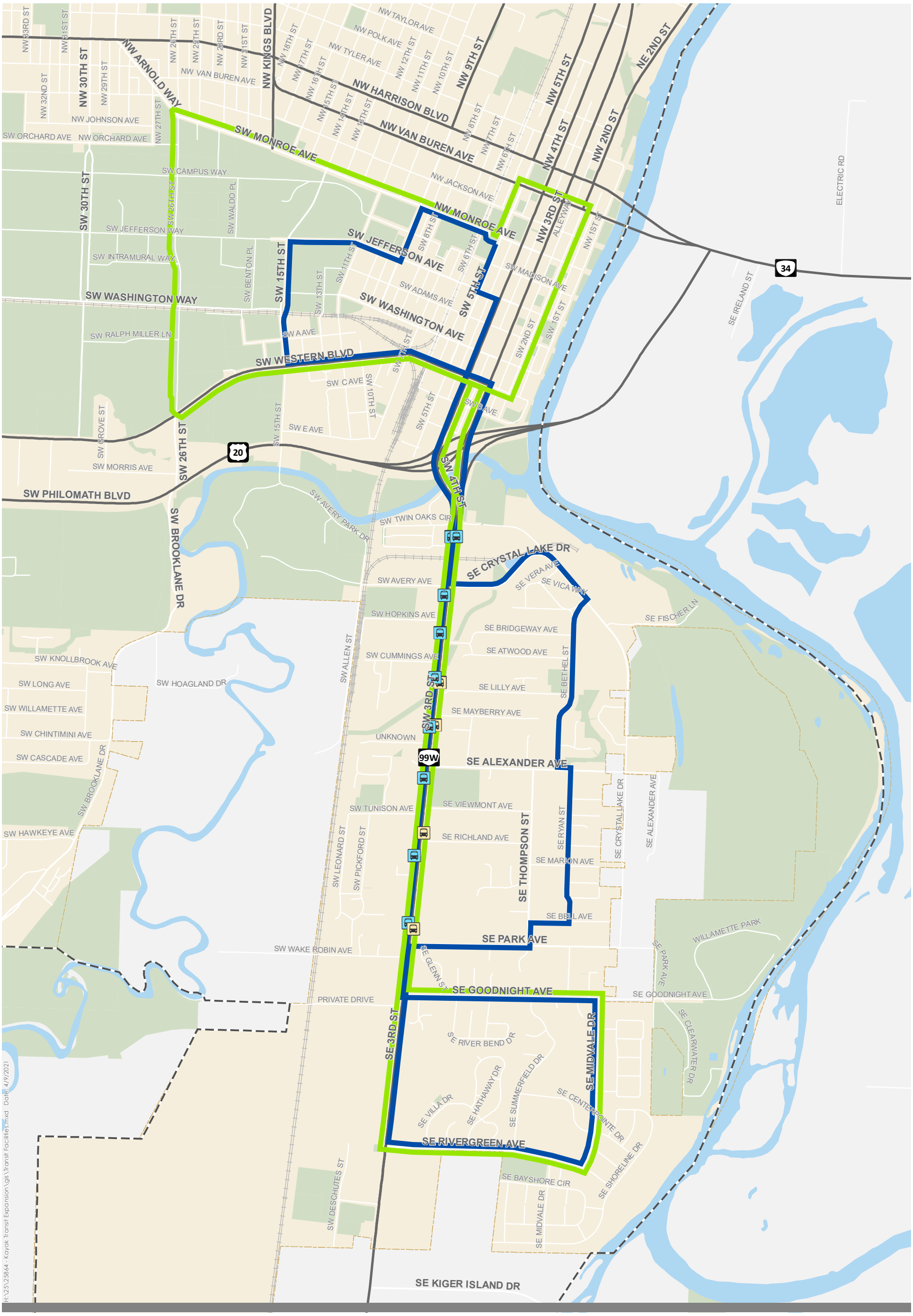


Figure 7

KITTELSON & ASSOCIATES

Existing Transit Facilities
Corvallis, Oregon

Transit Stop Amenities (Percentage of transit stops with shelters, benches, and lighting)

The team obtained Route 6 transit stop amenities data for the OR 99W corridor from ODOT to assess the percentage of transit stops equipped with shelters, benches, and lighting. Table 3 shows the total percentage of shelters, benches, and lighting at each stop on Route 6. As shown, the total percentage of shelters and benches is 31% and 38% respectively in the project area. No transit stops in the project area are equipped with lighting beyond adjacent street lighting.

Table 3. Total Percentage of Shelters, Benches, and Lighting at Route 6 Stops

Outbound Stops - Location	Service Type	Shelter	Bench	Lighting
OR 99W & SW Twin Oaks Circle	Regular	**Yes**	**Yes**	No
OR 99W & SW Avery Avenue	Regular	No	No	No
OR 99W & SE Bridgeway Avenue	Regular	No	No	No
OR 99W & SW Cummings Avenue	Regular	No	No	No
OR 99W & SE Mayberry Avenue	Regular	**Yes**	**Yes**	No
OR 99W & SE Alexander Avenue	Regular	No	**Yes**	No
OR 99W & SE Richland Avenue	Regular	**Yes**	**Yes**	No
OR 99W & SE Park Avenue	Regular	No	No	No
Inbound Stops - Location	**Service Type**	**Shelter**	**Bench**	**Lighting**
OR 99W & SE Park Avenue	Night Owl only	No	No	No
OR 99W & SE Richland Avenue	Night Owl only	No	No	No
OR 99W & SE Mayberry Avenue	Night Owl only	No	No	No
OR 99W & SE Lilly Avenue	Night Owl only	No	No	No
OR 99W & SE Twin Oaks Circle	Regular	**Yes**	**Yes**	No
Total Percentage of Amenities		**31%**	**38%**	**0%**

Frequency and On-Time Reliability of Transit Routes

The team obtained Route 6 frequency and on-time reliability data from ODOT to assess the on-time performance of the route. Due to the impacts of COVID 19 on transit systems, the team decided to analyze ridership and schedules, pre-COVID 19 on-time performance data, and on-time performance data during COVID. Table 4 shows the on-time performance pre-COVID 19 and during COVID 19 at all stops in the project area. As shown, Route 6 served all bus stops on time for more than 85% (target) of running time.

Table 4. On-Time System Performance and Frequency at Stops

Outbound Stops - Location	Service Type	Frequency (mins)	On-Time Performance (Pre-COVID)	On-Time Performance (During COVID)
OR 99W & SW Twin Oaks Circle	Regular	30	87%	98%
OR 99W & SW Avery Avenue	Regular	30	87%	98%
OR 99W & SE Bridgeway Avenue	Regular	30	87%	98%
OR 99W & SW Cummings Avenue	Regular	30	87%	98%
OR 99W & SE Mayberry Avenue	Regular	30	87%	98%
OR 99W & SE Alexander Avenue	Regular	30	87%	98%
OR 99W & SE Richland Avenue	Regular	30	87%	98%
OR 99W & SE Park Avenue	Regular	30	87%	98%
Inbound Stops - Location	**Service Type**	**Frequency (mins)**	**On-Time Performance (Pre-COVID)**	**On-Time Performance (During COVID)**
OR 99W & SE Park Avenue	Night Owl only	60	90%	91%
OR 99W & SE Richland Avenue	Night Owl only	60	90%	91%
OR 99W & SE Mayberry Avenue	Night Owl only	60	90%	91%
OR 99W & SE Lilly Avenue	Night Owl only	60	90%	91%
OR 99W & SE Twin Oaks Circle	Regular	30	87%	98%

Connecting Pedestrian/Bicycle Network (Number of Transit Stops Connected to Pedestrian and Bicycle Routes with an LTS of 2 or Lower)

The Route 6 transit stop locations on OR 99W were analyzed to see connections with pedestrian and bicycle routes with an LTS of 2 and lower. Table 5 shows the transit stops with pedestrian and bicycle connections and their corresponding LTS rating along the abutting streets, and Table 6 shows the BLTS and PLTS rating at transit stops along OR 99W. As shown in Table 6, only 1 out of 13 stops have a connecting OR 99W segment of BLTS of 2 or lower. None of the stops have a connecting OR 99W segment PLTS of 2 or lower.

Table 5. Transit Stops Connected to Pedestrians and Bicycle Routes and Corresponding LTS Ratings

Outbound Stops - Location	Service Type	From	To	BLTS	PLTS
OR 99W & SW Twin Oaks Circle	Regular	SW Mobile Place	OR 99W	1	2
OR 99W & SW Avery Avenue	Regular	SW Avery Park Road	OR 99W	2	2
OR 99W & SE Bridgeway Avenue	Regular	OR 99W	SE Atwood Avenue	1	4
OR 99W & SW Cummings Avenue	Regular	SW Edging Drive	OR 99W	N/A[1]	N/A[1]
OR 99W & SE Mayberry Avenue	Regular	OR 99W	1400 feet east from OR 99W on SE Mayberry Avenue	N/A[1]	N/A[1]
OR 99W & SE Alexander Avenue	Regular	OR 99W	SE Debord Street	1	2
OR 99W & SE Richland Avenue	Regular	OR 99W	SE Thompson Street	1	4
OR 99W & SE Park Avenue	Regular	OR 99W	SE Glenn Street	1	3
Inbound Stops - Location	**Service Type**	**From**	**To**	**BLTS**	**PLTS**
OR 99W & SE Park Avenue	Night Owl only	OR 99W	SE Glenn Street	1	3
OR 99W & SE Richland Avenue	Night Owl only	OR 99W	SE Thompson Street	1	4
OR 99W & SE Mayberry Avenue	Night Owl only	OR 99W	1400 feet east from OR 99W on SE Mayberry Avenue	N/A[1]	N/A[1]
OR 99W & SE Lilly Avenue	Night Owl only	OR 99W	SE Lilly Place	1	3 (westbound), 2 (eastbound)
OR 99W & SE Twin Oaks Circle	Regular	OR 99W	330 feet east from OR 99W on SE Twin Oaks Circle	1	2

[1]The street is not an abutting public street within the project area and hence BLTS and PLTS was not analyzed

Table 6. Connecting OR 99W Segment BLTS and PLTS Rating at Transit Stops along OR 99W Corridor

Outbound Stops - Location	Service Type	BLTS	PLTS
OR 99W & SW Twin Oaks Circle	Regular	2	3
OR 99W & SW Avery Avenue	Regular	3	3
OR 99W & SE Bridgeway Avenue	Regular	3	3
OR 99W & SW Cummings Avenue	Regular	3	3
OR 99W & SE Mayberry Avenue	Regular	3	3
OR 99W & SE Alexander Avenue	Regular	3	3
OR 99W & SE Richland Avenue	Regular	3	3
OR 99W & SE Park Avenue	Regular	3	3
Inbound Stops - Location	**Service Type**	**BLTS**	**PLTS**
OR 99W & SE Park Avenue	Night Owl only	3	3
OR 99W & SE Richland Avenue	Night Owl only	3	3
OR 99W & SE Mayberry Avenue	Night Owl only	3	4
OR 99W & SE Lilly Avenue	Night Owl only	3	4
OR 99W & SE Twin Oaks Circle	Regular	3	3

Average Stop Spacing

Google Maps was used to analyze the spacing between Route 6 transit stop locations on OR 99W. Table 7 shows the average spacing between stops. As shown, all stops have spacing below 0.25 miles (ODOT's APM target) except for the following stops:

- OR 99W & SE Richland Avenue/OR 99W & SE Park Avenue (inbound and outbound)
- OR 99W & SE Richland Avenue/OR 99W & SE Mayberry Avenue (inbound)
- OR 99W & SE Lilly Avenue/OR 99W & SE Twin Oaks Circle (inbound)

Table 7. Average Spacing Between Stops

Outbound Stops - Location		Average Spacing (miles)
From	To	
OR 99W & SW Twin Oaks Circle	OR 99W & SW Avery Avenue	0.16
OR 99W & SW Avery Avenue	OR 99W & SE Bridgeway Avenue	0.14
OR 99W & SE Bridgeway Avenue	OR 99W & SW Cummings Avenue	0.05
OR 99W & SW Cummings Avenue	OR 99W & SE Mayberry Avenue	0.13
OR 99W & SE Mayberry Avenue	OR 99W & SE Alexander Avenue	0.12
OR 99W & SE Alexander Avenue	OR 99W & SE Richland Avenue	0.19
OR 99W & SE Richland Avenue	**OR 99W & SE Park Avenue**	**0.26**
Inbound Stops - Location		**Average Spacing (miles)**
From	**To**	
OR 99W & SE Park Avenue	**OR 99W & SE Richland Avenue**	**0.26**
OR 99W & SE Richland Avenue	**OR 99W & SE Mayberry Avenue**	**0.32**
OR 99W & SE Mayberry Avenue	OR 99W & SE Lilly Avenue	0.05
OR 99W & SE Lilly Avenue	**OR 99W & SE Twin Oaks Circle**	**0.44**

SAFETY ANALYSIS

The purpose of safety analysis is to review the current conditions of the OR 99W corridor in order to identify the existing issues and to propose mitigation measures. The analysis included reviewing the historical crash data, Safety Priority Index System (SPIS) locations identified on ODOT's TransGIS website, and segments of high risk for pedestrians and bicycles, as identified in the Oregon Statewide Pedestrian and Bicycle Safety Plan[2], within the OR 99W study area. Notably, the crash analysis that was performed as a part of this effort, includes the entire OR 99W study area, which is different from the RSA corridor limits. The extended corridor includes the one-way OR 99W couplets between SW B Avenue and SW Western Boulevard, and the portion of the corridor between SE Richland Avenue and SW Airport Avenue.

Crash Analysis

The consultant team obtained crash data from the ODOT online crash reporting system between mileposts 83.93 and 87.85. The team considered two types of information regarding the crash history.

[2] http://onlinepubs.trb.org/onlinepubs/nchrp/docs/NCHRP20-44-13FinalReport.pdf

The first information source is the reported ODOT crash data for the five-year period between January 1, 2014 and December 31, 2018. ODOT's crash database includes crashes for which a crash report was completed. According to Oregon law, crash reports are required when damages associated with the crash exceed $1,500[3]. The second type of crash data the RSA team used for the analysis includes preliminary data for crashes that occurred between 2019 and 2021. ODOT's reported preliminary 2019 crash data includes fatal and injury A crashes. Additionally, the team considered 2020 and 2021 preliminary fatal crash information that could be found through newspaper and online search.

Figure 8 presents reported 2014-2018 crash numbers by severity. Injury A crashes involve participant(s) that have a suspected serious, but non-fatal injury. Injury B crashes involve participant(s) that have an evident minor injury. Injury C crashes involve participant(s) that have a suspected but not evident injury. "PDO" crashes refer to crashes that involve "property damage only". Two of the three fatal crashes that occurred in the reported 2014-2018 timeframe were a pedestrian crash in 2016 south of SE Alexander Avenue and a bicycle crash in 2018 at the pedestrian crossing just south of SE Chapman Place. An additional fatal crash involving a pedestrian occurred in February of 2021 at the intersection of SW 3rd Street and SW Western Boulevard[4]. Pedestrian and bicycle crashes represent 10% of the total crashes and 46% of the high severity (injury A and fatal) crashes.

[3] The reporting threshold increased from $1,500 to $2,500 on January 1, 2018. The crash data used in this report is based on both the $1,500 and $2,500599 threshold. Source:
https://www.oregon.gov/ODOT/Data/documents/Crash_Data_Disclaimers.pdf

[4] https://apnews.com/article/albany-corvallis-7a30fd6f10480b759b040ad36781fb48

Figure 8: 2014-2018 Reported Crash Severity by Year

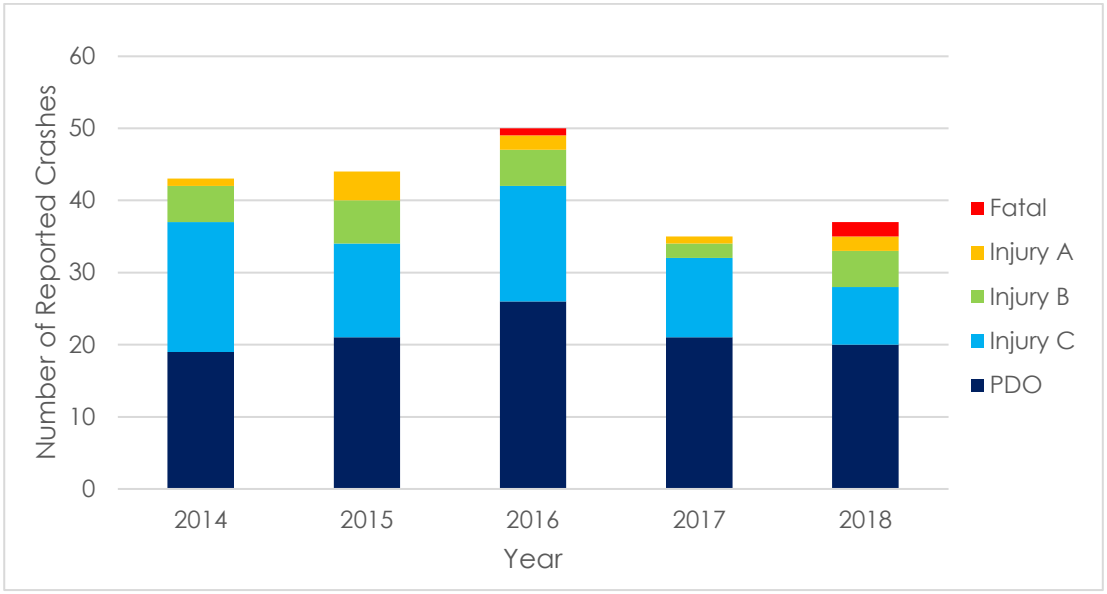


Figure **9** presents crashes by severity and collision type. The most common collision types among 2014-2018 reported crashes were rear-end (39%) and turning movement (27%).

