STATE OF OREGON **INTEROFFICE MEMO**

Department of Transportation
Transportation Development Division
Mill Creek Office Park
555 13th Street NE Suite 2
Salem, Oregon 97301-4178
(503) 986-3501

Date: August 18, 2020

TO: **Tom Guevara, Exit 27 IMSA Project Manager**

FROM: **Dejan Dudich, P.E., Transportation Analyst**
Tricia Tanner, EIT, Transportation Analyst
Kristie Gladhill, P.E., Senior Transportation Analyst
Transportation Planning Analysis Unit

Cc: **Brian Dunn, TPAU Manager**
Peter Schuytema, TPAU Senior Transportation Analyst
Jeremiah Griffin, ODOT District 8
Aaron Brooks, Interim Region 3 Traffic Manager
Will Fitzgerald, Region 3 Traffic Operations Engineer
Micah Horowitz, Region 3 Planning
Michael Wang, Region 3 Engineering
Jenna Marmon, Region 3 Active Transportation Liaison
Jennifer Boardman, Region 3 Transit Coordinator
Paige West, RVTD
Ryan McLaren, RVMPO
Karl MacNair, City of Medford
Carla Palladino, City of Medford
Matt Brinkley, City of Medford

SUBJECT: **Technical Memo #2, Appendix A: Existing Operations Analysis**
Exit 27 IMSA, South Medford

ODOT Region 3, in collaboration with the City of Medford, is analyzing traffic operations to identify Solutions within the Interstate 5 ("I-5") Exit 27 (South Medford) Interchange Management Study Area (IMSA) supported by Alternative Mobility Targets for the South Medford Interchange. During the morning peak in 2019 conditions, back-ups on the southbound off-ramp can extend onto the freeway mainline. The left turn traffic off the southbound off-ramp preferentially uses the right lane, as drivers try to stage themselves to make a right turn onto Barnett. Two major attractors/generators to the northeast of the study area are St. Mary's School, and the Asante Medical Center, along with other medical offices. In the afternoon peak, there is high volume making a westbound left from Barnett to go south on Highland Drive / Garfield Street and through the Single Point Urban Interchange (SPUI) interchange at Exit 27. The Oregon Department of Transportation (ODOT) *Analysis Procedures Manual* (APM) guided the methodologies and assumptions for this analysis.

Background Information

Project Area

The IMSA is focused on the study area of I5 Exit 27 extending to the OR99 / Garfield Street intersection to the southwest, the Barnett Road / Ellendale Drive intersection to the northeast, and the Barnett Road / E. Stewart Avenue intersection to the northwest. Figure A-1 below shows the study area extent, an area of commercial development.

The Exit 27 SPUI was built based on a 2007 IAMP, and built in 2009, with expected lifetime of more than 20 years

Center Drive, to the south of the freeway, connects Stewart Avenue to Garfield Street, with major traffic generators of shopping, places to eat, banking, hotels, and other services. A Walmart Supercenter that was not foreseen in the IAMP future land use planning was added midway along Center Drive in 2012. The development south of Garfield on Center was also not anticipated in the original interchange project for the SPUI; this was supposed to remain undeveloped and just had a pump station access.

Figure A-2 below shows the spread of roadway functional class within the study area. The legend shows both the functional classification for state owned roadways and non-state owned roadways. Within the study area I-5, Garfield Street from OR 99 to Barnett Road, OR 99 from Stewart Avenue to the south, and the section of Barnett Road west of Alba Drive to Stewart Avenue fall under the state jurisdiction of the State. All other roadways fall under the jurisdiction of the City of Medford.

Urban Interstate:	I-5
Urban Principal Arterials:	Garfield Street from Highland Drive to OR 99
	OR 99 in the study area
Urban Minor arterials:	Stewart Avenue
	Barnett Road
	Center Drive
	Garfield Street west of OR 99
Urban Collectors:	Highland Drive north of Barnett Road
	Ellendale Drive south of Barnett Road
Local roads:	Alba Drive
	Ellendale Drive north of Barnett
	Center Drive south of Garfield

Motorized vehicles dominate the transportation modes in the study area. The sidewalks and crossings are in good condition, and bike lanes are included on many of the study area roadways. Transit service is limited in the study area; for Route 24 is only one-way along the routes, see Figure A-3 for routes.