Figure 9**: 2014-2018 Reported Crash Severity by Collision Type**

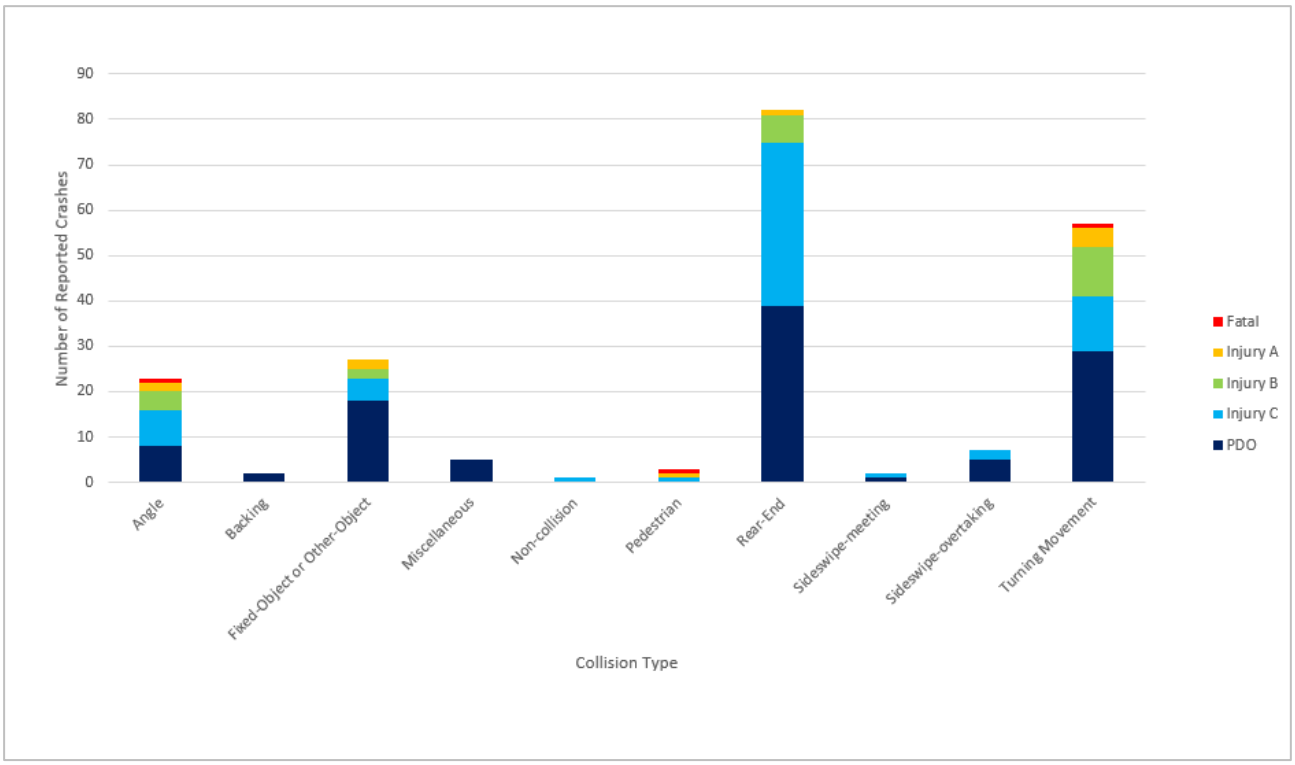
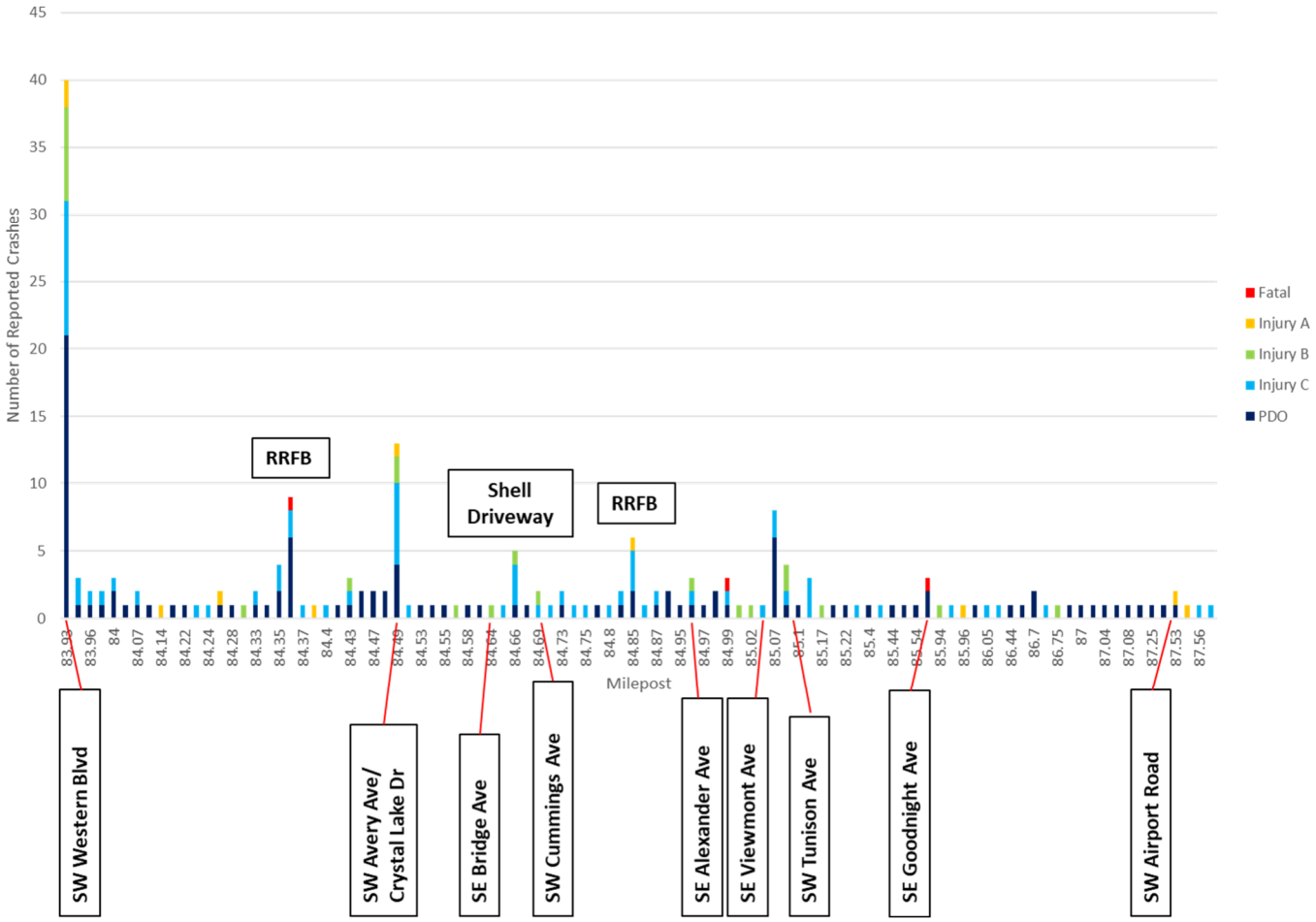


Figure 10 presents the reported 2014-2018 crash severity by milepost. Locations with the most crashes include the signalized intersections of OR 99W & SW Western Boulevard and OR 99W & Crystal Lake Drive (SW Avery Avenue), the RRFB pedestrian crossing south of SE Chapman Place (SW Twin Oaks Circle), and a mid-block location near the Lincoln Elementary School, just south of SE Viewmont Avenue.

Figure 10: 2014-2018 Reported Crash Severity by Milepost



The second set of preliminary crash data showed that three additional fatal crashes and one injury A crash occurred within the corridor during the 2019-2021 timeframe. Figure 11 summarizes the available information about 2014-2021 fatal and injury A crashes. The 2019-2021 fatal crashes were a bicycle crash and two pedestrian crashes, and the injury A crash was a bicycle crash. The fatal bicycle crash occurred in 2019 just north of the OR 99W/SE Chapman Place (SW Twin Oaks Circle) intersection. One fatal pedestrian crash occurred in 2020 at the pedestrian crossing just south of SE Chapman Place. At the time of the crash, the crossing had a pedestrian activated circular flashing beacon (wigwag) crossing. All wigwag style pedestrian crossings in the corridor have since been retrofitted with RRFBs. Another fatal pedestrian crash occurred at the intersection of SW 3rd Street and SW Western Boulevard. According to the news report, a bus was turning left from SW 3rd Street onto SW Western Boulevard and a pedestrian was crossing SW Western Boulevard in a crosswalk during a pedestrian signal phase.

Figure 11**: 2014-2020 Fatal and 2014-2019 Injury A Crashes**

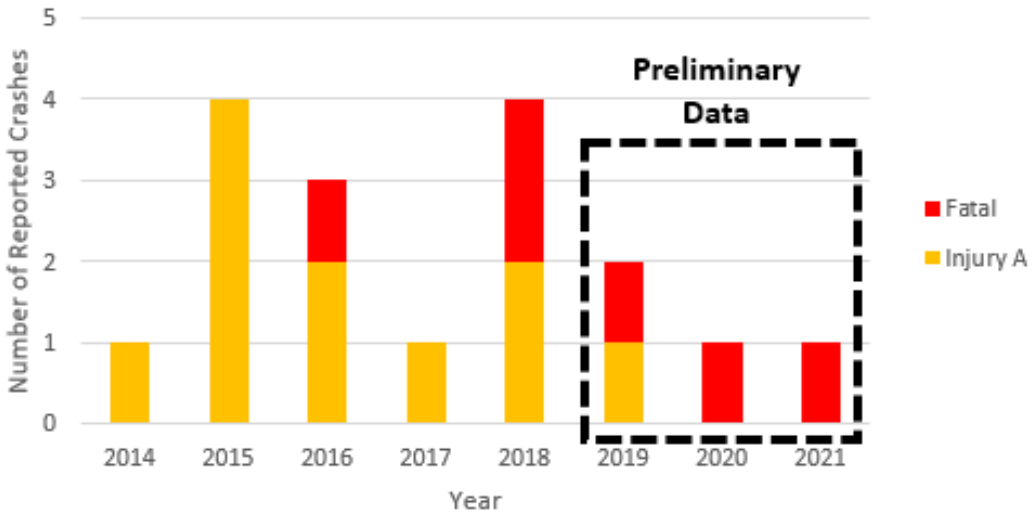


Figure 12, Figure 13, and Figure 14 present 2014-2018 reported crashes by month, day of the week, and time of the day. Most of the reported crashes happened during the fall months of the year, which correlates with shorter daylight hours and more rainy weather. In addition, most crashes occur Monday through Friday, which correlates with more people commuting to work and school days. A notable increase in crashes occurs between 3pm and 4pm, correlating with school releases.

Figure 12: 2014-2018 Reported Crashes by Month

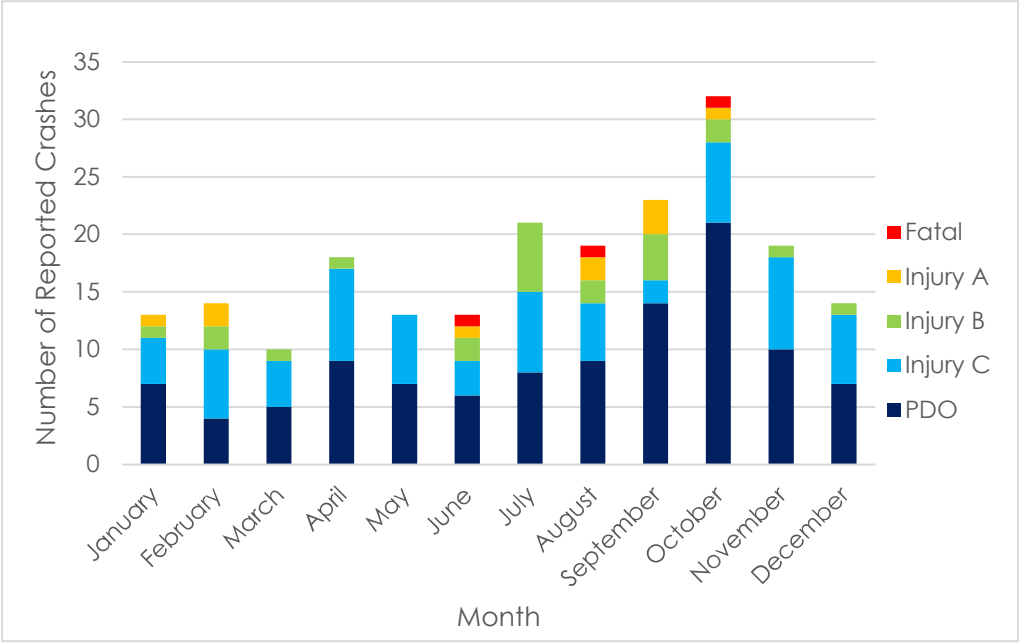


Figure 13: 2014-2018 Reported Crashes by Day of the Week

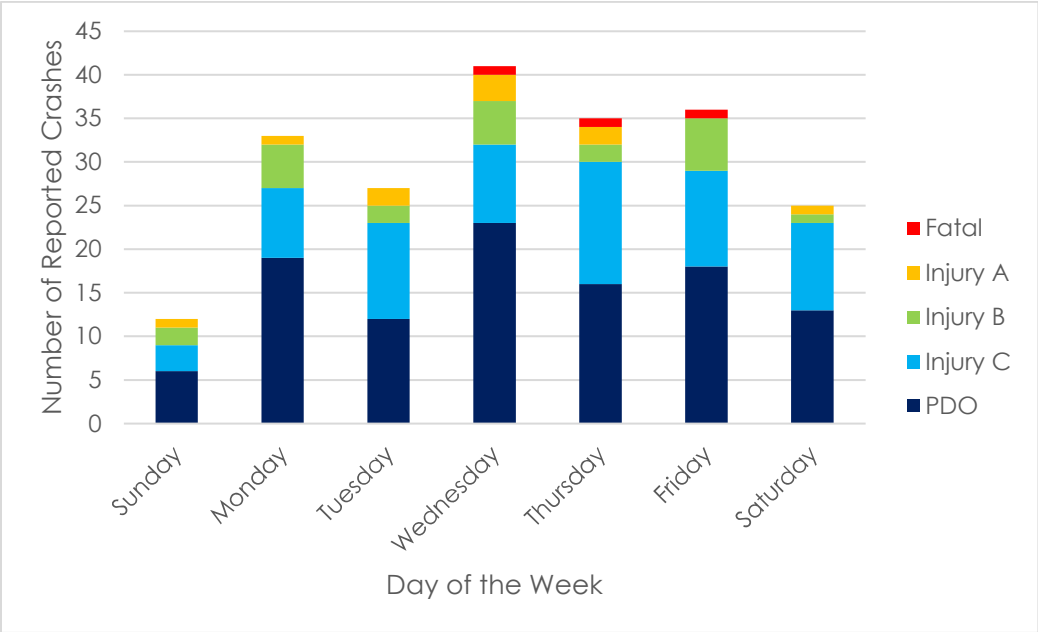


Figure 14: 2014-2018 Reported Crashes by Time of Day

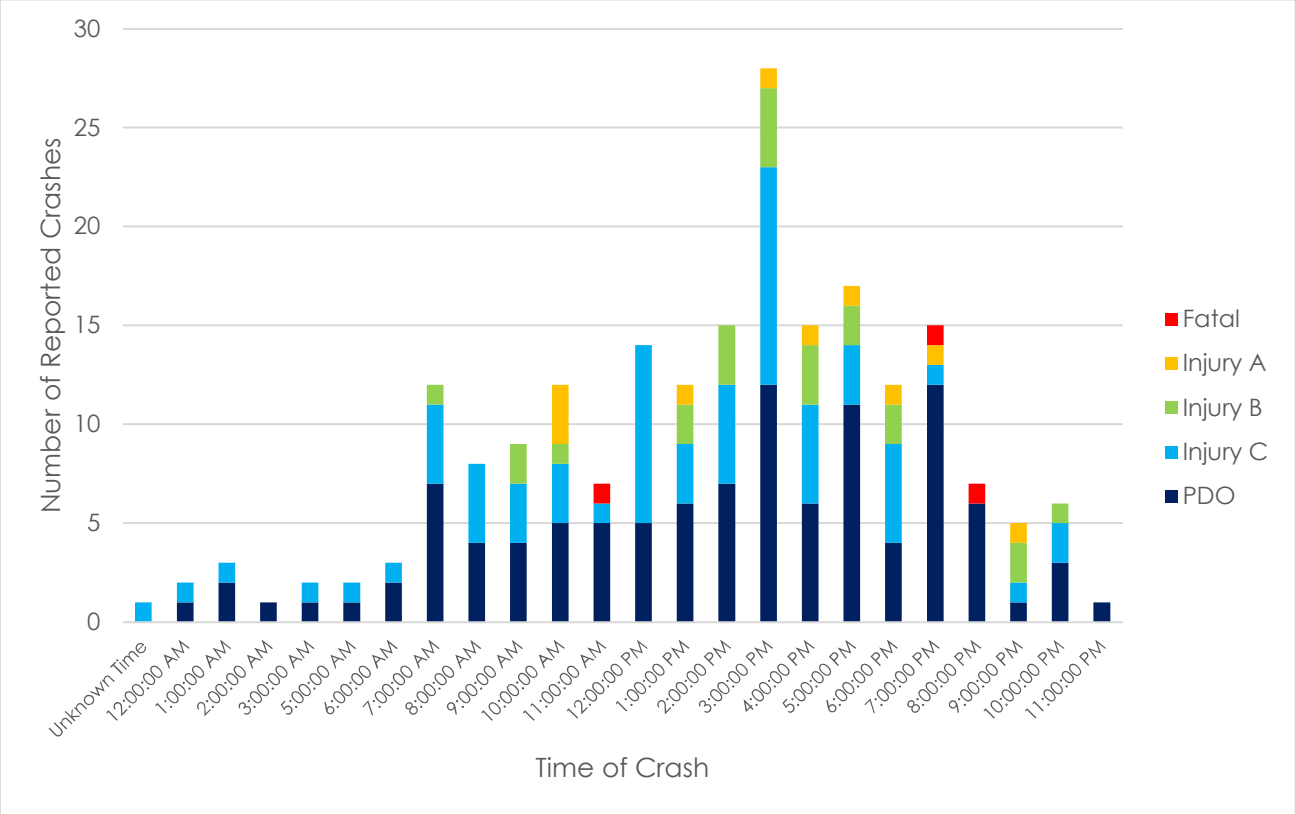


Figure 15 presents crashes tagged for alcohol and drug use. Out of the 209 total reported crashes, 5 crashes (2 %) were tagged for alcohol or drug use. Two of those crashes were fatal crashes.

Figure 15: 2014-2018 Reported Crashes Tagged for Alcohol and Drug Use

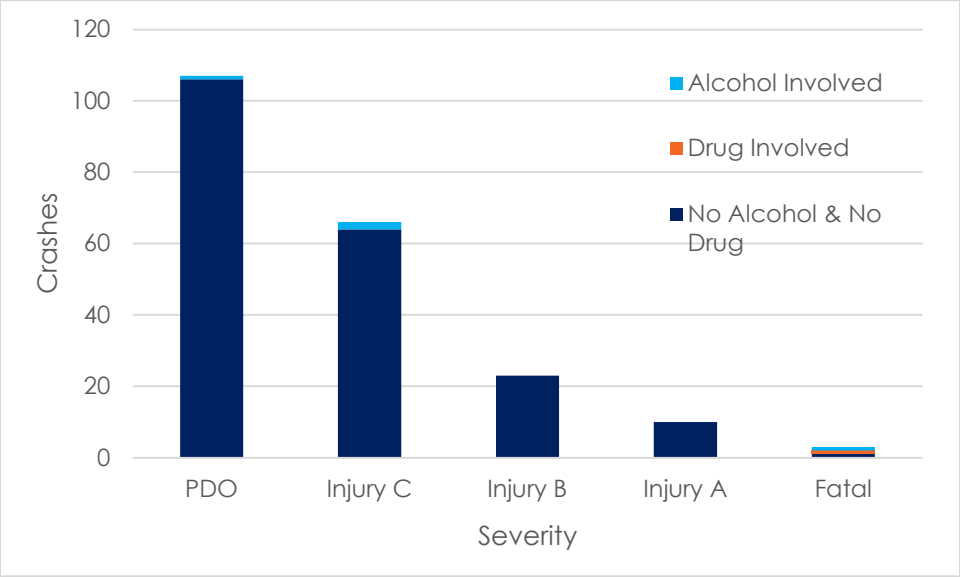


Figure 16 presents reported crashes that were tagged for exceeding the posted speed in the police reports. Fourteen percent of the total crashes involved excessive speeding between 2014 and 2018. None of those crashes were fatal. However, when including the preliminary data from the 2019-2020 crashes, the 2019 fatal bicycle crash was tagged for speeding.

Figure 16: 2014-2018 Reported Crashes Tagged for Speeding

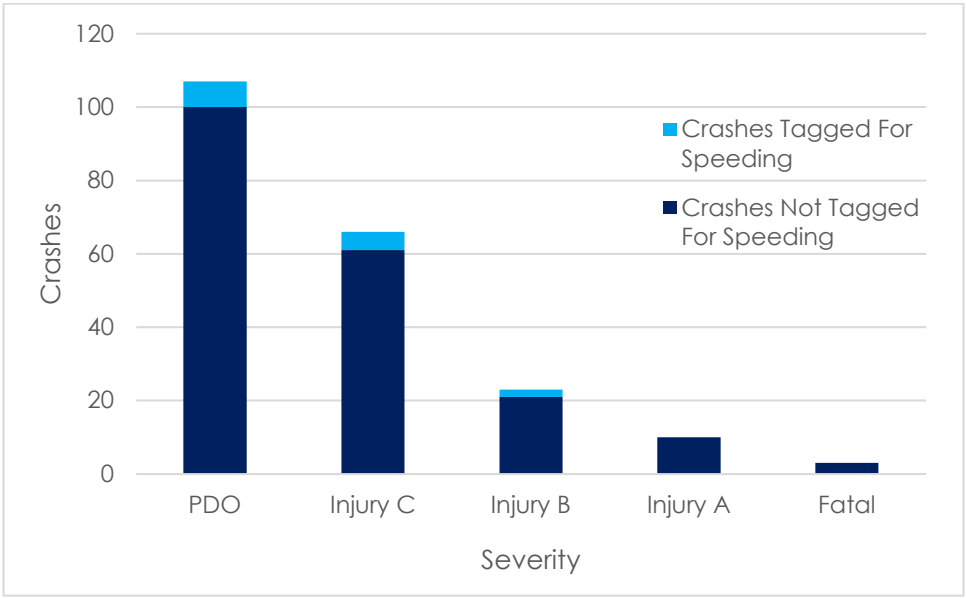
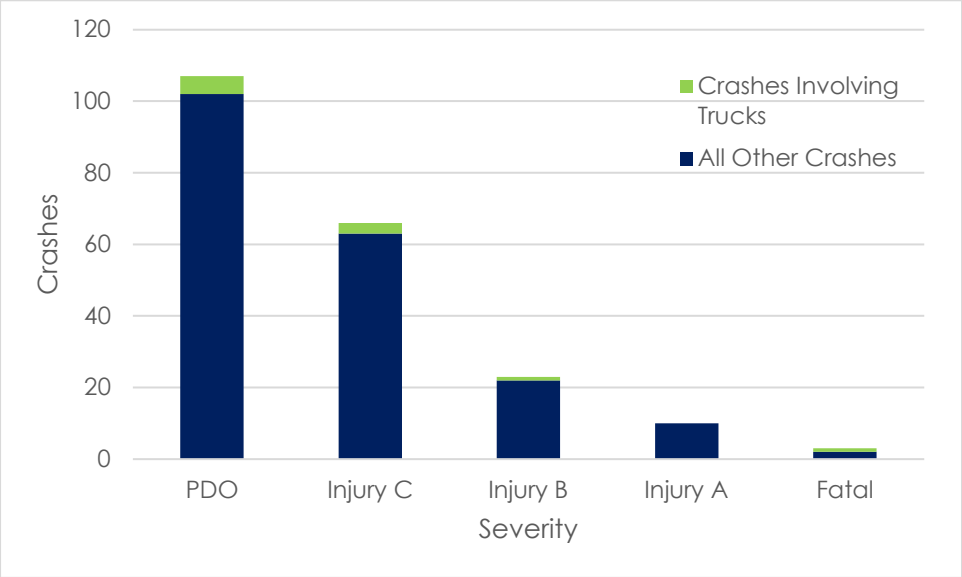


Figure 17 presents that 5% of the total reported crashes involved trucks. Most of the truck involved crashes were PDO or injury C crashes, one truck involved crash was an injury B crash, and one truck

involved crash was a fatal crash. Because there were three fatal crashes on the study corridor between 2014-2018, 33% of these crashes were truck involved crashes.

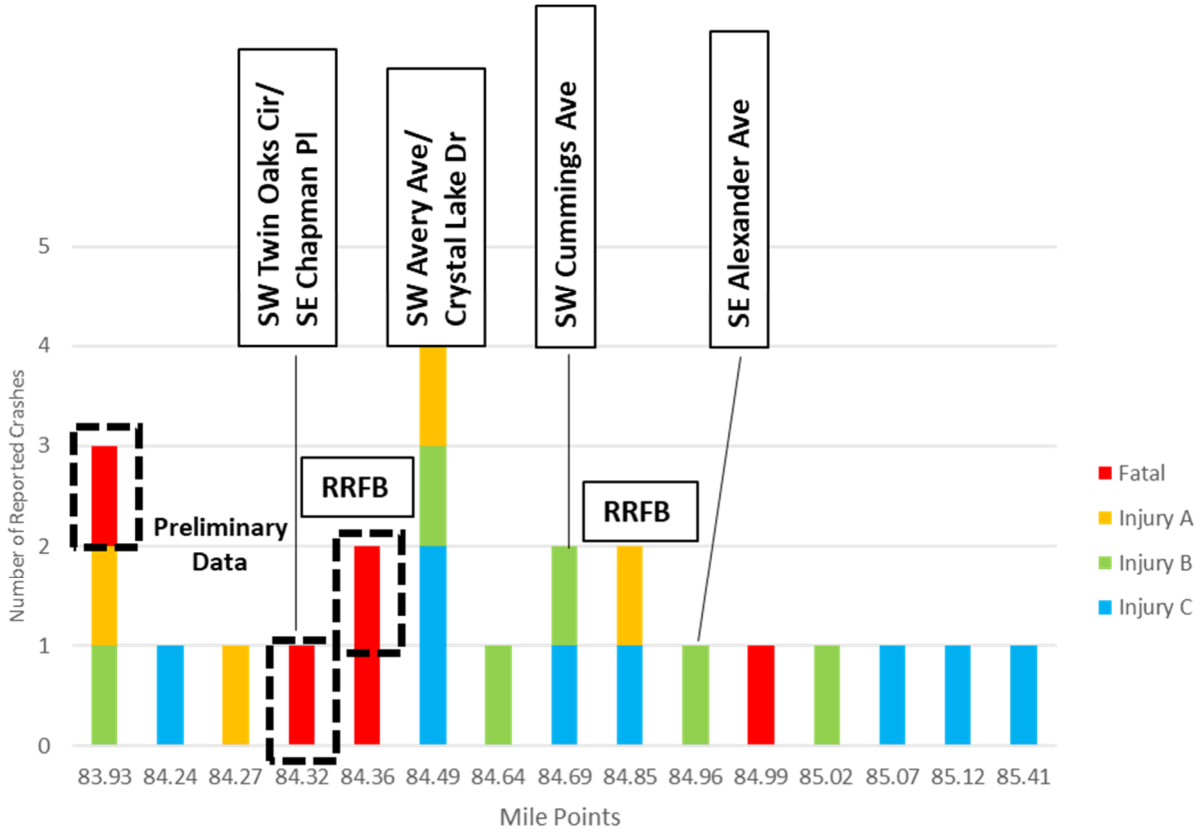
Figure 17: 2014-2018 Reported Crashes Involving Trucks



As noted above, pedestrian and bicycle crashes represent 10% of the total and 46% of the high severity (injury A and fatal) 2014-2018 reported crashes.

Figure **18** presents a distribution of pedestrian and bicycle crashes by milepost, including 2019-2021 preliminary data. The figure shows that the pedestrian crossing just south of SE Chapman Place experienced two fatal crashes in the 2014-2020 time period. At the time those crashes occurred, the crossing did not have RRFBs but instead had a “wigwag” style crossings.

Figure 18: 2014-2018 Reported and 2019-2021 Preliminary Pedestrian and Bicycle Crashes by Milepost



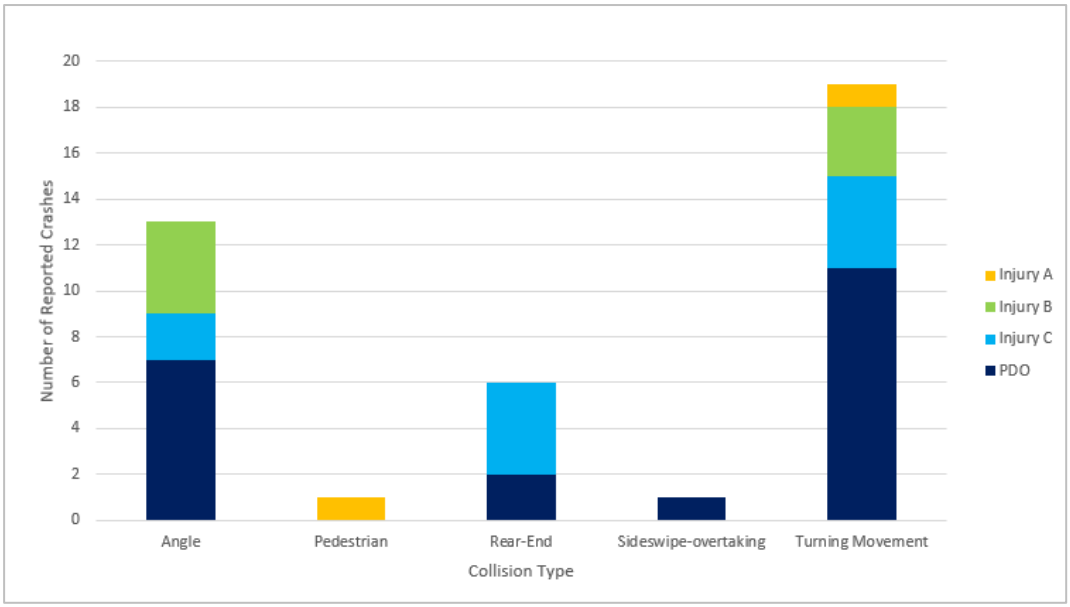
Location Specific Crash Analysis: Intersections of OR 99W with SW Western Boulevard

In addition to evaluating corridor-wide crash data, the consultant team looked more closely at the crashes that occurred at the intersection with SW Western Boulevard (milepost 83.93), as this location had the most reported crashes (40 total crashes between 2014 and 2018 which represents 22% of the total corridor crashes).

Notably, OR 99W becomes a one-way couplet to the north of the interchange with US 20/OR 34, thus there are two intersections of OR 99W with SW Western Boulevard. However, the crashes are reported at the same milepost for both intersections. Out of the 40 crashes reported at milepost 83.93, 21 occurred at the SW 3rd Street (OR 99W northbound) intersection and 18 occurred at the SW 4th Street (OR 99W southbound) intersection.

As presented in Figure 19, most crashes occuring at these two intersections are turning movement(48%) and angle (33%) crashes. The majority of those crashes (53%) are PDO crashes. Out of the 40 total crashes, 14 (35%) involve a left turn. Two crashes involved a pedestrian or a bicyclist.

Figure 19: 2014-2018 Reported Crashes at OR 99W & SW Western Boulevard by Collision Type



By reviewing the crash data at the OR 99W with SW Western Boulevard intersections more closely, the consultant team identified the following collision patterns that stand out the most:

- One vehicle making an eastbound left turn, another vehicle traveling northbound through (a total of 7 crashes, 18%). Two crashes that involve eastbound left turns also involve either a pedestrian or a bicyclist.
- One vehicle making an eastbound left turn, another vehicle traveling westbound through (a total of 6 crashes, 15%).
- One vehicle traveling northbound through, another vehicle also traveling northbound through (a total of 4 crashes, 10%, and primarly rear-end collisions).
- One vehicle traveling southbound through and another vehicle traveling eastbound through (a total of 4 crashes, 10%).

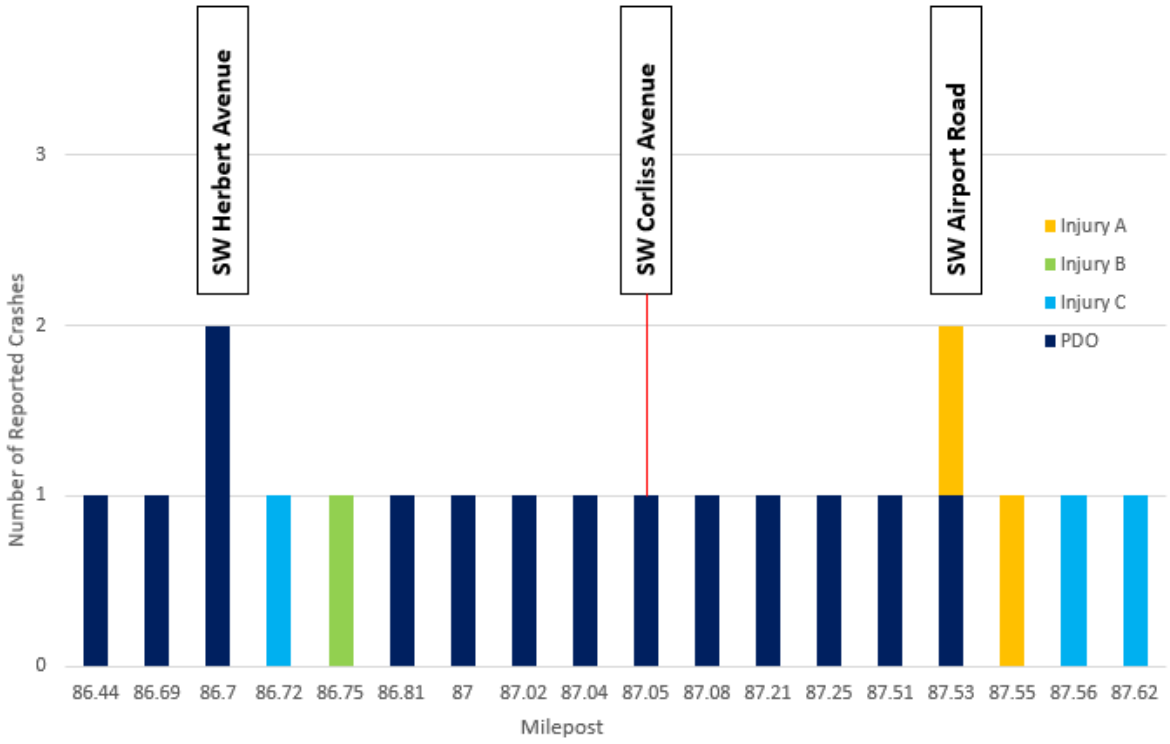
In summary, most crashes at the intersections of OR 99W with SW Western Boulevard occur in fall and winter seasons, with Wednesdays and Fridays being the most common days of the week. Sixty-three percent of the crashes take place in clear conditions and 60% occur in daylight. Two out of the 40 crashes have been flagged for speeding, and none were flagged for alcohol or drug use.

Location Specific Crash Analysis: Segment to The South of Kiger Island Drive

The consultant team also reviewed the crashes that occurred to the south of Kiger Island Drive more closely due to the fact that it included two injury A crashes, resulting in an injury A and fatal crash rate in excess of the statewide average, as presented in Table 11.

This segment is 1.26 miles long and included a total of 20 crashes in the reported 2014-2018 time frame. Two of those crashes were injury A crashes, one was an injury B crash, three were injury C, and 14 were PDO crashes. Figure 20 presents the crashes reported along a segment by milepost.