Figure A-1: Project Study Area

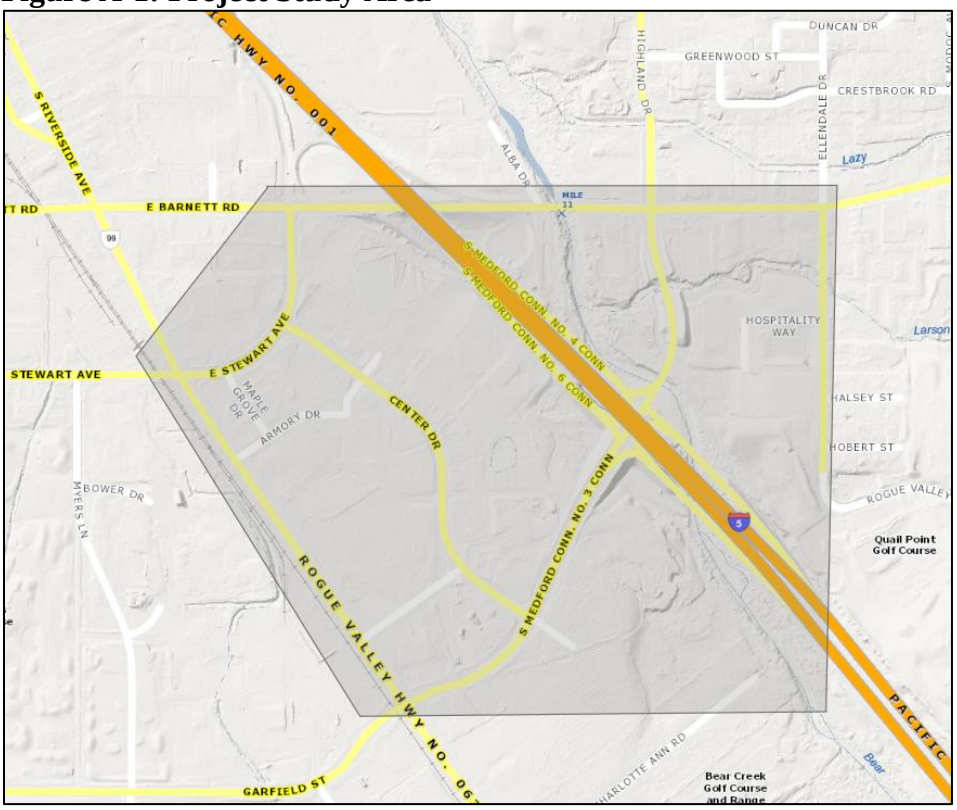


Figure A-2: Roadway Functional Classification

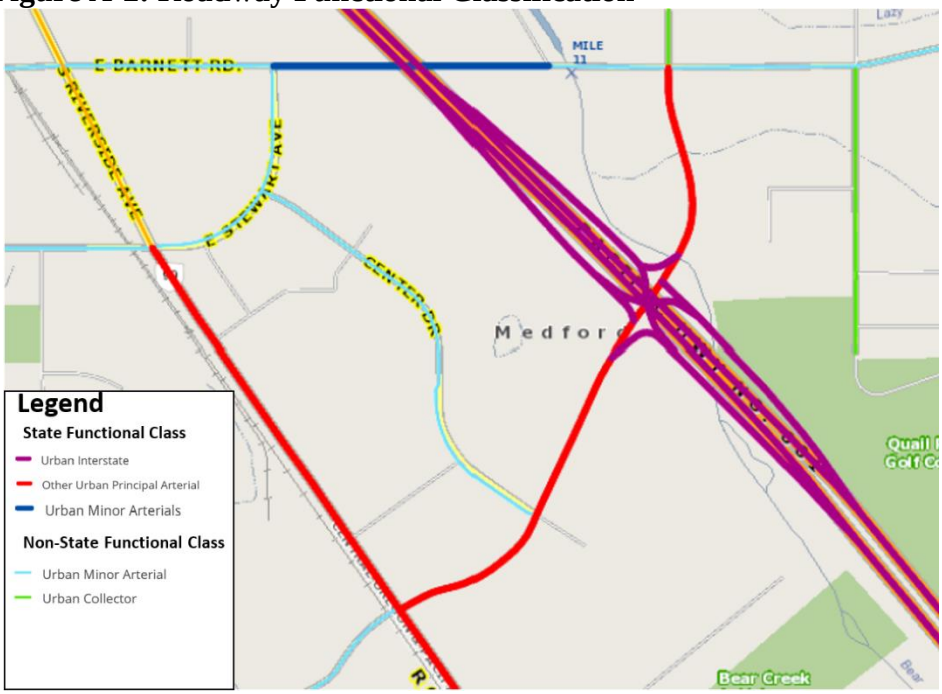
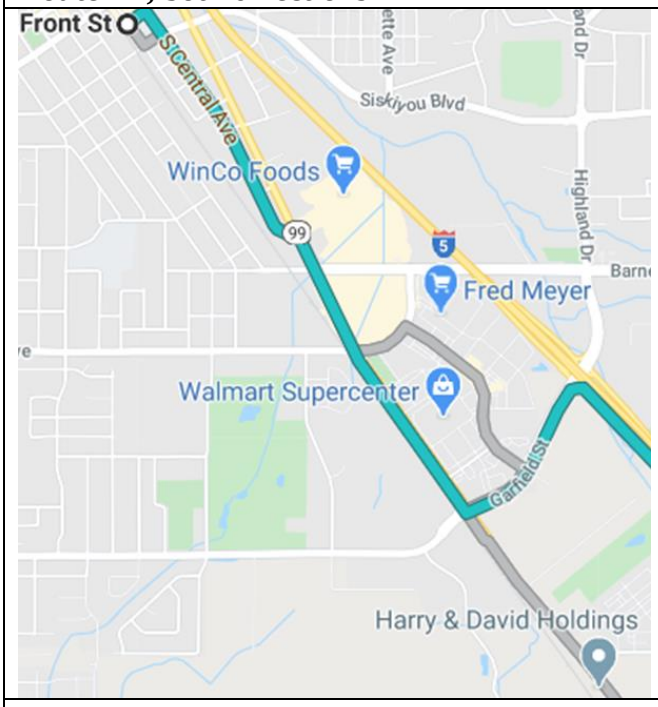
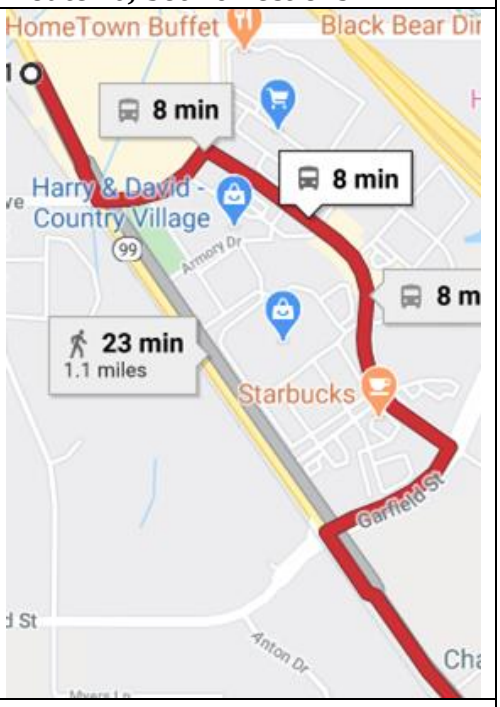