Figure 20: 2014-2018 Reported Crashes South of Kiger Island Drive



Both of the injury A crashes occurred within 100 feet of the intersection with SW Airport Road: one crash took place in 2017 and another took place in 2018. The 2017 crash was a fixed object collision. The vehicle was traveling from south to north and the driver was reported to be fatigued/sleepy/asleep and failed to stay within the roadway. The 2018 crash was a turning movement collision. One vehicle was traveling south on OR 99W and another vehicle was making a left turn out of SW Airport Road. The left-turning vehicle was reported to not yield to the vehicle traveling straight on OR 99W.

Crash Rates

The Consultant team computed crash rates for the intersections along the corridor for which ODOT TPAU provided AADT information, as well as for the segments in between those intersections. ODOT TPAU provided the consultant team with 2020 AADT values that needed to be adjusted for a 5-year average, given that the consultant team used 5 years of reported crashes. The consultant team obtained historical 2016 AADT information from the ODOT Transportation Volume Tables[5] for five locations along the

[5] https://www.oregon.gov/ODOT/Data/Documents/TVT_Complete_2016.pdf

corridor and used them to compute an adjustment factor for the 2020 AADT values. Segment AADT was computed as an average of the sum of the entering and exiting traffic between the intersections bounding a segment.

Intersection Crash Rates

To obtain intersection-related crashes, the consultant team used crashes within 100 feet of the intersections except for locations where intersections are located closer than 100 feet apart; in these situations, crashes were assigned to the nearest intersection.

The consultant team compared study intersection crash rates to the statewide 90th percentile crash rates provided in Exhibit 4-1 of ODOT's APM, Chapter 4[6]. The study corridor between mileposts 83.93 and 87.1 is classified as Urban Principal Arterial – Other and between mileposts 87.1 and 87.75 it is classified as Rural Minor Arterial[7]. Therefore, crashes at the intersections north of milepost 87.1 were compared to statewide **urban** crash rates and crashes at the intersections south of milepost 87.1 were compared to statewide **rural** intersections. Only one study intersection is located to the south of milepost 87.1 – SW Airport Drive. Additionally, Exhibit 4-1 provides statewide comparisons for 3-leg and 4-leg intersections but does not distinguish one-way couplets separately. For this analysis, the one-way couplet intersections of OR 99W with SW Western Boulevard were compared to the 90th percentile crash rates for 3-leg signalized intersections, based on the similarity in number of conflict points.

Notably, the offset intersections of OR 99W with SW Tunison Avenue and SE Viewmont Avenue, as well as the intersections with SW Goodnight Avenue and SE Goodnight Avenue were considered individual four-leg intersections in the crash rate calculations due to their proximity and the difficulty of separating the crash data. In particular, the RSA process determined that many people cross OR 99W in between SW Tunison Avenue and SE Viewmont Avenue which results in high number of collisions. Treating these two offset intersections as one allows for capturing all of the collisions that occur as a result of people crossing OR 99W.

Table 8 presents observed crash rates for 15 study intersections. Three of the study intersections exceeded the statewide 90th percentile crash rate: the offset intersection of SW Tunison Avenue and SE Viewmont Avenue, which includes the unmarked pedestrian crossing between the east and west intersection legs, and both one-way couplet intersections with Western Boulevard.

Error! Bookmark not defined.

[6] https://www.oregon.gov/ODOT/Planning/Documents/APMv2_Ch4.pdf

[7] https://www.oregon.gov/ODOT/Engineering/Documents_RoadwayEng/HDM_A-Functional-Classification.pdf

Table 8: Intersection Crash Rates

Intersection	Intersection Type For Rate Comparison	Annual Number of Crashes	Adjusted AADT	Observed Intersection Crash Rate[1]	90th Percentile Statewide Intersection Crash Rate[1]	Observed Crash Rate>90th Percentile Rate?
SW Western Boulevard & 4th Street (one way south)	Urban 3-leg, signalized	3.8	19,178	**0.54**	0.509	**Yes**
SW Western Boulevard & 3rd Street (one way north)	Urban 3-leg, signalized	5.2	17,322	**0.82**	0.509	**Yes**
SW B Avenue & 4th Street (one way south)	Urban 3-leg, stop-controlled	0.6	15,811	0.10	0.408	No
SW B Avenue & 3rd Street (one way north)	Urban 3-leg, stop-controlled	0.6	14,883	0.11	0.408	No
SW Twin Oaks Circle (SE Chapman Place)	Urban 4-leg, stop-controlled	1.6	28,078	0.16	0.408	No
SW Avery Avenue (Crystal Lake Drive)	Urban 4-leg, signalized	3.6	31,551	0.31	0.860	No
SE Alexander Ave	Urban 4-leg, signalized	2.4	18,250	0.36	0.860	No
SW Tunison Avenue & SE Viewmont Avenue (combined)	Urban 4-leg, stop-controlled	2.8	16,942	**0.45**	0.408	**Yes**
SE Richland Avenue	Urban 3-leg, stop-controlled	0.2	15,952	0.03	0.293	No
SE Park Avenue	Urban 3-leg, stop-controlled	0.4	15,652	0.07	0.293	No
SW Wake Robin Avenue	Urban 3-leg, stop-controlled	0.2	15,952	0.03	0.293	No
SW Goodnight & SE Goodnight (combined)	Urban 4-leg, stop-controlled	0.8	15,837	0.14	0.408	No
SE Rivergreen Avenue	Urban 3-leg, stop-controlled	0.6	15,378	0.11	0.293	No
SE Kiger Island Drive	Urban 3-leg, stop-controlled	0	11,507	0	0.293	No
SW Airport Drive	Urban 4-leg, stop-controlled	0.8	6,840	0.32	0.475	No

[1] Measured in crashes per million entering vehicles

The consultant team calculated critical crash rates for the study intersections following the ODOT's APM, Section 4.3.4 procedure. Per section 4.3.3, a reference population of minimum of 5 sites with similar characteristics (such as control type and number of intersection legs) is needed for establishing an internal reference population within a study area. The one-way couplet intersections of OR 99W with SW Western Boulevard and SW B Avenue have unique characteristics that do not allow to compare them to

other two-way facilities. Therefore, those intersections were excluded from the critical crash rate calculations. The consultant team established the following count of intersection types within the study area:

- Urban, 3-leg stop-controlled: 5 intersections
- Urban, 4-leg stop-controlled: 3 intersections
- Urban, 4-leg signalized: 2 intersections
- Rural, 3-leg stop-controlled: 1 intersections

Based on this information, only urban, 3-leg stop-controlled intersections have enough sites in the reference population for establishing an internal reference population crash rate. For the remaining intersection types, the consultant team used a statewide reference population and obtained average crash rates for the critical crash rate calculations from Exhibit 4-1 (APM). Table 9 below presents critical crash rates for the study intersection. As shown in the table, one of the study intersections exceeds the critical crash rate: the offset intersection of OR 99W with SW Tunison Avenue (SE Viewmont Avenue).

Table 9: Intersection Critical Crash Rates

Intersection	Intersection Type For Rate Comparison	Annual Number of Crashes	Adjusted AADT	Observed Intersection Crash Rate[1]	Reference Population Crash Rate[1]	Critical Crash Rate[1]	Observed Crash Rate>Critical Rate?
SW Twin Oaks Circle (SE Chapman Place)	Urban 4-leg, stop-controlled	1.6	28,078	0.16	0.198	0.31	No
SW Avery Avenue (Crystal Lake Drive)	Urban 4-leg, signalized	3.6	31,551	0.31	0.477	0.64	No
SE Alexander Ave	Urban 4-leg, signalized	2.4	18,250	0.36	0.477	0.69	No
SW Tunison Avenue & SE Viewmont Avenue (combined)	Urban 4-leg, stop-controlled	2.8	16,942	**0.45**	0.198	0.35	**Yes**
SE Richland Avenue	Urban 3-leg, stop-controlled	0.2	15,952	0.03	0.052	0.14	No
SE Park Avenue	Urban 3-leg, stop-controlled	0.4	15,652	0.07	0.052	0.14	No
SW Wake Robin Avenue	Urban 3-leg, stop-controlled	0.2	15,952	0.03	0.052	0.14	No
SW Goodnight & SE Goodnight (combined)	Urban 4-leg, stop-controlled	0.8	15,837	0.14	0.198	0.35	No
SE Rivergreen Avenue	Urban 3-leg, stop-controlled	0.6	15,378	0.11	0.052	0.14	No
SE Kiger Island Drive	Urban 3-leg, stop-controlled	0	11,507	0	0.052	0.16	No
SW Airport Drive	Urban 4-leg, stop-controlled	0.8	6,840	0.32	0.196	0.44	No

Segment Crash Rates

The consultant team used two approaches for determining segments for calculating crash rates:

- The first approach considers the overall segment crash rate for the principal arterial and minor arterial portions of the corridor;
- The second approach evaluates the crash rate of individual segments between the study intersections to help identify potential locations of focus.

Approach One: Overall Segments

For the first approach, the consultant team used the entire two-way principal arterial and minor arterial portions of the study corridor. The consultant team compared the overall segment crash rates to

statewide average crash rates presented in Table II of the ODOT Crash Rate Book[8]. The consultant team compared the corridor segments to the north of milepost 87.1 to 2018 Urban Fringe - Other Principal Arterial rate, and the segments to the south of milepost 87.1 to 2018 Urban Fringe – Minor Arterials rate. All crashes along the segment, including intersection-related crashes, were captured in the crash rates. As shown in Table 10, the segment between SW Twin Oaks Circle (SE Chapman Place) and SE Kiger Island Drive exceeds the statewide highway crash rate for similar facilities.

Table 10: Overall Segment Crash Rates (approach 1)

Segment (From – To)	Five-Year Total Number of Crashes	AADT (two-way link)	Segment Length[1]	Observed Segment Crash Rate[2]	Average Statewide Highway Crash Rates[2]	Observed Crash Rate>Statewide Average Rate?
SW Twin Oaks Circle (SE Chapman Place) – SE Kiger Island Drive	127	26,886	1.98	**1.31**	1.21	**Yes**
SE Kiger Island Drive – South End of the Corridor	20	8,794	1.26	0.99	1.25	No

[1] Measured in miles

[2] Measured in crashes per million entering vehicles per mile

In addition to the overall segment crash rates, the consultant team compared fatal and injury A segment crash rates to Table V: 2018 Fatal and Injury Highway Crash Rates and Casualty Rates of the ODOT Crash Rate Book[9]. As shown in Table 11, the observed crash rates for both segments exceed the statewide fatal and injury A crash rates. Notably, both injury A crashes along the second segment occurred at and just south of the intersection with SW Airport Road. A more detailed evaluation of crashes at this intersection is presented earlier.

[8] https://www.oregon.gov/odot/Data/Documents/Crash_Rate_TableII_2018.pdf

[9] https://www.oregon.gov/odot/Data/Documents/Crash_Rate_TableV_2018.pdf

Table 11: Fatal and Injury A Segment Crash Rates (Approach 1)

Segment (From – To)	Five-Year Fatal & Injury A Number of Crashes	AADT (two-way link)	Segment Length[1]	Observed Segment Fatal & Injury A Crash Rate[2]	Average Statewide Highway Fatal & Injury A Crash Rates[2]	Observed Crash Rate>Statewide Average Rate?
SW Twin Oaks Circle (SE Chapman Place) – SE Kiger Island Drive	7	17,013	1.98	**7.21**	6.48	**Yes**
SE Kiger Island Drive – South End of the Corridor	2	7,534	1.26	**9.89**	7.90	**Yes**

[1] Measured in miles

[2] Measured in crashes per 100 million entering vehicles per mile

Approach Two: Individual Segments

Recognizing that calculating segment crash rates for the entire corridor length does not help identify location-specific corridor safety issues, the consultant team also calculated segment crash rates for individual segments between study intersections. No segment crash rates were calculated between SW Western Boulevard and SW B Avenue due to the lack of a statewide comparison for one-way roads, and between SE Park Avenue and SW Wake Robin Avenue due to the close proximity of the two intersections. Although several of the segments are short, which may increase the chance that a small number of crashes may result in a high crash rate, this approach was used as another initial screening to help the team identify areas for potential deeper review.

Similarly to the first approach, the consultant team compared overall segment crash rates to statewide average crash rates presented in Table II of the ODOT Crash Rate Book[8]. Table 12 presents crash rates for the corridor segments identified using the second approach. Four of the study segments exceed the statewide average crash rates and are further described below:

- SW Twin Oaks Circle (SE Chapman Place) to SW Avery Avenue (Crystal Lake Drive): This segment is 0.10 miles long and contains the pedestrian crossing near the Co-op where multiple crashes were reported. Eighteen total crashes were reported on this segment.
- SW Avery Avenue (Crystal Lake Drive) to SE Alexander Avenue: This segment is 0.41 miles long and contains six 3-legged intersections, two pedestrian crossings, and a Shell gas station driveway. Thirty-four total crashes were reported on this segment.
- SE Alexander Avenue to SW Tunison Avenue: This segment is 0.04 miles long (200 feet) and included two reported crashes. The short segment length is contributing to a high crash rate.
- SE Viewmont Avenue to SE Richland Avenue: This section is 0.02 miles long (100 feet) and included three reported crashes. The short segment length is contributing to a high crash rate.

Table 12: Overall Segment Crash Rates (approach 2)

Segment (From – To)	Five-Year Total Number of Crashes	AADT (two-way link)	Segment Length[1]	Segment Crash Rate[2]	Average Statewide Highway Crash Rates[2]	Observed Crash Rate>Statewide Average Rate?
SW B Avenue - SW Twin Oaks Circle (SE Chapman Place)	12	28,204	0.30	0.78	1.21	No
SW Twin Oaks Circle (SE Chapman Place) - SW Avery Avenue (Crystal Lake Drive)	18	27,489	0.10	**3.59**	1.21	**Yes**
SW Avery Avenue (Crystal Lake Drive) - SE Alexander Avenue	34	21,723	0.41	**2.09**	1.21	**Yes**
SE Alexander Avenue - SW Tunison Avenue	2	16,851	0.04	**1.63**	1.21	**Yes**
SE Viewmont Avenue - SE Richland Avenue	3	15,421	0.02	**5.33**	1.21	**Yes**
SE Richland Avenue - SE Park Avenue	3	15,376	0.21	0.51	1.21	No
SW Wake Robin Avenue - SW Goodnight	1	15,689	0.07	0.5	1.21	No
SE Goodnight - SE Rivergreen Avenue	0	13,633	0.32	0	1.21	No
SE Rivergreen Avenue - SE Kiger Island Drive	3	11,487	0.32	0.45	1.21	No
SE Kiger Island Drive - SW Airport Drive	14	8,895	1.17	0.74	1.25	No
South of SW Airport Drive	2	6,347	0.19	0.91	1.25	No

[1] Measured in miles

[2] Measured in crashes per million entering vehicles per mile

Summarily to the first approach, the consultant team compared fatal and injury A segment crash rates to the crash rates presented in Table V of the ODOT Crash Rate Book[9]. Since the intersection-related crashes were excluded from the second approach analysis, there were only three segments that experienced fatal or injury A crashes. Table 13 presents crash rates for the segments that experienced fatal or injury A crashes in the 2014-2018 period. Two of the reported segments exceed the statewide rates.

Table 13: Fatal and Injury A Segment Crash Rates (approach 2)

Segment (From – To)	Five-Year Fatal & Injury A Number of Crashes	AADT (two-way link)	Segment Length[1]	Segment Fatal & Injury A Crash Rate[2]	Average Statewide Highway Fatal & Injury A Crash Rates[2]	Observed Crash Rate>Statewide Average Rate?
SW B Avenue - SW Twin Oaks Circle (SE Chapman Place)	2	28,204	0.30	**12.95**	6.48	**Yes**
SW Twin Oaks Circle (SE Chapman Place) - SW Avery Avenue (Crystal Lake Drive)	2	27,489	0.10	**39.87**	6.48	**Yes**
SW Avery Avenue (Crystal Lake Drive) - SE Alexander Ave	1	21,723	0.41	6.15	6.48	No

[1] Measured in miles

[2] Measured in crashes per 100 million entering vehicles per mile

Safety Priority Index System

The ODOT Statewide Priority Index System (SPIS) identifies sites along state highways where safety issues warrant further investigation. The SPIS is a network screening developed by ODOT for identifying locations on state highways through consideration of crash frequency, crash severity, and traffic volume. The consultant team identified which locations along the study corridor were reported within ODOT's Top 5% and Top 10% SPIS locations in three most recent SPIS cycles (2016-2018).

Figure 21 presents the two locations along the study corridor that are within top 5% and top 10% SPIS sites: OR 99W intersections with SW Avery Avenue (SE Crystal Lake Drive) and SW Western Boulevard.

Figure 21

KITTELSON & ASSOCIATES

Top SPIS Locations
Corvallis, Oregon

Pedestrian and Bicycle Systemic Safety Risk Analysis

ODOT recently completed *NCHRP 20-22(13) Implementation of NCHRP Research Report 893: the Oregon DOT Statewide Pedestrian and Bicycle Plan*[2]*,* systemic safety analysis aimed at identifying high risk locations for pedestrian and bicycle crashes along the state highway system.

The objective of this plan is to update the *ODOT Pedestrian and Bicycle Safety Implementation Plan* (ODOT, 2014) and inform future iterations of ODOT's All Roads Transportation Safety (ARTS) program. Systemic safety, opposed to the traditional crash history, allows practitioners to proactively identify high risk sites for potential safety improvements based on specific risk factors. Locations identified as top 20% based on the risk factor screening correspond to the highest risk locations throughout the state whereas locations in the lowest 20% correspond to the lowest risk locations throughout the state. A summary of the risk factors used as part of the *Oregon DOT Statewide Pedestrian and Bicycle Plan* is described below.

Pedestrian Risk Analysis

Figure 22 illustrates the results of the pedestrian risk analysis conducted as part of ODOT's statewide systemic safety analysis along the project extents for the Facility Plan. Several segments, including the southbound couplet through the interchange and the segments approximately between SE Goodnight Avenue and SE Rivergreen Avenue score in the top 20% in the state for pedestrian risk factors. Much of the corridor, especially between SW Avery Avenue and SE Goodnight Avenue, scores in the second 20% in the state for pedestrian risk factors. The pedestrian risk factors used as part of the analysis include:

- Principal Arterial
- Number of Lanes (>=Four Lanes)
- High-Access Density
- No Sidewalks (or Only One Side)
- Posted Speed (>=35mph)
- Mixed Use Zoning
- Proximity to Schools (one mile)
- Proximity to Transit Stops (1/4 mile)
- High Population over the Age of 64

Bicycle Risk Analysis

Figure 23 illustrates the results of the bicycle risk analysis conducted as part of ODOT's statewide systemic safety analysis along the project extents for the Facility Plan. The entire corridor study area scores in the top 60% in the state for bicycle risk factors, and the segment approximately between SW Avery Avenue and just south of SE Goodnight Avenue scores in the top 20% in the state for bicycle risk factors. The bicycle risk factors used as part of the analysis include:

- Principal Arterial
- Minor Arterials
- Number of Lanes (>=Four Lanes)
- High-access Density
- No Bike Lane
- Posted Speed (>=35mph)
- Mixed Use Zoning
- Proximity to Schools (one mile)
- Proximity to Transit Stops (1/4 mile)
- High Population over the Age of 64

Figure 22

KITTELSON & ASSOCIATES

Statewide Pedestrian Risk Analysis
Corvallis, Oregon


SW 35TH ST
SW 30TH ST
SW HANSON ST
SW 26TH ST
SW A AVE
SW 13TH ST
SW 11TH ST
SW 10TH ST
SW 7TH ST
SW 6TH ST
SW ADAMS AVE
SW 1ST ST
SW 2ND ST
ALLEY WAY
SW B AVE
SW 5TH ST
SW 15TH ST
SW E AVE
SW WESTERN BLVD
SW MORRIS AVE
20
SW PHILOMATH BLVD
SW BROOKLANE DR
SW AVERY PARK DR
SW 4TH ST
34
SW TWIN OAKS CIR
SW AVERY AVE
SE CRYSTAL LAKE DR
SW BIRDIE DR
SW COUNTRY CLUB DR
SW KNOLLBROOK AVE
SW LONG AVE
SW WILLAMETTE AVE
SW CHINTIMINI AVE
SW CASCADE AVE
SW ROTH ST
SW WHITESIDE DR
SW HOAGLAND DR
SW ALLEN ST
SE BRIDGEWAY AVE
SE ATWOOD AVE
SE BETHEL ST
SE LILLY AVE
SE MAYBERRY AVE
SW 3RD ST
UNKNOWN
SE ALEXANDER AVE
SW FAIRHAVEN DR
SW DeARMOND DR
SW WOLVERINE DR
SE VIEWMONT AVE
SE RICHLAND AVE
SW LEONARD ST
SW PICKFORD ST
SE 3RD ST
SE THOMPSON ST
SE RYAN ST
SE CRYSTAL LAKE DR
SE ALEXANDER AVE
SW AGATE AVE
SW BROOKLANE DR
SW WAKE ROBIN AVE
SE BELL AVE
SE PARK AVE
WILLAMETTE PARK
SE GLENN ST
SE GOODNIGHT AVE
PRIVATE DRIVE
SE PARK AVE
SE CLEARWATER DR
SE MIDVALE DR
SE HATHAWAY DR
SE SUMMERFIELD DR
SE VILLA DR
SE RIVERGREEN AVE
SE BAYSHORE CIR
SE SHORELINE DR
SW DESCHUTES ST
99W
SW HERBERT AVE
SE KIGER ISLAND DR
SW WELTZIN AVE
SE CORLISS AVE
SE 3 MILE LN
SW CONVILL AVE
SW HOUT ST
SW LOWE ST
SE GAGNON ST
POWELLS RD
SW INGALLS ST
SW AIRPORT AVE
SW AIRPORT PL
SW PLUMLEY PL
SW PLUMLEY ST
H:\24\24658 - OR99W South Corvallis Facility Plan\GIS\Bicycle Risk.mxd Date: 11/9/2020
Top 20%
Second 20%
Third 20%
Fourth 20%
Lowest 20%
Railroads
Public Land
Corvallis City Boundary
UGB
0
1,680 Feet

Figure 23

SAFETY CONCERNS

The consultant team has identified a number of corridor-wide and location-specific safety concerns through reviewing crash data, field observations, and stakeholder input.

Speed

The consultant team identified high operating speeds by motor vehicles for the context as one of the key issues along the corridor. The posted speed along the urban portion of the study corridor varies between 25 and 35 mph, and it increases to 50 mph south of SW Goodnight Avenue. Despite the low speed limits in the urban portion of OR 99W, many vehicles, including large trucks, do not comply with the posted speed. High speeds result in less reaction time for the drivers and make it more difficult for pedestrians to determine a gap in traffic. The consultant team determined that speeding is one of the reasons why the corridor has a high proportion of rear-end collisions: when a car stops at a pedestrian crossing or an intersection, the following driver does not have a sufficient reaction time to stop the vehicle.

During one of the site visits completed as a part of the Roadway Safety Audit (RSA), the RSA team witnessed a rear-end collision when a southbound motorist stopped for a pedestrian at the updated RRFB pedestrian crossing just south of SE Chapman Place. The team also observed multiple motorists turn on their hazard lights as they stopped for pedestrians at the updated RRFB pedestrian crossings. The drivers most likely do that to warn the vehicles behind them of their stopping.

Lighting

The consultant team observed that reduced or minimal lighting is an issue along the corridor, especially the east side of OR 99W and to the south of Crystal Lake Drive. Insufficient lighting creates an uncomfortable environment for people using the sidewalks and the bicycle lanes. Reduced or inconsistent lighting at crossings and intersections makes it difficult for the drivers to see people crossing the roadway. In addition, back lighting from land uses obstructs drivers, and people walking and biking from seeing signage, especially, regulatory signs, such as speed limit signs.

Signage

The consultant team identified multiple signage issues along the corridor. The team observed sign clutter, consisting of roadway signs and those from private properties, throughout the corridor. Another issue is the mounting of speed limit signs: the consultant team observed that some signs were mounted at a height above that which would allow many headlights to trigger signage retroreflectivity. Some speed limit signs are also hard to see due to insufficient overhead lighting. The team also observed an absence of wayfinding signs for people walking and biking. Finally, southbound on OR 99W approaching the ramps to US 20/OR 34, the right lane becomes a trap lane but does not have signage and pavement markings to indicate this prior to the ramp.

Crossings

Multi-lane facilities like OR 99W create a double threat for pedestrians crossing both sides of the roadway: 1) the potential for a person driving a vehicle to strike the person walking across in front of them and 2) when a pedestrian is crossing and one person driving stops for the pedestrian but the person in the vehicle behind passes the stopping vehicle, potentially striking the pedestrian.

Limited lighting or visibility at multiple existing crossings throughout the corridor make it difficult for drivers to see crossing pedestrians. This also results in pedestrians and drivers being unable to make eye contact at night. Further, the lighting at some of the crossings is not appropriately located and does not provide lighting onto crossing pedestrians for approaching motorists.

Bicyclist and Pedestrian Comfort

Many people travel by bicycle in South Corvallis, especially in the more urban portion of the city. During multiple site visits, the consultant team observed many bicyclists riding on sidewalks, indicating that people are not comfortable riding in the bicycle lanes. Facilities with no buffer from faster moving motor vehicles and poor bicycle lane conditions can create an unsafe or uncomfortable environment and can lead to unpredictable bicycling behavior.

Sidewalks are available in the northern portion of the corridor, but they end at SW Goodnight Avenue. In addition, the consultant team observed that there are many obstacles experienced by people walking on the sidewalks: garbage and recycling bins, mailboxes, and vegetation often times block sidewalks. In addition, the proximity of vehicle traffic to the sidewalks and the absence of any buffers creates a loud and uncomfortable environment for people using the sidewalks. Condition of travelways is further discussed in the section below.

Condition of Travelways

The current condition of existing sidewalks, bicycle lanes, and travel lanes create additional challenges. Poor drainage causes water to settle in bicycle lanes resulting in bicyclists moving into travel lanes or onto the sidewalk. The pavement quality of the roadway, sidewalks, and the shared use path is poor. Uplifts in the sidewalk pavement creates tripping hazards. Many permanent and temporary obstacles are present in bicycle lanes and on the sidewalks. The sidewalks and intersections are not compliant with the Americans with Disability Act (ADA) at many locations throughout the corridor, though many curb ramps will be reconstructed in 2021.

LOCATION-SPECIFIC SAFETY CONCERNS

Bicycle and Pedestrian Connections North/South Through the Interchange

The connection of downtown Corvallis to the southern part of the city through the interchange of OR 99W, US 20, and OR 34 is highly challenging and uncomfortable for people walking and biking. The routes through this area are undefined and appear piecemealed with indirect connections between curb ramps. Inconsistent sidewalks and trail portions make pedestrians cut through open space and cross at undesirable locations. A lack of wayfinding with a variety of potential routes creates confusion for users who might be unfamiliar with the area. These behaviors are evident by the number of desire lines (user paths) through this area. In addition, the northbound Marys River bridge, which is one of the OR 99W one-way couplets, has bridge girders extending into the sidewalk, which creates a confined walking space.

Vehicular speeds vary through this area as well. Many drivers are accelerating on the ramps to match the higher speeds of the connecting roadways or maintain high speeds as they come from the connecting highway. Design speeds through this area generally exceed the posted speed limit, further encouraging higher operating speeds.

The bicycling connection is very poor through the interchange as well. The southbound road of the OR 99W couplet provides a standard bicycle lane but there is no connection for bicyclists to stay on OR 99W through the lane drop to the westbound on-ramp. There is a shared use trail next to the Willamette River that people can use to avoid riding through the interchange. The connection of the trail to the bicycle lane on the west side of OR 99W is not well signed and is out of direction for those traveling southbound from west of OR 99W.

Crossings

Multiple locations throughout the corridor contain high risk crossing conditions for people, as is evident by the number of crashes related to people walking and biking while crossing. As mentioned above, 10% of all crashes and 46% of the high severity and fatal crashes within the study area involve people walking and biking. The crossing just south of SE Chapman Place has a high number of total crashes, although the 2020 improvements of the crossing are yet to be evaluated as crash data is not yet available. The consultant team identified that there is also a strong desire to cross OR 99W north of SE Chapman Place, south of the river.

The crash data also suggests that many people cross the corridor between SE Viewmont Avenue and SW Tunison Avenue, south of Lincoln Elementary School. Currently, there is not an enhanced crossing at this location. An existing RRFB is located approximately 230 feet south, between SW Tunison Avenue and SE Richland Avenue, but that would be out of direction for many people walking and biking between the school (and other points to the north) and the Tunison neighborhood.

COUNTERMEASURES AND SAFETY IMPROVEMENTS

The following section provides potential solutions to address the identified issues highlighted above. These solutions were created through the Road Safety Audit process and an additional review of crash trends at Western Boulevard/OR 99W prompted by a recent fatal pedestrian crash at this location. The solutions in this report have not been reviewed for feasibility. These solutions will be further refined through the facility planning processes. Crash reduction factors (CRF) are provided for those solutions to which a relevant CRF exists.

Near-Term Suggestions

The consultant team identified the following near-term suggestions to address the corridor issues.

Speed Feedback Signs

High vehicle operating speeds were identified to be one of the key issues of the corridor. The presence of speed feedback signs at multiple locations would help manage driving speeds and reduce the risk of speed related crashes[10]. Possible locations for installing these signs include but are not limited to:

- Southbound (4th Street in downtown OR 99W couplet) between B Street and the interchange
- Northbound, entering the corridor from the south

In addition, the existing speed feedback signs should be maintained.

Install Speed Feedback Sign
Crash Reduction Factor (CRF): 10% for all crash types
Source: ODOT Countermeasure Number: RD12

RRFB Advance Warning

One of the issues identified by the consultant team was drivers not having enough reaction time when a vehicle ahead of them stops at a pedestrian crossing. The team believes this to be the primary reason of the large number of rear-end collisions at the pedestrian crossing south of SW Chapman place. An advance RRFB warning assembly north of SE Chapman Place would provide southbound drivers with additional time to react. This may be a relevant treatment at other places along the corridor as well.

Install Flashing Beacons as Advance Warning
Crash Reduction Factor (CRF): 36% for rear end crashes
Source: Morena, D. A., Wainwright, W. S., and Ranck, F., "Older Drivers at a Crossroads." Public Roads, Vol. 70, No. 4, Washington, D.C., FHWA, (2007) pp. 6-15.
Note: *This is based on flashing beacons as advance warnings for signalized intersections. Advance warning systems are expected to perform similarly for a signalized intersection as an activated crossing.*

Signage Improvement

The consultant team proposed multiple ways to improve the signage along the OR 99W corridor based on the issues identified in the previous section:

- Evaluate the existing signs for their importance, remove less critical ones to reduce sign clutter, review signage for correct installation, and adjust and/or enhance signage as needed

[10] https://www.oregon.gov/ODOT/Engineering/Docs_TrafficEng/CRF-Appendix.pdf

- Evaluate the location of speed limit signs and make sure they are positioned where they are most visible and retroreflectivity is maximized
- Add wayfinding signs throughout the corridor for people walking and biking
- Move street name signs closer to the edge of the roadway

Mid-Term Suggestions

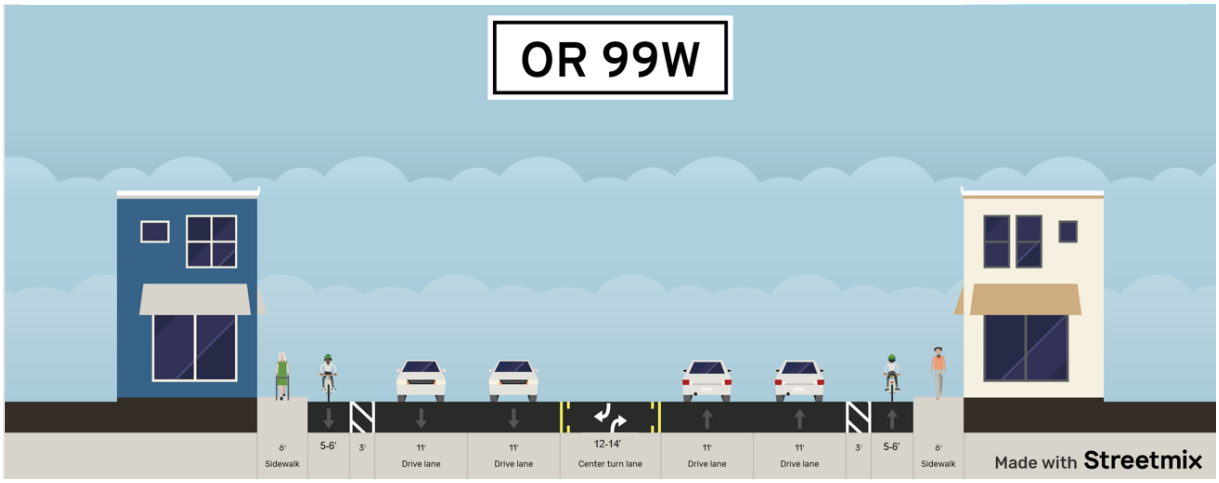
The consultant team identified the following mid-term suggestions to address the corridor issues.

Cross Section Modification

A modified layout of the roadway would create more of a boulevard feeling and would increase the comfort and have a positive influence on the safety of the people using the corridor. This implementation can occur primarily through restriping. Narrower lanes would encourage slower and more careful driving behavior. An additional buffer for the bicycle lanes, preferably with vertical elements such as flexposts, would create a safer and more comfortable environment for bicyclists. Additional medians (with landscaping) where feasible would also encourage more careful driving.

Figure 24 presents a potential typical future cross-section of OR 99W. The presented cross-section is just one of the possible options and the lane widths can be finalized once the exact roadway measurement is available.

Figure 24: Future Potential Cross-Section



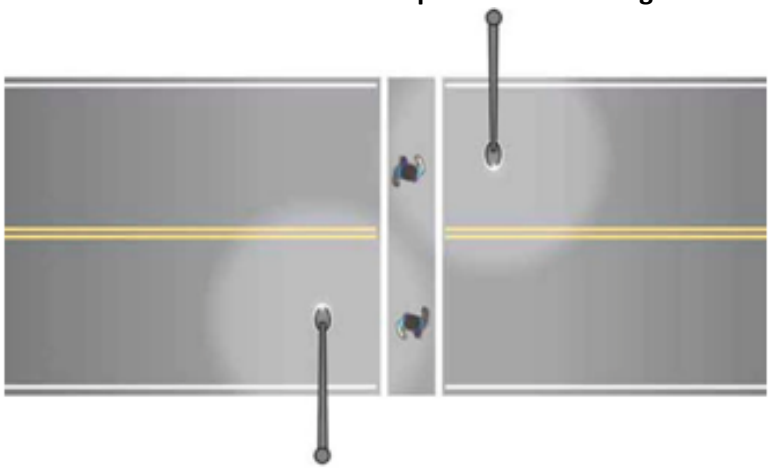
Source: Made with Streetmix

Crossings Improvements

Enhancing crossing locations can increase the comfort and safety of people crossing OR 99W. Enhancements that are not specific to particular locations include but are not limited to:

- Striping double white lines leading to crossings to reduce the likelihood of a double threat from a vehicle changing lanes to avoid stopping.
- Improving lighting, especially on the motor vehicle approach side of the pedestrian crossing to make those in the crossing more visible to the approaching people driving as shown in Figure 25.

Figure 25: Illustration of illumination located in advance of pedestrian crossing



Source: FHWA - https://www.fhwa.dot.gov/publications/research/safety/08053/

In addition to the corridor-wide crossing enhancements, the RSA team believes that a few location-specific improvements will bring additional safety benefit. As mentioned above, a marked pedestrian crossing is desired at the offset SE Viewmont Avenue/SW Tunison Avenue intersection.

Figure 26 presents a crossing layout that is proposed by the RSA team. It includes marked crosswalk striping and a median. A pedestrian hybrid beacon (PHB) should be considered at this midblock location, especially because of proximity to the school. Pedestrian Hybrid Beacons are a traffic control device that remains dark for drivers until activated by a pedestrian. Once activated, it begins to flash yellow to warn motorists, which is then followed by a steady yellow and a steady red phase[11] (see Figure 27). This would replace the RRFB that currently exists between SW Tunison Avenue and SE Richland Avenue (approximately 230 feet to the south). If a PHB is not feasible, an overhead RRFB should be considered.