Figure A-3: RVTD (Rogue Valley Transit District) Transit Routes in Study Area

Route 1X, both directions

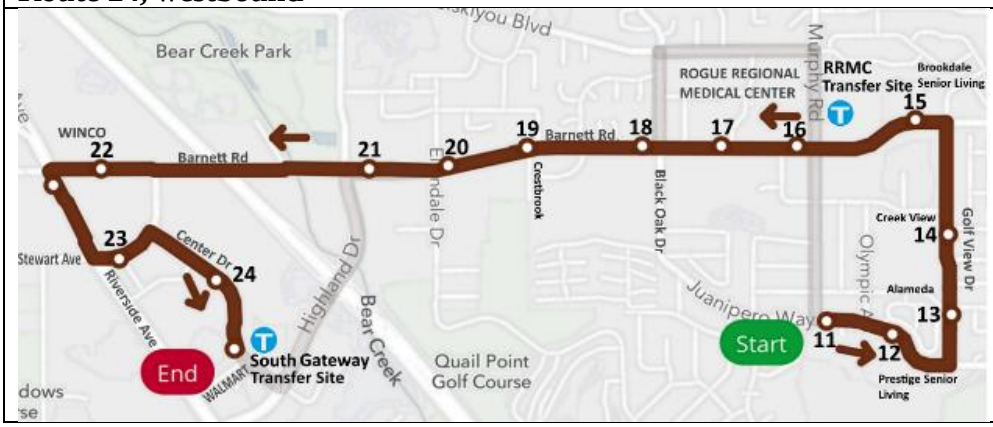


Route 10, both directions



Route 24, eastbound

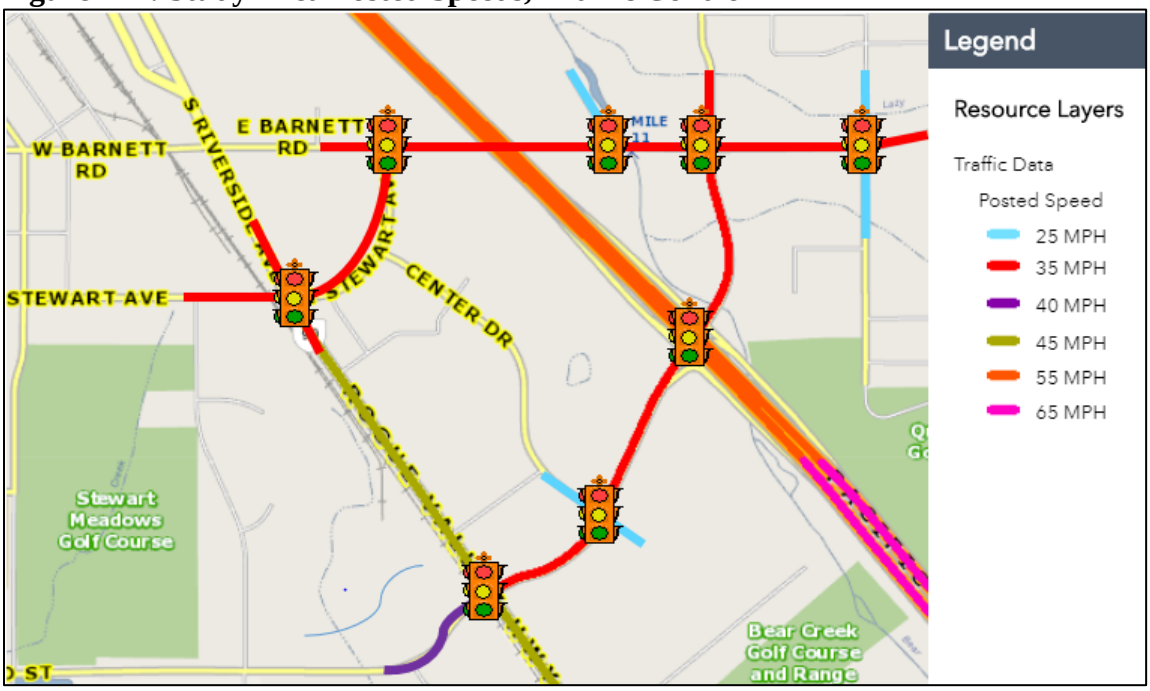
Route 24, westbound



Inventory Data

Inventory data can be found in Appendix C, including lane configurations, speeds, roadway characteristics, and observed vehicle queues. Figure A-4 shows the posted speed limits and traffic control at the study intersections.

Figure A-4: Study Area Posted Speeds, Traffic Control



Performance Measures

The study area falls within the Rogue Valley MPO (RVMPO) boundaries and the state jurisdiction operational standards used will be guided by Table 6 of the Amended 2011 Oregon Highway Plan (OHP) and Table 10-2 of the HDM (Highway Design Manual). The volume-to-capacity (V/C) ratio is used as a standard measure of intersection operations. The OHP and HDM provide different targets that are used for different purposes. The OHP mobility targets assist in the planning phase and help determine future system deficiencies so are used for current conditions as well as future no-build scenario. The HDM V/C's are used to develop a future year design life option that addresses stated future deficiencies, so are used to compare alternatives. Each roadway classification will be compared to its appropriate standard from the OHP and HDM. Table A-1 shows the OHP and HDM V/C Ratio Targets and LOS Standards.

Table A-1: State V/C Ratio Targets

	V/C Targets	
Roadway	**OHP** Current conditions, Future No-Build	**HDM** Alternatives
Interstate highway, including Ramp Terminals	0.85	0.75
District/Local Interest Roads Garfield St at I-5 ramps Garfield St at Center Dr OR 99 at Garfield St	0.95	0.85

The City of Medford Municipal Code sections 10.461 and 10.462 specify LOS targets as shown in Table A-2.

Table A-2: City and County LOS and V/C Ratio Standards

Roadway	**LOS**
City of Medford Barnett Rd at Ellendale Dr Barnett Rd at Stewart Ave Barnett Rd at Alba Dr	D
Barnett Rd at Highland Dr OR 99 at E Stewart Ave	E

Note: These criteria will be compared to analysis results with PHF (Peak Hour Factor) set to 1.0.

2019 Volume Development

Traffic counts were taken in 2019, see locations and count data information in Table A-3. The traffic counts were reviewed to determine individual and system-wide peak hours for the operational analyses. The AM system-wide peak hour was found to be 7:30 – 8:30 am; PM peak hour was 16:30 – 17:30 (4:30 – 5:30 pm).

Counts were adjusted to the 30th highest hour conditions (30HV) for both AM and PM peak hour volumes using seasonal factors. The processes used for developing the seasonal factors were detailed in the Methodology Memorandum, see TM#2 Appendix I.

Raw counts, seasonally adjusted AM and PM peak hour volumes, peak hour factors, K factors, truck percentages, pedestrian volumes, and bicycle turn movements can be found in Appendix B.

Table A-3: Traffic Count Summary

Study Intersection	Count Date	Count Duration	Seasonal Adjustment Factor
Barnett Rd at E. Stewart Ave	9/25/2019	16 hour	1.06
Barnett Rd at Alba Dr	12/3/2019	16 hour	1.14
Barnett Rd at Highland Dr	9/25/2019	16 hour	1.06
Barnett Rd at Ellendale Dr	9/25/2019	16 hour	1.06
Garfield St at I-5 Exit 27 Northbound Ramp Terminal	9/25/2019	16 hour	1.05
Garfield St at I-5 Exit 27 Southbound Ramp Terminal	9/25/2019	16 hour	1.05
Garfield St at Center Dr	9/25/2019	16 hour	1.06
Garfield St at OR 99	9/25/2019	16 hour	1.06
Riverside Ave / OR 99 at E. Stewart Ave	12/3/2019	16 hour	1.14

Volume balances were started at the I-5 Exit 27 interchange, and balanced working outward from there in both directions through the network. Balances were rounded to the nearest five (5) vehicles. Note that since counts were not taken for the Stewart Avenue/Center Drive intersection, the network was not balanced between Stewart Avenue, at OR99 and Stewart Avenue at Barnett Road. Balanced volumes can be found in Appendix E.