[11] https://safety.fhwa.dot.gov/ped_bike/tools_solve/fhwasa14014/

Unlike a PHB, an RRFB does not provide a steady red phase and uses an irregular flash pattern[12] (see Figure 28). According to ODOT's crash reduction factors, a PHB is a more effective treatment than an RRFB[13], therefore it is more desired to be installed at this location.

Notably, a median at this location is likely to interfere with the emergency vehicles entering and exiting the fire station on SW Tunison Avenue. The fire station is likely to be relocated in the next five years. If a PHB or overhead RRFB is installed before the relocation of the fire station, the RSA team suggests working with the fire department when designing the crossing to come up with a feasible design that does not interfere with emergency vehicle access.

[12] https://safety.fhwa.dot.gov/intersection/conventional/unsignalized/tech_sum/fhwasa09009/

[13] https://www.oregon.gov/ODOT/Engineering/Pages/ARTS.aspx

Figure 26: Potential Crossing Improvement at SW Tunison Ave/SE Viewmont Ave

Source: Base Image from Google Earth

Figure 27: An Example of a Pedestrian Hybrid Beacon (PHB)

Source: FHWA

Figure 28: An Example of a Rectangular Rapid Flashing Beacon (RRFB)

Source: **FHWA**

Install Pedestrian Hybrid Beacon
Crash Reduction Factor (CRF): 55% for pedestrian and bicycle crashes
Source: ODOT Countermeasure Number: BP19

The consultant team also suggested replacing the RRFB south of SE Chapman Place with a PHB. Similarly, if a pedestrian hybrid beacon is not feasible, an overhead RRFB should be considered.

Lighting Improvements

The consultant team identified that reduced overhead lighting is another key corridor issue. The team suggests installing additional segment lighting along the corridor for lighting consistency, especially south of SW Avery Avenue (SE Crystal Lake Drive) and on the east side of the corridor. The consultant team also suggests considering additional lighting at all four corners of intersections and at pedestrian crossings, on the approaching motorist side of the pedestrian crossing.

Provide Intersection Lighting
Crash Reduction Factor (CRF): 42% for bicycle and pedestrian night crashes
Source: ODOT Countermeasure Number BP2

Provide Highway Lighting
Crash Reduction Factor (CRF): 28% for night crashes
Source: Elvik, R. and Vaa, T., "Handbook of Road Safety Measures." Oxford, United Kingdom, Elsevier, (2004)

SW Western Boulevard Intersections Improvement

The consultant team identified that the intersections of one-way couplet OR 99W with SW Western Boulevard experience a high number of crashes, as discussed above. The team believes that a number of implementations could improve the safety at those intersections.

- In order to address collisions with **left-turning vehicles,** the team recommends adding protective left-turn phases for the traffic turning left from SW Western Boulevard onto OR 99W. The team supposes that the crashes are caused by left-turning vehicles not being able to find long enough gaps in oncoming traffic when deciding to make a turn.

Replace Permissive Left Turns to Protected only
Crash Reduction Factor (CRF): 99% for all crashes
Source: ODOT Countermeasure Number: I9

- The consultant team believes that the **rear-end collisions** could be due to high driving speeds resulting in drivers not having enough reaction time to stop for a vehicle in front of them. A number of measures for lowering speeds along the corridor are discussed above.
- The consultant team believes that a substantial number of angle collisions are a result of people driving through the intersection on a **red light.** A possible solution for emphasizing the signal is adding reflective backplates to the signal head. This should make the traffic head stand out and attract more attention to the signal. Those driving through the intersection during a red light coming from SW Western Boulevard during the morning and evening periods may have reduced visibility due to sun patterns.

Improve Signal Hardware: Lenses, Reflectorized Back plates, Size, and Number
Crash Reduction Factor (CRF): 20-30% for all crashes
Source: ODOT Countermeasure Number: I2

Bicycle and Pedestrian Comfort Improvement

The consultant team believes that the aforementioned cross-sectional changes would have a positive influence on safety and improve the comfort of people walking and biking throughout the corridor. In addition, the team suggests considering the following solutions to improve the existing corridor conditions. Although these are all listed as mid-term solutions, the feasibility of implementation may vary based on feasibility of implementation.

- Add buffered bicycle lanes throughout the corridor (part of near-term suggestions)
- Improve wayfinding (part of near-term suggestions) through the corridor, and the interchange specifically

- Remove obstacles from sidewalks and bicycle lanes
- Provide wider sidewalks and a vegetation buffer strip between the roadway and sidewalk, which might require additional right-of-way.
- Add curb extensions (bulb-outs) to shorten pedestrian crossing distance across city/local road approaches
- Tighten the intersection corner curb radii on city/local road approaches to encourage slower vehicle turning movements

Install Buffered Bike Lanes
Crash Reduction Factor (CRF): 47% for bicycle crashes
Source: ODOT Countermeasure Number: BP24

Add Street Trees
Crash Reduction Factor (CRF): 10% for all crash types
Source: ODOT Countermeasure Number: BP31

Add Curb Extensions
Crash Reduction Factor (CRF): 30% for all crash types
Source: ODOT Countermeasure Number: I33

Travelway Improvements

The consultant team believes that improving the condition of the current travelways will have a positive influence on safety and improve the comfort of people using the corridor. The RSA team suggested the following improvements to address the corridor concerns:

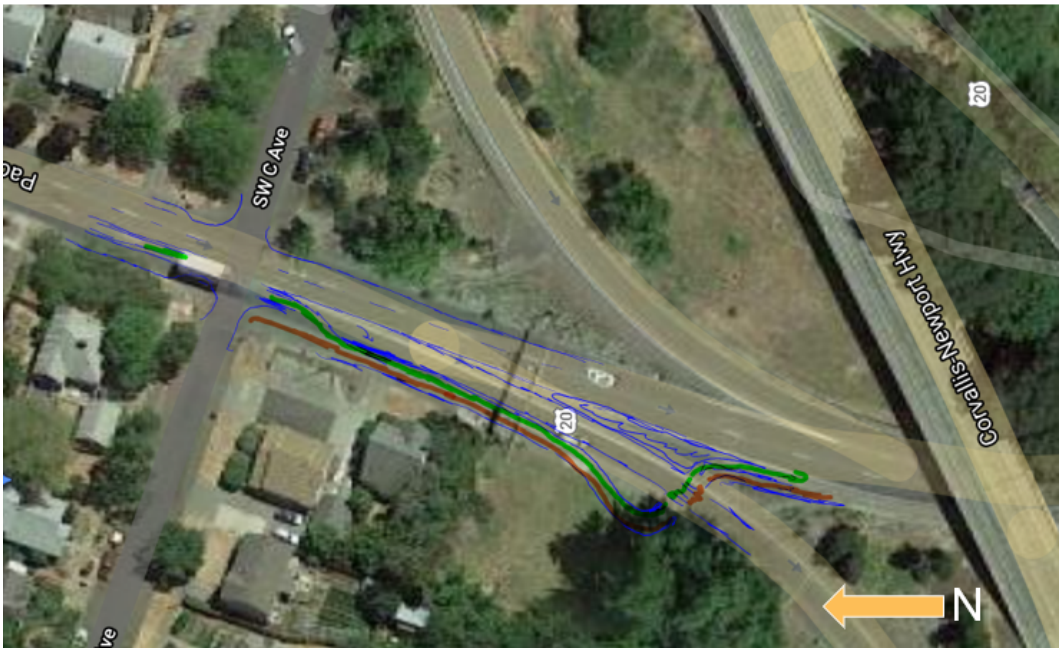
- Evaluate and improve ADA compliance of bus stops, ramps, crossings, and intersections
- Repave the roadway, and repave or replace the sidewalks and shared use path segments in poor condition
- Improve drainage throughout the corridor
- Remove and/or reduce obstacles

Multimodal Ramp Improvements

The team developed several ideas to improve direct connections and wayfinding through the interchange. The team suggests improving bicycle and pedestrian connectivity at the current OR 99W/4th Street southbound to US 20/OR 34 west ramp.

Figure 29 and Figure 30 below present two options for the proposed improvement. Option #1 would widen the current sidewalk to a shared use path, shift the people biking onto the path, and provide an enhanced crossing across the ramp. Option #2 preserves the dedicated bicycle lane by creating a typical right-turn pocket with the bicycle lane between the right-turn and through lane cross over. Option #2 still adds an enhanced crossing for pedestrians crossing the ramp. Both options assume a bike lane is added to this segment. This may be done through widening or through a road reconfiguration along southbound 4th Street to provide two southbound travel lanes and one bikelane. This could be incorporated into a future pavement preservation/restriping project. Corvallis Transportation System Plan Project M104 is the Downtown Circulation Study is expected to more directly address this bicycle connection.

Figure 29: Trap Lane Removal, Option 1



Source: Base Image from Google Earth

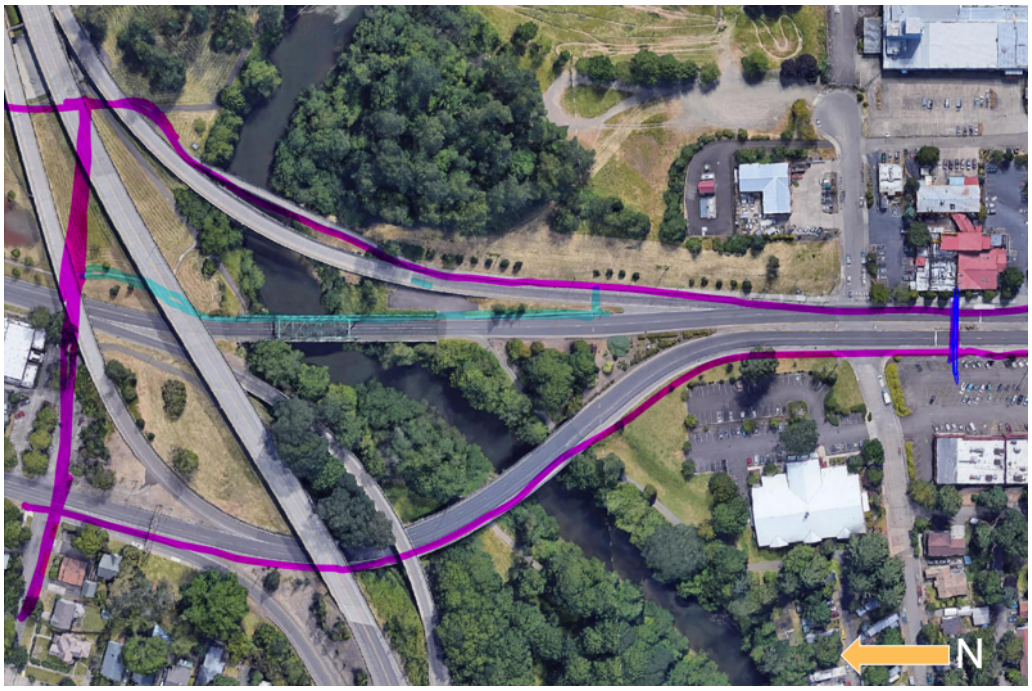
Figure 30: Trap Lane Removal, Option 2

Source: Base Image from Google Earth

Install Urban Green Bike Lanes at Conflict Points
Crash Reduction Factor (CRF): 39% for bicycle crashes
Source: ODOT Countermeasure Number: BP6

The team also suggested improving the overall navigation through the interchange. The proposed improvements include emphasis of the existing bicycle lane in the southbound direction, creating clear signage to direct northbound users to the existing shared use path on the east side of the interchange, and creating a connection from SW C Ave to the shared use path. The shared use path on the east side of the interchange can be used by people biking and walking in both directions depending on their origin and destination. Figure 31 presents a sketch of the potential connections. For this solution, the current northbound bridge connection would be deemphasized for people walking and biking, as it would require more improvements to make it comfortable.

Figure 31: Proposed Pedestrian and Bicycle Improvements at the Interchange

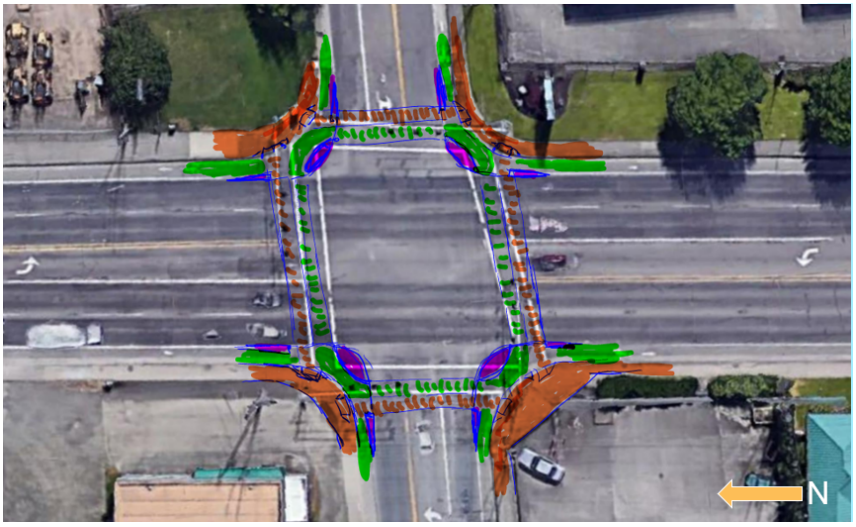


Source: Base Image from Google Earth

Additionally, the consultant team suggests improving bicycle crossings at signalized intersections to the south of the interchange. The intersection at SW Avery Avenue (Crystal Lake Drive) is used by people biking on the shared use path on the east side of the road accessing the southbound bicycle lane on the west side of the road. The team proposed creating a protected intersection at this location. At protected intersections, the bikeway is separated from the parallel motor vehicle traffic. Instead of merging into traffic, they cross in a designated bike crossing location and have right of way over motor vehicles turning.

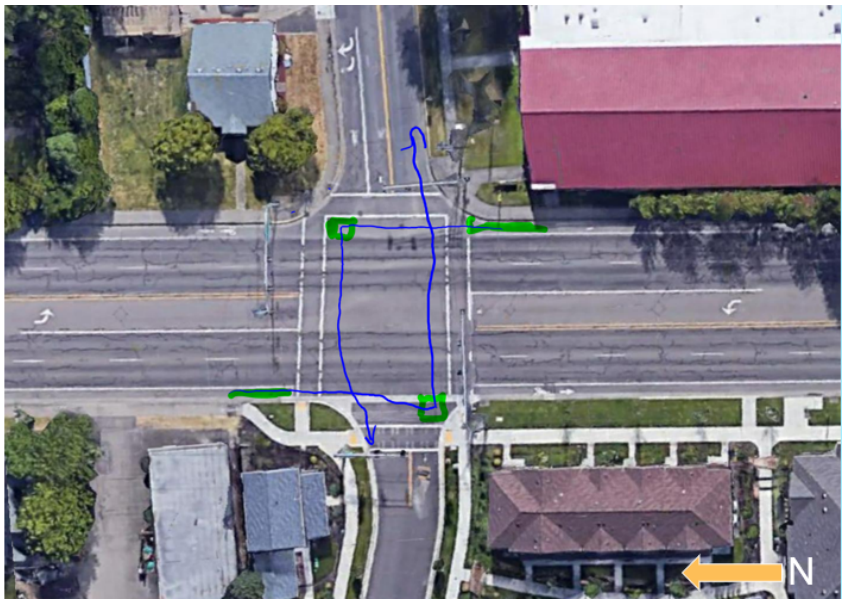
Moreover, the RSA team proposed adding bicycle two-stage left-turn boxes at SE Alexander Avenue. Two-stage left turn boxes provide a marked place for bicyclists to wait for making a two stage left turn at an intersection. Figure 32 and Figure 33 present an initial concept of the proposed improvements at these two intersections.

Figure 32: Proposed Improvements (Protected Intersection) at SW Avery Avenue (Crystal Lake Drive)



Source: Base Image from Google Earth

Figure 33: Proposed Improvements (Striped Bicycle Boxes) at Alexander Avenue



Source: Base Image from Google Earth

Install Bike Box at Conflict Points
Crash Reduction Factor (CRF): 3530% for bicycle crashes
Source: ODOT Countermeasure Number: BP7

Long-Term Suggestions

The RSA team identified the following long-term suggestions to address the corridor issues.

Interchange Improvement

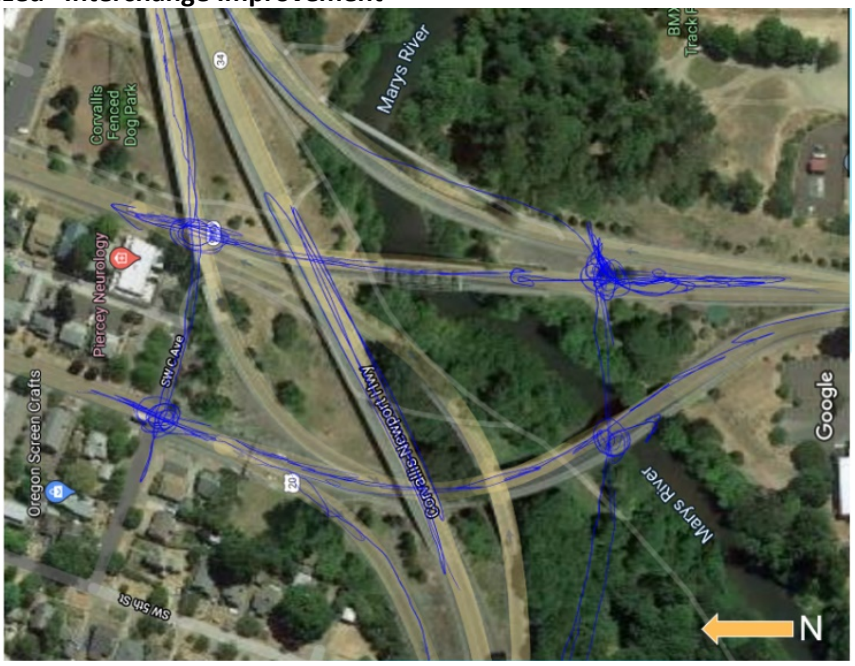
The consultant team identified that the interchange at the north end of the corridor contributes to multiple corridor issues and safety risks. The current interchange layout has several free-flow movements that do not match what is existing in an urban setting to the north and to the south, and operates more similarly to access controlled facilities. Interchange ramps have a posted advisory speed of 25-35 mph but were likely designed to accommodate 45 mph traffic, encouraging high speed driving. The team identified a need to "urbanize" the interchange in order to set contextual differences between high-speed highways and the urban setting of Corvallis. Higher speed ramps are also more difficult to cross for people walking and biking as they do not include appropriate facilities for people walking and biking. Proposed potential interchange layouts are presented below, but ultimately an Interchange Access Management Plan is expected to be necessary to evaluate all possible solutions.