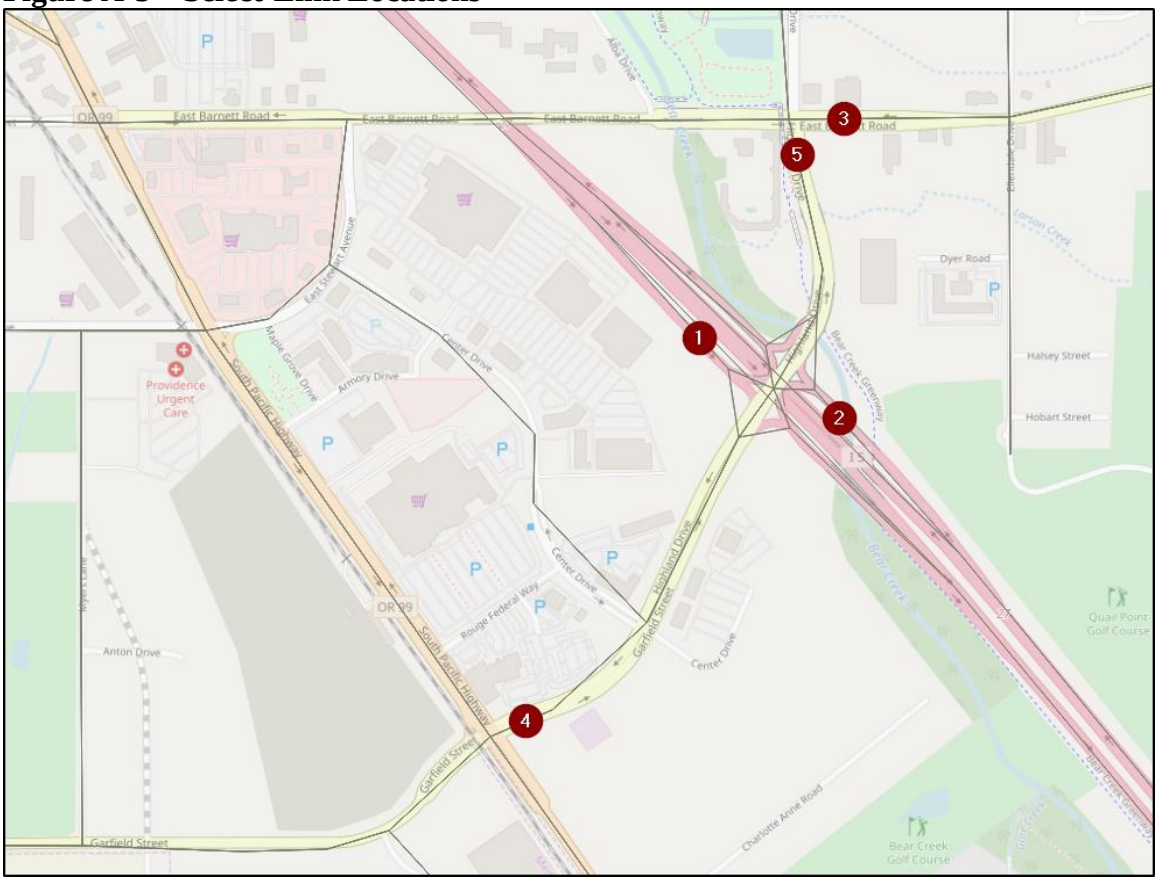
2017 Select Link Analysis

Purpose

Select-link analysis was requested for both AM and PM peak hours in the study area of the I-5 Exit 27 interchange (Figure A-1) to determine the traffic patterns and trip types (short-distance versus regional/through) in the study area.. The selected links for this analysis are listed below and shown on a map in Figure A-5.

1. Southbound I-5 off-ramp
2. Northbound I-5 off-ramp
3. East leg of Barnett Road/Highland Drive intersection, both directions
4. South leg of Barnett Road/Highland Drive intersection, both directions
5. Northeast leg of Garfield Street/OR99 intersection, both directions

Figure A-5 – Select-Link Locations



Methodology

TPAU used the current Rogue Valley MPO (RVMPO, version 4.3) JEMnR (Joint Estimated Model in R) model to determine the routing of the traffic around the project area. The current RVMPO v. 4.3 model is calibrated for the PM peak hour; AM peak hour factors were developed to provide an AM peak hour scenario. Select-link analysis was completed on both the AM and PM peak scenarios for the locations shown above in Figure A-5. Appendix F has details of the select link work and select link figures.

Results

Exit 27 Southbound off-ramp

As seen in Table A-4, nearly half the Exit 27 southbound off-ramp traffic volume is getting on I-5 at Exit 30 to the north (46% AM peak, 57% PM peak), about evenly split coming from west and east of the freeway. The Exit 27 southbound off-ramp traffic volume is then splitting between going south on Garfield Street (AM peak 53%; PM peak 59%) and northbound on Garfield Street (AM peak 46%; PM peak 41%).

Of the traffic going southbound, 18% turns north on Center Drive towards shopping areas (Walmart, Fred Meyer, Harry and David's), motels, and restaurants; ~27% makes the left turn to go south on OR 99.

The Exit 27 southbound off-ramp traffic that goes north on Garfield Street predominantly is going to turn right to go east on Barnett Road (AM peak 40%, PM peak 37%).

Table A-4 – Traffic Percentages to and from Exit 27 Southbound off Ramp

Exit 27 Southbound Off Ramp	Percent Traffic		Appendix F Figure(s)
	AM Peak Hour	PM Peak Hour	
From			
Exit 30 SB on ramps	46%	57%	Figure F-2 Figure F-3
To			
South on Garfield St	53%	59%	Figure F-4 Figure F-5
North on Center Dr	18%	18%	
South on OR 99	26%	27%	
North on Garfield St	46%	41%	
East on Barnett Rd	40%	37%	
North on Highland Dr	5%	1%	
West on Barnett Rd	4%	<1%	

Exit 27 Northbound off-ramp

A shown in Table A-5, the Exit 27 northbound off-ramp has traffic volume coming from on ramps at Exit 24, about evenly split from west and east of the freeway; Exit 21 , and Exit 19, mostly from west of the freeway at both these exits. The remaining traffic volume (AM peak 39%, PM peak 49%) is coming from farther south.

The Exit 27 northbound off-ramp traffic volume splits between going south on Garfield Street (AM peak 26%; PM peak 34%) and north on Garfield Street (AM peak 73%; PM peak 66%).

Table A-5 – Traffic Percentages to and from Exit 27 Northbound off Ramp

Exit 27 NB Off Ramp	Percent Traffic			Appendix F Figure(s)
	AM Peak Hour	PM Peak Hour		
From				
Exit 24 on ramp	15%	19%		Figure F-6 Figure F-7
Exit 21 on ramp	21%	12%	Most from west of I-5	Figure F-8 Figure F-9
Exit 19 on ramp	25%	20%	Most from west of I-5	Figure F-10 Figure F-11
farther south	39%	49%		
To				
South on Garfield St	26%	34%		Figure F-12 Figure F-13
North on Center Dr	9%	9%		
South on OR 99	4%	2%		
West on Garfield St	4%	6%		
North on OR 99	10%	17%		
North on Garfield St	73%	66%		
North on OR 99 from Barnett Rd	25%	15%		
North on Highland Dr	21%	29%		
East on Barnett Rd	12%	10%		

Barnett Road at Garfield Street

Table A-6 shows where traffic volumes going through EB Barnett Road, east of the Highland Drive intersection are coming from and going to. Traffic is coming primarily from eastbound Barnett Road and from the Exit 27 southbound off-ramp. Traffic volumes from this link are primarily going north into the Asante Medical Center and continuing east on Barnett Road.

Table A-6 – Traffic Percentages to and from EB Barnett Rd, east of Highland Drive

Eastbound Barnett Rd, East of Highland Drive	Percent Traffic		Appendix F Figure(s)
	AM Peak Hour	PM Peak Hour	
From			
EB Barnett Rd	31%	47%	Figure F-14 Figure F-15
Exit 27 SB off-ramp	35%	26%	
WB Garfield St east of OR 99	10%	8%	
Exit 27 NB off-ramp	11%	7%	
To			
South on Hilldale Ave	14%	14%	Figure F-14 Figure F-15
South on Black Oak Dr	14%	12%	
North into Asante Medical Center	30%	17%	
continuing east	38%	47%	

Garfield Street at OR 99

Table A-7 shows where volumes going EB through the northeast leg of the Garfield Street intersection with OR 99 are coming from and going to. The largest percentage of traffic volume is coming from northbound OR 99, then from Garfield Street east of OR 99 and from southbound OR 99. Traffic volume is slitting between going to the Exit 27 northbound on ramp, continuing north on Garfield Street, or onto the Exit 27 southbound on ramp.

Table A-7 – Traffic Percentages to and from EB Garfield Street at OR 99

EB Garfield Street at OR 99	Percent Traffic		Appendix F Figure(s)
	AM Peak Hour	PM Peak Hour	
From			
NB on OR 99	43%	43%	Figure F-22 Figure F-23
EB Garfield St east of OR 99	34%	25%	
SB on OR 99	24%	32%	
To			
Exit 27 NB on ramp	29%	28%	Figure F-22 Figure F- 23
North on Garfield St	34%	32%	
Exit 27 SB on ramp	32%	34%	

Summary

About half of the Exit 27 off-ramp traffic volume comes from short freeway trips of six miles or less: Southbound from the interchange to the north (Exit 30, three miles away), and northbound from the three interchanges to the south (Exit 24, Exit 21, and Exit 19).

For the Exit 27 Southbound off-ramp, nearly half the Exit 27 off-ramp traffic volume gets onto I-5 at Exit 30, with a fairly even split coming from west and east of I-5. Traffic volume off the Exit 27 southbound off-ramp has a higher percentage of the traffic going northbound in the AM peak (46%) than in the PM peak (41%); and nearly 40% of the traffic volume is headed to eastbound Barnett Road (AM peak 40%, PM peak 37%). Of the traffic volume from the Exit 27 southbound off-ramp, 18% goes north on Center Drive, to major shopping, food, and lodging attractors. More than a quarter of the Exit 27 southbound off-ramp traffic volume heads south on OR 99 W.

The Exit 27 northbound off-ramp gets roughly 50-60% of its traffic volume from the three previous on ramps, with some time of day differences at these ramps. Traffic volumes from the Exit 27 northbound off-ramp go primarily to the north (AM peak 73%, PM peak 66%), splitting between westbound, northbound, and eastbound directions from there.

2019 Operational Analysis Results

Traffic Analysis

Existing traffic operations (LOS and v/c) were analyzed using HCM 6th edition based tools (Synchro and SimTraffic version 10) for all study intersections. Intersection signal timing was provided by the City of Medford for intersections on Barnett Road and OR 99 at Stewart Avenue; ODOT Region 3 provided signal timing for the Garfield Street at Exit 27 interchange, Garfield Street at Center Drive, and Garfield Street at OR 99. SimTraffic calibration was done separately for AM peak and PM peak, then balanced volumes were used for operational analysis. Details of operational analysis can be found in Appendix G.

Operational analysis results are summarized in Tables A-8, A-9, and A-10. Facility types include 3SG (three-legged signalized intersection), 4SG (four-legged signalized intersection), and SPUI. Table A-8 has the calculated LOS for each of the study area intersections and shows the LOS standard for the City of Medford intersections. For signalized intersections that fall under the jurisdiction of the City of Medford, LOS is calculated with a peak hour factor of 1 to match their standards. The three intersections under the jurisdiction of ODOT have the Oregon Highway Plan V/C standard and LOS shown.

The existing conditions analysis shows that the study area intersections meet their respective standards during both AM and PM peak hours with the exception of the Garfield Street and I-5 Exit 27 interchange during the AM peak, where the V/C is 0.89, higher than the 0.85 standard. The interchange AM peak hour V/C not meeting OHP standards is likely

caused by the back-up from northbound right turn (NBR) at Highland Drive and Barnett Road backing all the way to the interchanges. The southbound off-ramp EBL movement vehicles preferentially use the rightmost of the two LT lanes, to stage themselves to turn right at Barnett Road. This back-up also impacts the northbound off-ramp right turn, as their progression can be blocked. It should be also noted that while the intersection of Highland Drive and Barnett Road meets the City of Medford LOS standard, it's the calculated V/C is above 1 and its LOS is equal to the standard, which indicates the potential for future operational challenges as volumes increase.

Table A-8: 2019 Existing Conditions Study Intersections Operational Analysis

Intersection	Facility Type	LOS Std	LOS		OHP V/C Std	V/C		Critical Movement	
			AM	PM		AM	PM	AM	PM
Barnett Rd at E. Stewart Ave	3SG	D	B[1]	C[1]	N/A	0.53	0.74	WBL	WBL
Barnett Rd at Alba Dr	3SG	D	A[1]	A[1]	N/A	0.29	0.42	EBT	WBT
Barnett Rd at Highland Dr	4SG	E	E[1]	E[1]	N/A	1.13	1.18	NBR	WBL
Barnett Rd at Ellendale Dr	4SG	D	C[1]	C[1]	N/A	0.79	0.70	EBT	WBT
Garfield St / I-5 Exit 27 Interchange	SPUI	N/A	D	C	0.85	**0.89**	0.81	EBL	SBR
Garfield St / Center Dr	4SG	N/A	B	C	0.95	0.56	0.72	EBL	WBT
Garfield St / OR 99	4SG	N/A	C	C	0.95	0.67	0.75	EBT	NWT
Riverside Ave / OR 99 at Stewart Ave	4SG	E	D[1]	D[1]	N/A	0.65	0.92	EBT	SET

[1] LOS for comparison to the Medford standard is computed with PHF set = 1 for all movements throughout the network.

Tables A-9 and A-10 summarize intersection queue lengths and blockage. Figure A-6 shows the AM peak queue lengths and upstream blockage; Figure A-7 shows the PM peak queue lengths and upstream blockage. The 95th percentile queue is the length of queue that has only a 5% probability of being exceeded. Queue length observations from the site visit are provided in Appendix C, Inventory.

Barnett Road at Stewart Avenue has storage bay blockages in the PM for WBL 5% of the time and northbound left (NBL) 13% of the time, but these do not seriously affect operations.

At the intersection of Barnett Road and Highland Drive both AM and PM peak hours experience higher than average queues in opposite directions. During the AM peak the northbound approach blocks storage 59% of the time, and backs up into the Interchange roughly 58% of the time. This is mostly caused by the high northbound volume turning right. During the PM peak westbound traffic making a left turn to head south to the interchange has storage bay blockage 17% of the time. The southbound has storage bay blockage 44% of the time, and queues spill back to Greenwood Street 83% of the time.

Further to the East of the study area the intersection of Ellendale Drive and Barnett Road has EB, WB, and northbound storage bay blockages in both AM and PM peaks. During the PM peak, the westbound queue can extend back to Crestbrook Road. This heavy westbound volume is likely caused by students and faculty from St. Mary's school and by employees of the medical center going home after their work day.

At the SPUI interchange queue, spill back and upstream blockage can be seen on three of the approaches. During the AM peak the EBL turn has a high traffic volume, preferentially using the rightmost lane to turning into the rightmost northbound lane to be staged for a right turn at Barnett Road to the north; there is storage bay blockage from this 17% of the time. The back-up in that northbound right lane can cause the WBR from the northbound off-ramp to not be able to progress through the yield, with storage bay blockage 88% of the time that blocks access to the WBL from the off-ramp and can spill onto the northbound mainline 56% of the time. Additionally the northbound through (NBT) is affected, with storage bay blockage 70% of the time in AM peak and upstream blockage of Center Drive to the south 11% of the time.

Garfield Street at Center Drive has EB and WB storage bay blockage in both AM and PM peak. PM peak also sees storage bay blockage for the northbound movements and southbound left, likely due to increased traffic to the shopping and eating options along Center Drive.

OR 99 at Stewart Avenue has storage bay blockage for the SET 43% of the time in the PM peak.