The next review of the Oregon Highway Plan Expressway designation at this location may also consider the need to urbanize the interchange. The most recent affirmation of the Expressway designation, in 2018, pre-dated this technical memo.

"Urbanized" Interchange

This layout would remove the current high-speed ramps and make new connections and at-grade intersections. The consultant team expects that those intersections will need to be controlled to manage movements on and off OR 99W. Figure 34 presents a concept sketch of a split-diamond interchange configuration. Establishing the eastbound ramps and at-grade intersections will be challenging due to the need to cross the Marys River.

Figure 34: "Urbanized" Interchange Improvement

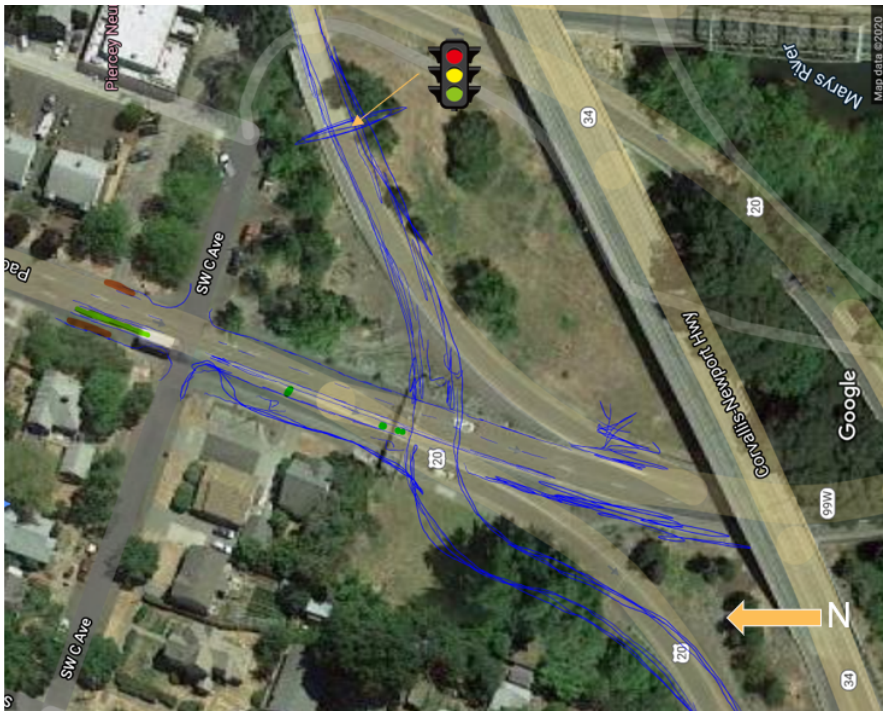


Source: Base Image from Google Earth

"Urbanizing" an Intersection

Looking more specifically at the westbound US 30/OR 34 off ramp to OR 99W south, an option for urbanizing this intersection would remove free movements and add a signal with a pedestrian crossing at the ramp exist. Figure 35 presents a draft sketch of an intersection layout.

Figure 35: "Urbanizing" an Intersection



Source: Base Image from Google Earth

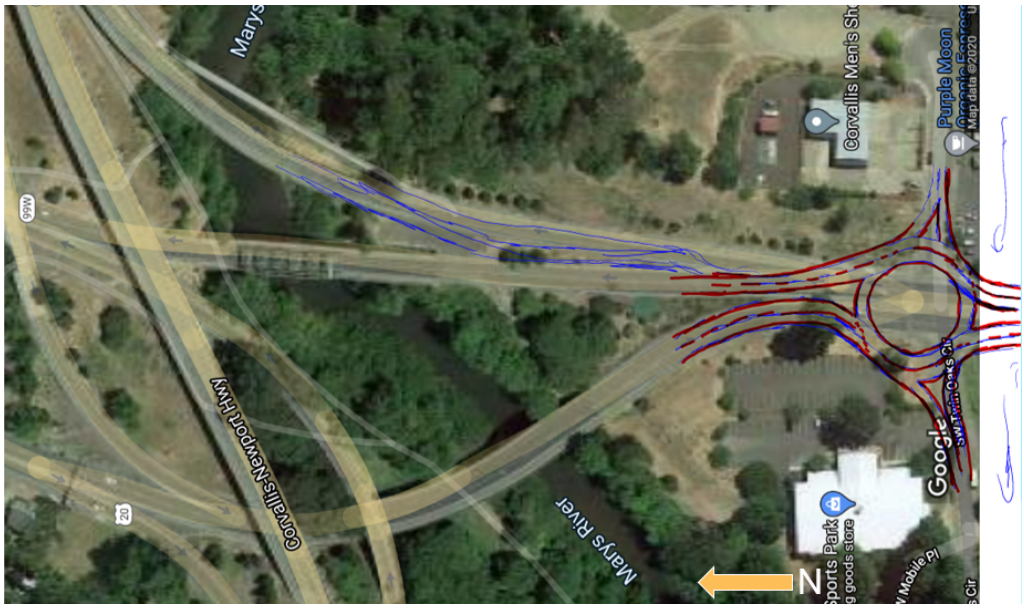
Northern Gateway of South Corvallis

As previously mentioned, motorists leaving the interchange and entering South Corvallis may be conditioned to drive higher than the 25 mph speed limit if they were previously traveling at higher speeds on US 20/OR 34 west or due to the character of the roadway. Because of the less urbanized design of the interchange, people walking and biking often cross just south of the interchange to access destinations on the other side of the road. Managing speeds along the entire corridor, and especially at this location, is key to improving safety.

This solution uses a roundabout to manage the speeds of traffic entering South Corvallis and those travelling onto the OR 34 east ramp. Figure 36 presents a concept sketch of a roundabout layout. This solution may require purchasing right-of-way but is not expected to impact any existing buildings. In addition to managing speeds, the roundabout would provide an opportunity for people driving to make a U-turn on the corridor, increasing the ability to add medians for traffic calming and reducing conflict points along the corridor without reducing access to driveways.

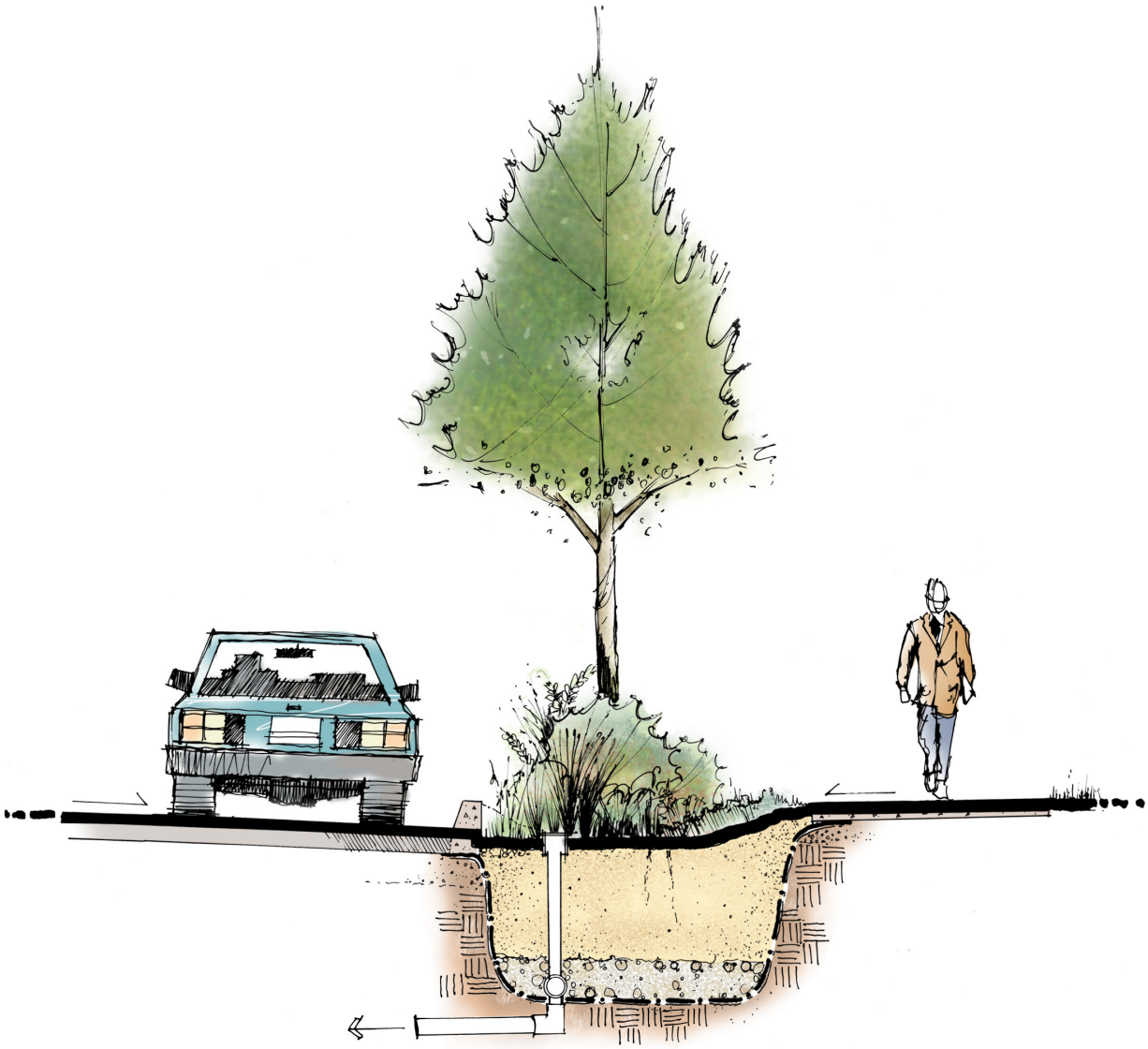
Adding a roundabout could also allow for wayfinding signs to indicate entry to South Corvallis. This could serve as a "gateway" to the area and provide traffic calming, reducing the ability to speed through the area.

Figure 36: Roundabout Solution



Source: Base Image from Google Earth

Appendix A Stormwater and Cross Section Toolkit



99W SOUTH CORVALLIS FACILITY PLAN
GREEN STREETS TOOLBOX

KITTELSON & ASSOCIATES

GREENWORKS™

Green Street Stormwater Facility Overview:

Inherent in roadway design is the responsibility to manage stormwater, treat runoff and balance the protection of our natural resources with the necessary provision of transportation infrastructure. The incorporation of green streets infrastructure allows us to mitigate the harmful impacts of our transportation infrastructure by mitigating air and water pollution, promoting bio-diversity and habitat connectivity, while enhancing our public right of ways (ROWs) for vehicular and non-vehicular uses alike.

A green street is a stormwater management approach that incorporates vegetation, soil and engineered systems to slow, filter and cleanse stormwater runoff from impervious surfaces. Distinct benefits of implementing green street infrastructure include the following:

- Reduced burden on existing "gray" stormwater infrastructure
- Filtration of pollutants and improved air quality
- Street beautification with vegetated space
- Maintaining and restoring natural hydrologic processes
- Protection, and enhancement of habitat quantity and quality
- Improved safety for all users
- Enhanced pedestrian realm and encouragement of non-vehicular use and pedestrian access.

This toolkit presents a range of stormwater design solutions able to support the 99W South Corvallis Facility Plan. Any stormwater infrastructure proposed in the ROW must be sized appropriately and take into consideration the effect on the range of users in the ROW to maximize safety. Implementation of the proposed solutions may be viewed as a connected system such that the overall capacity of the system is understood as a network of facilities working together, able to be expanded incrementally.

Tools appropriate for the 99W South Corvallis facility plan are overviewed in the following section along with design considerations for how to apply them. The final section of this toolkit provides recommendations on which tools to apply within the study area based on individual roadways TSP classifications.

Lake Oswego, OR

Design Approach:

When assessing which combination of tools to employ, it is helpful to keep in mind some guiding principles for effective green street development:

- Maximize green street and stormwater treatments to reduce stormwater pollution and volumes
- Strive to treat runoff as close as possible to where it falls and integrate solutions with street design, which will in turn reduce the need for subsurface infrastructure
- Maximize infiltration to support groundwater
- Minimize impervious paving
- Integrate green street stormwater solutions into street designs rather than placing them in a corner or as an afterthought
- Utilize vegetated facilities as much as possible to support runoff treatment and maximize aesthetic benefit for users.

A combination of approaches and facility types can be used within a catchment area and project. Design considerations in selecting potential treatment options include the following:

- Local soil infiltration rates
- Vegetation and tree selection that maximizes stormwater benefits
- Off-site stormwater discharge location
- Seasonal high groundwater levels
- Locations of below and above ground utilities
- Site context, street classification, adjacent land uses, existing land and tree cover, and slope

Sisters, Or

Green Street Stormwater Tools:

Street Side Swale

Overview

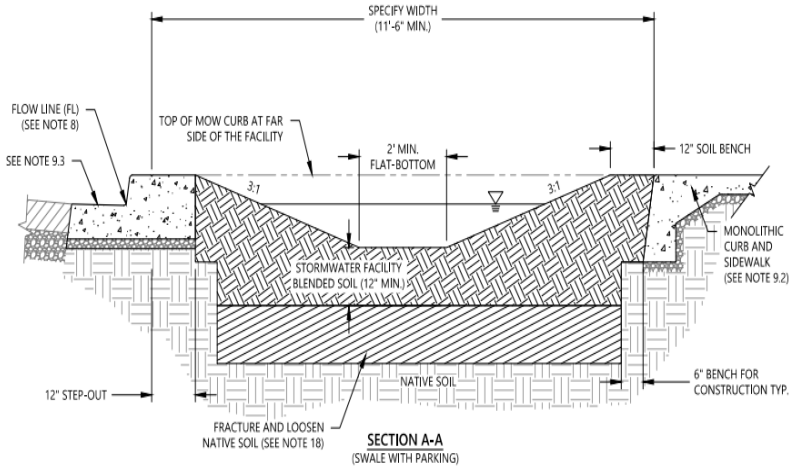
- A graded landscape with bermed side slopes appearing as a linear, shallow, open channel with shallow side slopes.
- Naturally conveys stormwater at a slow, controlled rate and act as a filter medium removing pollutants and allowing infiltration.
- Can reduce the need for subsurface drainage pipes
- Aesthetic improvement to streetscape
- Footprint can adapt to a diversity of geometric conditions.
- Routine maintenance is required

Good choice where:

- ROW has +/- 12' of available space for required swale dimensions.
- Providing pedestrians with buffered space from the roadway is a priority
- There is a desire to provide larger contiguous planting areas to support wildlife corridors
- A low cost replacement for drainage ditches is desired.

Design Guidelines:

- Depth of swale from growing medium to overflow elevation: 9" average
- Longitudinal slope of swale: 6% or less
- Flat bottom width: 2'minimum
- Side slope of swale: 3:1 maximum
- Depth of growing medium: 12" minimum, recommended 24"



Section Example: Image Courtesy of City of Portland Stormwater Management Manual

South Shore Commerce Center, Portland, OR

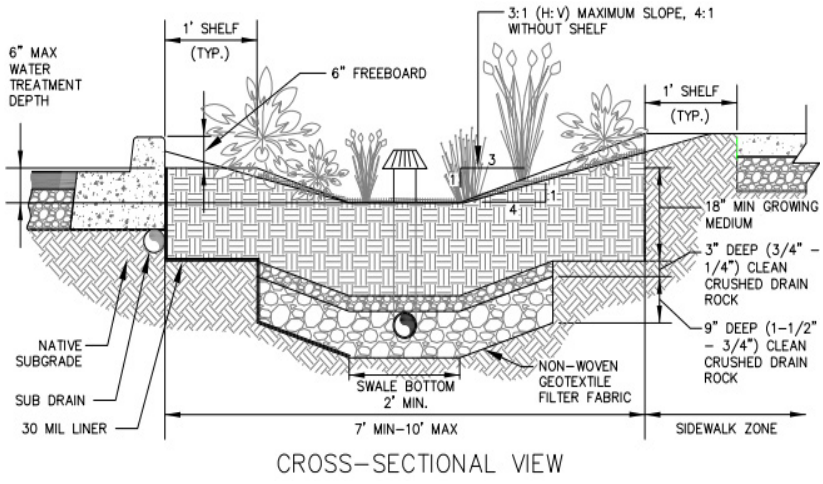
Seattle, WA

GREENWORKS.

Median Stormwater Planter

Overview

- Stormwater planter positioned in the middle of the roadway: allows runoff to be managed in the center of the street rather than along the sides
- Requires 7'minimum to 10' preferred width for effective stormwater treatment.
- Naturally conveys stormwater which can reduce the need for subsurface drainage pipes
- Contributes to traffic calming. This effect is furthered by the introduction of street trees.
- Aesthetic improvement to streetscape
- Routine maintenance is required



Section Example: Image Courtesy of City of Clean Water Services Handbook

Good choice where:

- Curbside constraints preclude introduction of street side swales or stormwater planters
- Roadway improvements allow the consideration of re-grading and sloping at least one side towards the center
- A turning lane is not required
- There is a desire for a planted median

Design Guidelines:

- Depth of planter from growing medium to overflow elevation: 9" average
- Longitudinal slope of swale: 6% or less
- Flat bottom width: 2'
- Side slope of swale: 3:1 maximum
- Depth of growing medium: 24"
- At least one side of roadway slopes towards center of ROW.