Table A-9: 2019 Existing Conditions 95th Percentile Queue Length

Intersection	Approach	95th percentile Queue[1] (ft)		Upstream Blockage (AM or PM,% time, intersection blocked)[2]
		AM	PM	
Barnett Rd at Stewart Ave	EB	125	200	
	WB	175	300	
	NB	125	225	
Barnett Rd at Alba Dr	EB	100	125	
	WB	125	175	
	SB	50	50	
Barnett Rd at Highland Dr	EB	300	300	
	WB	375	850	
	NB	**1750**	350	AM, 58%, SPUI
	SB	325	**975**	PM, 83%, Greenwood St
Barnett Rd at Ellendale Dr	EB	500	425	
	WB	375	**1400**	PM, 19%, Crestbrook Rd
	NB	150	200	
	SB	100	75	
Garfield St / I-5 Exit 27 SPUI	EB	1325	850	AM, 6%, SB I-5
	WB	**1850**	250	AM, 56%, NB I-5
	NB	**1550**	350	AM, 11%, Center Dr
	SB	325	325	
Garfield St / Center Dr	EB	900	400	AM, 4%, OR 99
	WB	825	975	
	NB	25	100	
	SB	200	800	PM 5%, Rogue Credit Union Ln
Garfield St / OR 99	EB	550	250	AM, 7%, Anton Dr
	WB	250	400	
	SEB	175	275	
	NWB	500	375	
OR 99 at Stewart Ave	EB	250	250	
	WB	125	250	
	SEB	175	675	
	NWB	200	250	

Blackened box indicates 95th percentile queue > link length
[1] 95 percentile queue rounded up to nearest 25'
[2] Blockage >5% of the time

Table A-10: 2019 Existing Conditions Storage Bay Blockage[1]

Intersection	Approach	Average Percent Time Blocked[1]	
		AM	PM
Barnett Rd at E. Stewart Ave	WBL		5
	NBL		13
Barnett Rd at Highland Dr	WBL		17
	NBR	59	
	SBT		44
Barnett Rd at Ellendale Dr	EBT	29	24
	WBT	26	48
	NBL	7	14
Garfield St / I-5 Exit 27 SPUI	EBL outer lane	17	
	EB		22
	WB	88	
	NBL	5	
	NBT	70	7
	SBT	11	5
Garfield St / Center Dr [NB/SB]	EBT	23	11
	WBT	18	24
	NBL		8
	NBTR		9
	SBL		30
Garfield St / OR 99	EBTR	15	
	NWT		18
	NWR	7	
Riverside Ave / OR 99 at Stewart Ave	SET		43

[1] 5% or greater

Figure A-6: AM Peak Queue Lengths and Upstream Blockage Locations

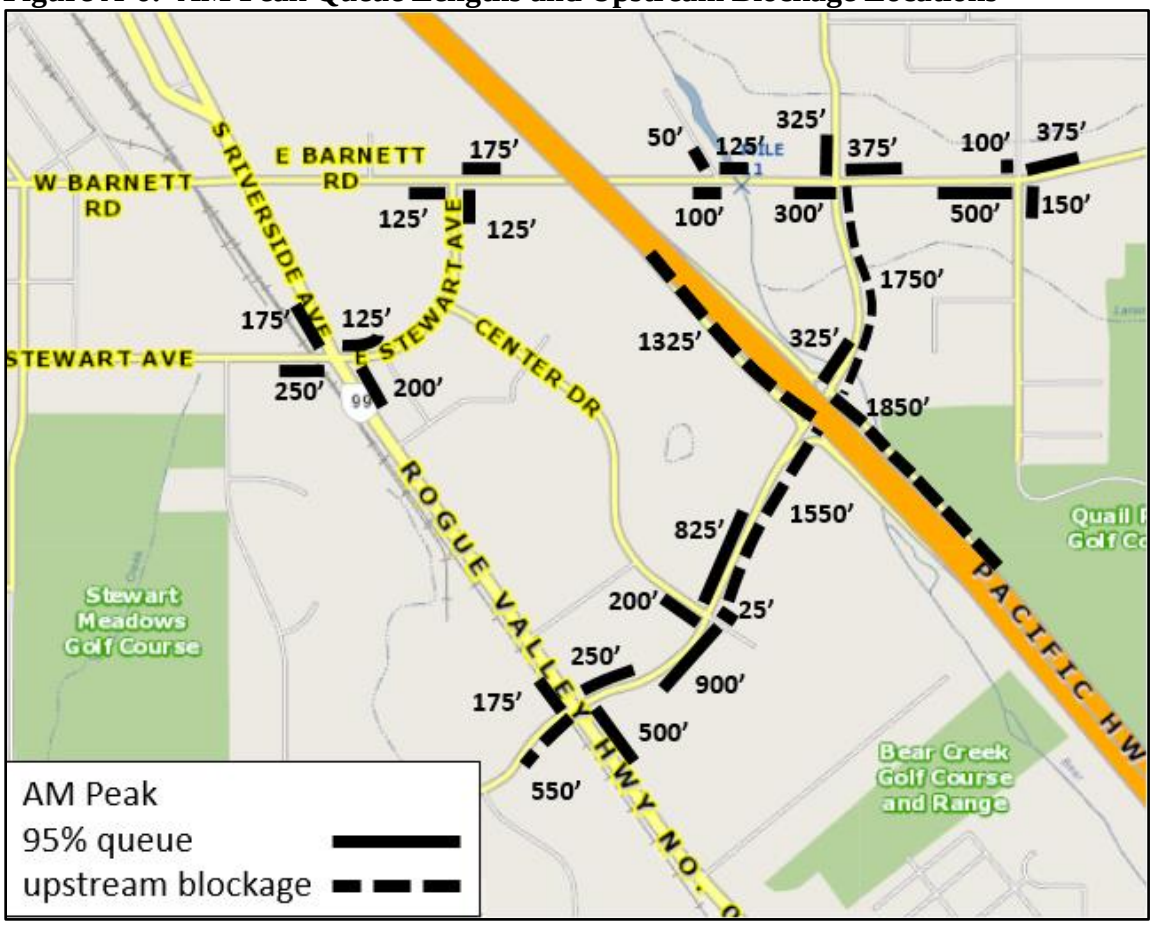


Figure A-7: PM Peak Queue Lengths and Upstream Blockage Locations

Tables A-11 and A-12 display the results of the AM and PM peak freeway operational analysis that was done using HCS7 software. The State standard for V/C on I-5 through the study area is 0.85. The standard is only exceeded during the AM peak analysis in two locations along the Southbound stretch of I-5: the southbound off-ramp diverge and the southbound mainline upstream of the interchange are both above the standard 0.85 V/C. Both of these locations have higher volumes than the other similar locations at and around the interchange. The higher volumes and V/C are likely caused by the backup of traffic from the southbound off-ramps EBL at the intersection of I-5 and Garfield Street onto the southbound mainline. This analysis result is also further supported by observed trends of traffic backing onto the Mainline during AM periods.

Table A-11: 2019 Existing Conditions AM Peak I-5 Freeway Operational Analysis

Freeway Facility	Volume	Critical Movement	V/C Std	V/C
NB off-ramp, diverge	640	v_F, v_{12}	0.85	0.61
SB off-ramp, diverge	1385	v_{12}	0.85	0.88
NB on ramp, merge	890	v_F	0.85	0.66
SB on ramp, merge	565	v_F	0.85	0.64
NB mainline, downstream of interchange	2460	N/A	0.85	0.68
NB mainline, past/through interchange	1570	N/A	0.85	0.43
NB mainline, upstream of interchange	2210	N/A	0.85	0.61
SB mainline, downstream of interchange	2355	N/A	0.85	0.65
SB mainline, past/through interchange	1790	N/A	0.85	0.49
SB mainline, upstream of interchange	3175	N/A	0.85	0.88

v_F = freeway flow rate upstream of off-ramp, downstream of on ramp
v_{12} = freeway flow rate in (right most) lanes 1, 2 upstream of off-ramp; downstream of on ramp
v_R = ramp flow rate

Table A-12: 2019 Existing Conditions PM Peak I-5 Freeway Operational Analysis

Freeway Facility	Volume	Critical Movement	V/C Std	V/C
NB off-ramp, diverge	735	v_F	0.85	0.65
SB off-ramp, diverge	1080	v_{12}	0.85	0.71
NB on ramp, merge	1430	v_F	0.85	0.80
SB on ramp, merge	815	v_F	0.85	0.62
NB mainline, downstream of interchange	3190	N/A	0.85	0.83
NB mainline, past/through interchange	1760	N/A	0.85	0.46
NB mainline, upstream of interchange	2515	N/A	0.85	0.65
SB mainline, downstream of interchange	2450	N/A	0.85	0.63
SB mainline, past/through interchange	1635	N/A	0.85	0.42
SB mainline, upstream of interchange	2715	N/A	0.85	0.70

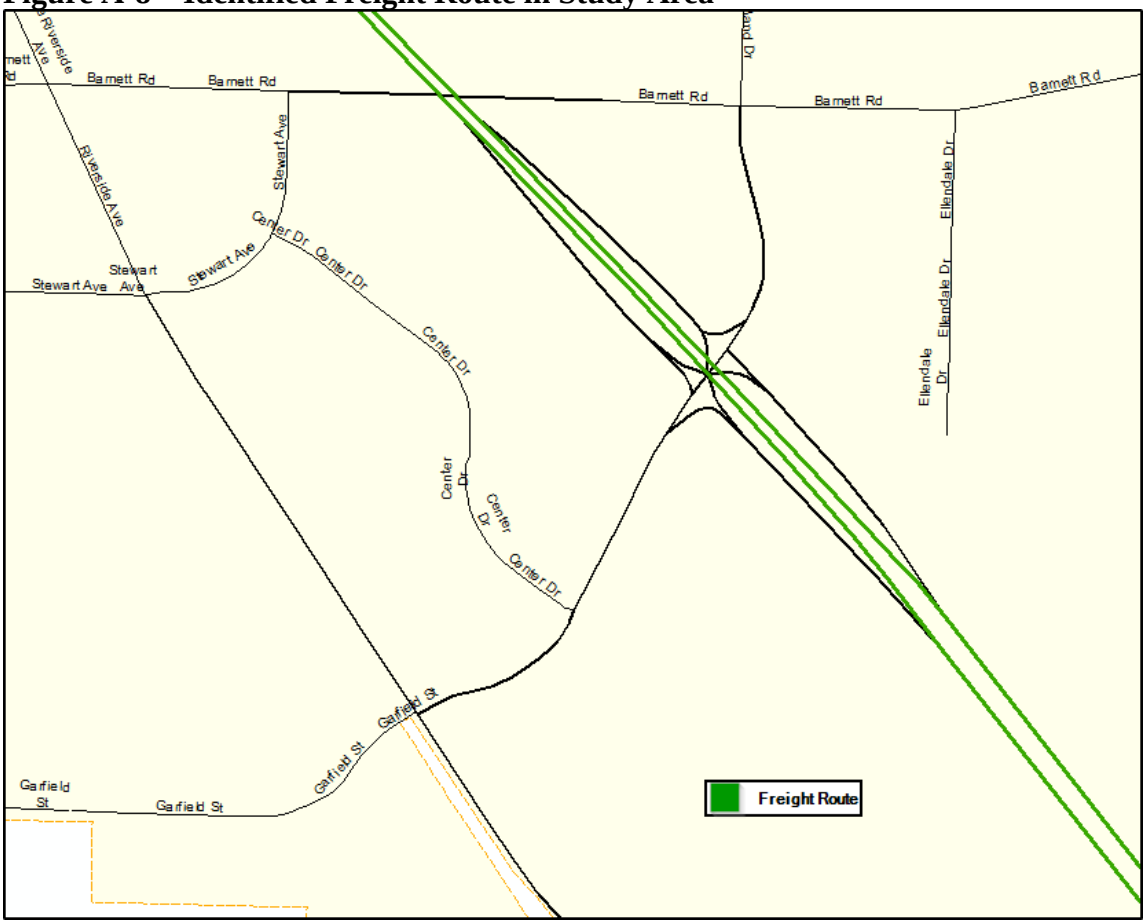
v_F = freeway flow rate upstream of off-ramp, downstream of on ramp
v_{12} = freeway flow rate in (right most) lanes 1, 2 upstream of off-ramp; downstream of on ramp
v_R = ramp flow rate

Freight

In the project area, I-5 (Pacific Highway No. 1) is a designated freight route as shown in Figure A-8. Travel time reliability is especially critical to freight, so congestion issues affecting the study area are of concern to freight as well. Truck percentages (see Appendix B, Figures B-9 and Figure B-10) are highest in the study area at the intersection of Garfield Street at Center Drive and at the interchange.

The SPUI design at the interchange has geometry that accommodates large truck turning radius easily.

Figure A-8 – Identified Freight Route in Study Area



Existing Conditions Crash Analysis

The purpose of the crash analysis is evaluate the existing safety conditions for the study area. The crash analysis is based off the 2013 – 2017 crashes in the study area, from the crash database maintained by ODOT's Crash Analysis and Reporting Unit. All study area crashes used for the crash analysis are shown in Appendix D.

Crash Types

The crashes in the project area are typical for this type of urban facility with arterial intersections: 44% of the crashes were intersection or intersection related. Rear-end and sideswipe overtaking made up 65% of the crashes, typical collision types as vehicles approach intersections or congestion. Turning crashes also were prevalent: 29% of the intersection crashes; 18% of the segment crashes. Most crashes (34%) occurred in the 3 pm – 6 pm PM peak; only 8% of crashes were in the 6 am – 9 am AM peak period.

Safety Improvement Opportunity Areas

Safety improvement opportunity areas are any location that:

- exceeds the 90th percentile crash rate
- exceeds a 2017 Crash Rate Table II rate
- is a Top 5% or 10% SPIS site
- was found to have an excess amount of expected crashes
- was identified in the Oregon Roadway Departure Plan
- was identified in the Oregon Intersection Safety Implementation Plan

Existing conditions safety improvement opportunity areas are listed in Table A-13.