SW 124th Ave., Tualatin, OR

Curbside Stormwater Planter

Overview

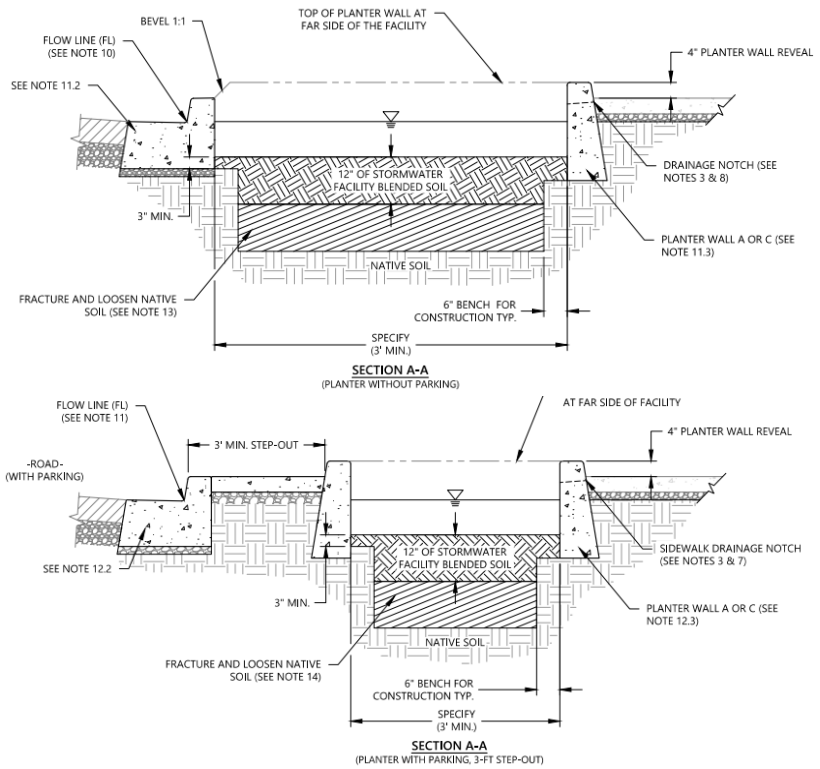
- A specialized, landscape planter installed curbside designed to accept runoff.
- Can be designed to infiltrate stormwater or retain water and reduce peak runoff through the addition of impervious liners and sub-drainage.
- Plantings are incorporated to provide filtration, water uptake and assist with removal of pollutants.
- Ideal choice for many streets given their broad design standards, small setback needs, and ability to incorporate liners.
- Provides a physical buffer between pedestrians and the street
- Aesthetic improvement to streetscape
- Can vary in size to accommodate constraints behind the back of curb.
- Routine maintenance is required

Good choice where:

- There is ample space between sidewalk and curb for installation

Design Guidelines:

- 36" interior width minimum plus 6" planter walls. 48" interior width minimum if a tree is included.
- Depth of planter from growing medium to overflow elevation: 9" average
- Depth of growing medium: 12" minimum, 24" recommended
- Slope within planter: 0.5% or less



Section Example: Image Courtesy of City of Portland Stormwater Management Manual

Beaumont Village Lofts - Portland, OR

SE Water Ave, Portland, OR

GREENWORKS

Curb Extensions

Overview

- Similar to curbside planters in their design but are designed to occupy the width of a parking stall.
- Designed to capture, slow, and infiltrate stormwater within a planted area.
- Often used for retrofit projects
- Vegetation height important consideration for safety (visibility)
- Provides traffic-calming effect
- Can be introduced mid-block in place of a parking space.

Portland, OR

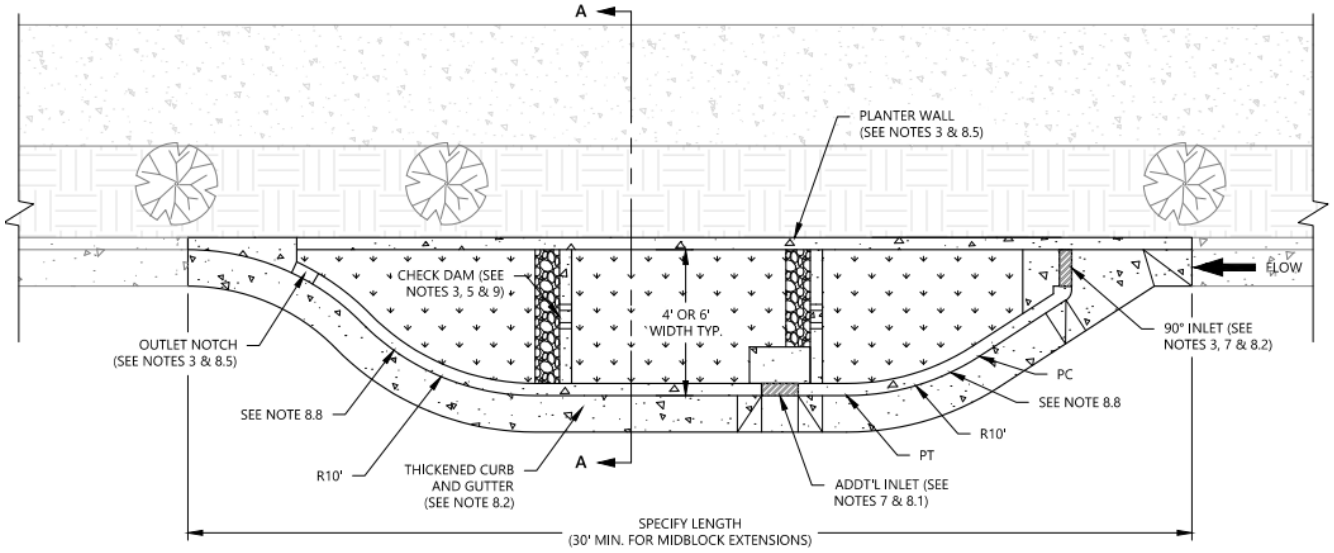
Good choice where:

- Increasing pedestrian safety is a priority
- There is a desire to slow vehicle speeds. This is done by physically narrowing the street.
- There is a desire to enhance pedestrian crossing.
- There is an on-street parking lane and parking space can be sacrificed

Cascade Ave, Sisters, OR

Design Guidelines:

- Extend no less than 4' from face of curb, up to the width of a parking lane
- Swale (with side slopes), or a variety of stormwater planter designs can be used.
- If introduced at an intersection, turning radii must be considered.
- Placement should take into consideration how bicyclists will navigate around the facility.



Plan Example: Image Courtesy of City of Portland Stormwater Management Manual

Stormwater Tree Facilities

Overview

- Stormwater management inside vaulted pavements or structural cells designed to hold engineered soil mixes that provides stormwater filtration and support optimal tree growth.
- Inlets from the street gather runoff – collected directly into the cells or vault system for treatment and overflow discharge.
- The most compact "green" design option (outside of permeable pavement) for streets with limited space.
- Common commercial option: Contech Filterra, Silva Cell.
- Ability to store a large amount of stormwater

Image Courtesy of Philadelphia Green Streets Design Manual

Good choice where:

- A small-scale retrofit is desired
- The curbside area is constrained and space is not available for a full-size infiltration basin or curb extension.
- Quick and easy maintenance is desired.

Design Guidelines:

- A small-scale retrofit is desired
- Quick and easy maintenance is desired.

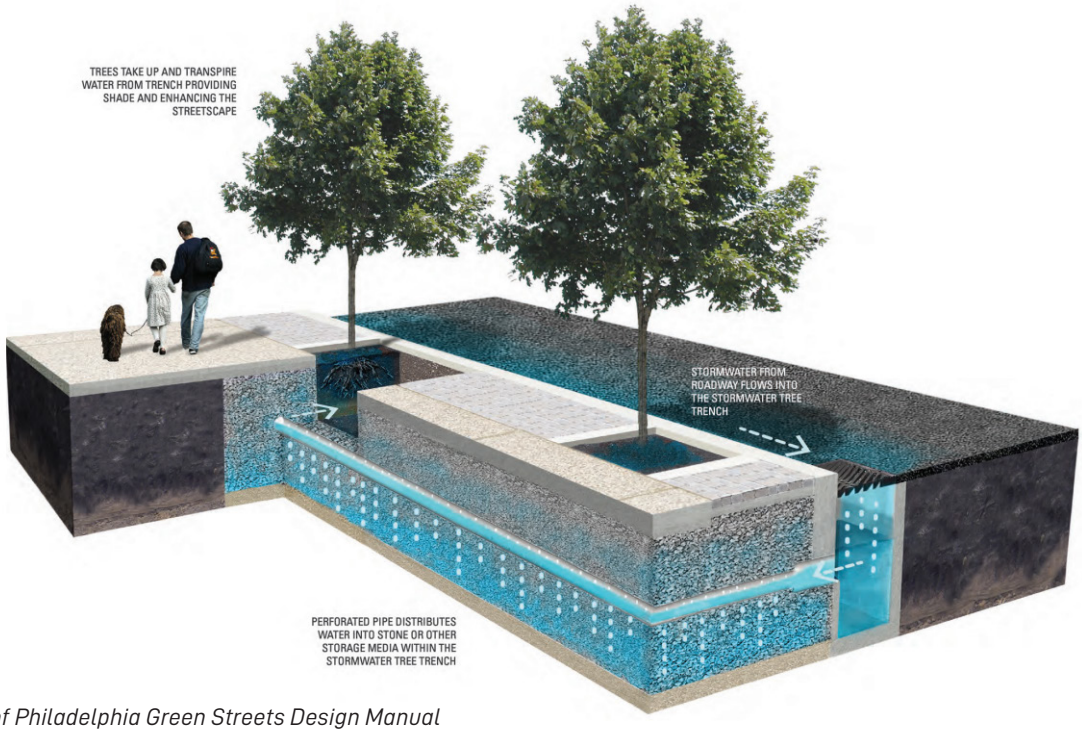


Image Courtesy of Philadelphia Green Streets Design Manual

Permeable/Pervious Paving

Overview

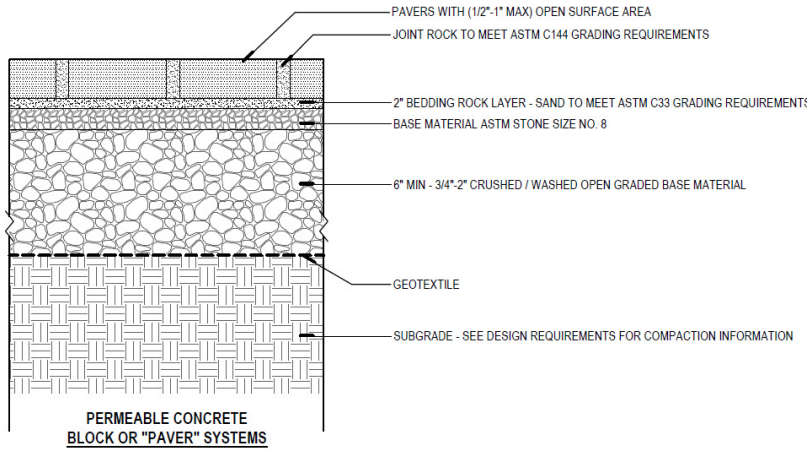
- Permeable pavement is a hard surface comprised of materials that allow water to infiltrate and thereby reduce runoff as compared to impervious surfaces.
- There are multiple options for permeable paving systems that can be implemented in parking areas: Permeable pavers, pervious asphalt, pervious concrete
- Permeable pavers allow stormwater to percolate through gaps between solid pavers.
- Pervious asphalt and concrete allow stormwater to percolate through the porous paving material.
- All permeable/pervious options allow stormwater to percolate in place, rather than running off into the surrounding areas or storm drains.
- All permeable/pervious options allow more air to tree roots and their supporting microbes
- Flatter sites provide better opportunity for permeable/pervious paving.
- Provide infiltration rates of 2"/hour and greater.

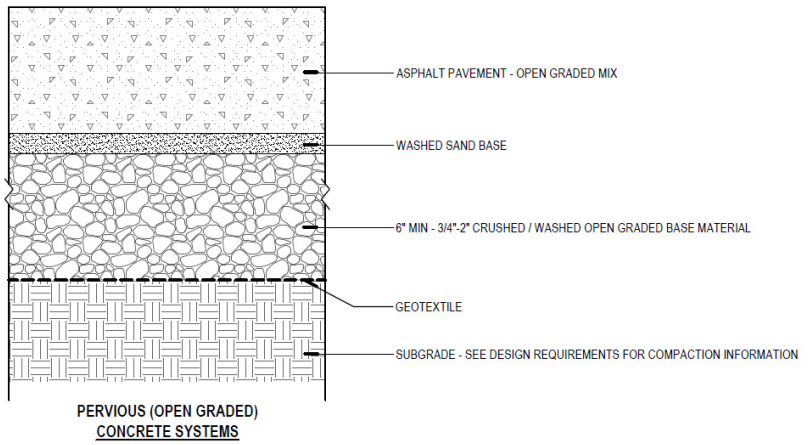
Good choice where:

- On local roads, there is minimal space to build out vegetated stormwater facilities and a parking lane exists.
- There is not a below grade impervious layer in place such as an old layer of asphalt or a concrete sub-base that would inhibit infiltration.
- There is a desire to reduce impervious paving.

Design Guidelines:

- Interlocking pavers should not be used in bike lanes
- Selection must consider traffic loading and volume restrictions
- Use of permeable paving systems does not mean that un-infiltrated stormwater leaving the paving system is considered "treated". Additional requirements may apply.
- Periodic clean out of the surface is required
- It must be ensured that no sediment builds up on the pavement. Sources of sediment, such as adjacent landscaping, should be controlled as much as possible.
- Additional sub-drainage and outfall may be required.





Images above Courtesy of Clackamas Water Environment Services

Portland, OR

Portland, OR

GREENWORKS.

Green Streets Applications based on Corvallis TSP Roadway Classification:

TSP Classification: Arterial Highway (99W)

- Main travel route, highest volume of motor vehicle traffic

Toolkit Options :

Street side vegetated swale
- May be positioned between sidewalk and back of curb as vegetated buffer with street trees & native vegetation
- May be positioned outside the - sidewalk as ROW or easements allow for
- Minimum width: 11'-6"
- Option for a 5-lane roadway that is already maximizing the ROW width: Remove turning lane and center driving lanes in the ROW to free up space for street side swale. This option is only feasible in areas where the middle turning lane is not needed.

Median stormwater planter with street trees & native vegetation
- Minimum width: 7'
- This option is only feasible in areas where the middle turning lane is not needed.
- At least one half of roadway must slope towards center of ROW. This may require re-grading.

Curbside stormwater planter
- Minimum width: 36" internal width without tree. 48" internal width with tree
- Positioned between sidewalk and back of curb in the "planter strip".

Section Example:

5 Lane roadway with central median stormwater planter. Planter strip planted with street trees. In locations where road crown does not support a median stormwater planter, planter strips may be replaced with curbside stormwater planters

TSP Classification: Arterial (Western Boulevard)

- Connect parts of the city and serve traffic traveling to and from the arterial highway
- Provide greater accessibility to neighborhoods, connect activity generators, and provide efficient through-movement for local traffic

Toolkit Options:

Street side vegetated swale sidewalk buffer with street trees & native vegetation
- Minimum width: 11'-6"
- May be used as buffer between roadway & sidewalk due to large planter strip

Median stormwater planter with street trees & native vegetation
- Minimum width: 7'
- This option is only feasible in areas where the middle turning lane is not needed.
- At least one half of roadway must slope towards center of ROW. This may require re-grading.

Curbside stormwater planter
- Positioned between curb and sidewalk
- Minimum width: 36" internal width without tree. 48" internal width with tree

Curb extension
- Curb bulb at intersection may be installed in parking strip to enhance cross walks and provide stormwater planter.
- Width: Minimum width - 48" from face of curb up to the width of a parking stall

Section Example:

3 Lane roadway with central median swale (or stormwater planter) and street trees. Street side vegetated swale and street trees provided in expanded planter strip.

TSP Classification: Collector (Crystal Lake Drive)

- Connect neighborhoods to arterials.
- Major neighborhood routes

Toolkit Options:

Vegetated swale sidewalk buffer with street trees & native vegetation
- Minimum width: 11'-6"
- May be used as buffer between roadway & sidewalk where planter strip width allows

Curbside stormwater planter
- Minimum width: 36" internal width without tree. 48" internal width with tree

Stormwater tree facility
- Minimum width: 5'

Permeable paver or pervious concrete/asphalt parking lane (where parking is provided)
- Minimum width: 10'

Curb extension
- Width: Minimum width - 48" from face of curb up to the width of a parking stall

Section Example:

2 Lane roadway with curbside stormwater planters and street trees.

TSP Classification: Neighborhood Collector (Park Avenue, Goodnight Avenue)

- Provide more direct access to residences, only serve limited through travel
- Lined with residences and designed to serve lower volumes of traffic

Toolkit Options:

Vegetated swale sidewalk buffer with street trees & native vegetation where planter strip width allows.
- Minimum width: 11'-6"
- May be used as buffer between roadway & bike path or sidewalk

Curbside stormwater planter
- Minimum width: 36" internal width without tree. 48" internal width with tree

Stormwater tree facility
- Minimum width: 5'

Permeable paver or pervious concrete/asphalt parking lane (where parking is provided)
- Minimum width: 10'

Curb extension
- Width: Minimum width - 48" from face of curb up to the width of a parking stall

Section Example:

2 Lane roadway with curbside stormwater planters and street trees.

TSP Classification: Local Street

- More direct access to residences without serving through travel in Corvallis.
- Lined with residence and designed to serve lower volumes of traffic

Toolkit Options:

Vegetated swale sidewalk buffer with street trees & native vegetation where planter strip width allows
- Minimum width: 12'
- May be used as buffer between roadway & bike path or sidewalk

Curbside stormwater planter
- Minimum width: 36" internal width without tree. 48" internal width with tree

Stormwater tree facility
- Minimum width: 5'

Permeable paver or pervious concrete/asphalt parking lane (where parking is provided)
- Minimum width: 10'

Curb extension
- Width: Minimum width - 48" from face of curb up to the width of a parking stall

Section Example:

2 Lane roadway with curb extension and pervious paving in parking stalls..