Table A-13: Existing Conditions Safety Improvement Opportunity Areas

Safety Improvement Opportunity Areas	Critical Crash Rate	Top 10% SPIS Site	2012 Intersection Plan Report
Barnett Rd at Stewart Ave			●[1]
Barnett Rd at Highland Ave		●	
I-5 SB off-ramp (WX, WY[2])		●	
I-5 NB mainline (Rd 2) between ramps	●		
I-5 SB mainline (Rd 1) north of SB off-ramp	●		
I-5 SB mainline (Rd 1) between ramps	●		
Riverside Ave (OR 99), Stewart Ave north to Barnett Rd	●	●	
Stewart west of OR 99 to Myers Ln	●		
Garfield St, Center Dr to SPUI (WU[2])		●	
Garfield St, SPUI to Barnett Rd (WU[2])		●	
Barnett Rd west of Stewart Ave to OR 99	●		
Barnett Rd east of Ellendale Dr to Hilldale Ave	●	●	

[1] The 2012 Intersection report was based on 2005-2010 crash data. The Exit 27 SPUI interchange was under construction and in use by 2009. Prior to that construction, the southbound off-ramp intersected with Barnett Road at Stewart Avenue; so the intersection flagged in the 2012 Intersection Plan report was a different facility (4SG ramp terminal) than the current 3SG, lower traffic volume intersection.

[2] WX, WY, and WU are connector identifiers.

More detail by safety issue area can be found in Table A-14 for intersections, Table A-15 for freeway/freeway ramps, and Table A-16 for segments.

Table A-14: Intersection Safety Improvement Opportunity Areas 2013 – 2017 Crash Types, Severity, and Trends

Location Description		Facility Type	Reason(s) Identified as Safety Improvement Opportunity Area
Barnett Rd/Stewart Ave		**3SG**	**Intersection Plan Report**
Crash Summary	This intersection had 13 crashes from 2013 – 2017, showing a steady decrease in crashes each year; 38% of the crashes (5 crashes) occurred in 2013; 46% were PDO (property damage only); 54% injury B or C (minor injury). There were no fatal crashes or serious injury crashes. Turn crashes were 38% of the crashes, 38% were rear ending crashes. More than half (54%) of the crashes happened between 3 pm – 6 pm, the PM peak hours.		
Crash Patterns	• Turning crashes, not yielding right away • Rear end crashes from following too closely		
Barnett Rd/Highland Ave		**4SG**	**Top SPIS Site**
Crash Summary	This intersection had 46 crashes from 2013 – 2017; no fatal or serious injury crashes Rear end movement were 59% of the crashes and 33% were turning movement. More than a third (35%) of these occurred between 3 pm – 6 pm, the PM peak hours. Friday and Saturday crashes made up 46% of the crashes. Most crashes happened during the day, with dry pavement conditions		
Crash Patterns	• Turning crashes, not yielding right away • Rear end crashes from following too closely		

Table A-15: Freeway/Freeway Ramp Safety Improvement Opportunity Areas
2013 – 2017 Crash Types, Severity, and Trends

Location Description		**Facility Type**	**Reason(s) Identified as Safety Improvement Opportunity Area**
SB off-ramp		**Segment**	**Top SPIS Site**
Crash Summary	There were 5 crashes on the SB off-ramp from 2013 – 2017; 2 in 2015 and 3 in 2017; 3 were during the AM peak hours (6 am – 9 am) and the other 2 were during the PM peak hours (3 pm – 6 pm). Rear end crashes approaching the ramp terminal were 80% (4) of the crashes; the other crash was distracted driver, lane departure near the beginning of the ramp, striking a fixed object. The one serious injury crash: • Tuesday 1/20/2015 5pm, during a clear, dry, dark with street lights, a 85 year old female was following too closely and rear ended the stopped vehicle in front of her at MP 27.90, causing a three vehicle crash.		
Crash Patterns	• Rear end crashes		
NB MN (Rd2) between the ramps		**Segment**	**Critical Crash Rate**
Crash Summary	There were 17 crashes on the NB I-5 mainline between the ramps from 2013 – 2017; 2 in 2013, 1 in 2014, 4 in 2015, 5 in 2016, and 5 in 2017. There were no fatal or serious injury crashes. Rear end movement crashes were 76%, most on dry pavement. There were 4 crashes during the early morning between 12 – 3 am; two were rear end crashes that involved speed and alcohol.		
Crash Patterns	• Rear end crashes • Speed and alcohol		
SB MN (Rd1)north of SB off-ramp		**Segment**	**Critical Crash Rate**
Crash Summary	There were 21 crashes on SB I-5 north of the SB off-ramp from 2013 – 2017. Four of these were speed involved crashes; three distracted. Rear end movement crashes were 86% of the crashes, 62% on dry pavement. A third (33%) occurred 6 am – 9 am (AM peak) and 29% in the PM peak hours (3 pm – 6 pm); 38% on Wednesdays. Crashes were located approaching the Exit 27 off-ramp. There was 1 serious injury crash: • Friday 8/18/2017 at 3pm, during clear, dry, daylight, a motorcycle was driving recklessly and over the posted speed rear ended a vehicle and was ejected from the motorcycle.		
Crash Patterns	• Rear end crashes • Following too closely		
SB MN (Rd1) between the ramps		**Segment**	**Critical Crash Rate**
Crash Summary	There were 9 crashes SB I-5 between the ramps. There were no fatal or serious injury crashes. Rear end movement crashes were 67% of the crashes; 33% (3 crashes) occurred from 6 – 9am and involved speeding; 22% occurred during darkness.		
Crash Patterns	• Rear end crashes • Speeding		

Table A-16: Segment Safety Improvement Opportunity Areas
2013 – 2017 Crash Types, Severity, and Trends

Location Description		**Facility Type**	**Reason(s) Identified as Safety Improvement Opportunity Area**
Riverside Ave from Stewart Ave north to Barnett Rd		**Segment**	**Critical Crash Rate, Top SPIS site**
Crash Summary	There were 31 crashes on this segment from 2013 – 2017; 8 in 2013, 3 in 2014, 3 in 2015, 6 in 2016, and 11 in 2017. Rear end movement crashes were 55% of the crashes and 42% were turning movement crashes. Regarding time of day, 42% occurred from 12 – 3pm, 35% from 3 pm – 6 pm. Most were dry conditions during daylight hours. There were no fatal crashes and two serious injury crashes: • Monday 10/14/2013 7pm during clear, dry, darkness with streetlights; a NB vehicle was driving on the wrong side of the road, caused a five vehicle crash. • Saturday 2/18/2017 4pm during clear dry daylight hours, a NB vehicle performed improper lane change causing the crash.		
Crash Patterns	• Turning crashes, not yielding right away • Rear end crashes from following too closely		
Stewart Ave, west of OR99 to Myers Ln		**Segment**	**Critical Crash Rate**
Crash Summary	There were 8 crashes on this segment from 2013 – 2017; no fatal or serious injury crashes. Rear end crashes were 63% (5) of the total. Most occurred from 3 – 6 pm during daylight. Two were head-on crashes: 8/14/16 at 9 am on a Sunday; 1/9/2017 7 am on a Monday, icy conditions, EB car driving recklessly, failed to maintain lane and drove on wrong side, struck on-coming car.		
Crash Patterns	• Rear end crashes from following too closely		
Garfield St, Center Dr to SPUI (WU)		**Segment**	**Top SPIS Site**
Crash Summary	There were 6 crashes on this segment from 2013 – 2017; no fatal or serious injury crashes. All 6 crashes were rear end movement crashes, on dry pavement during daylight hours.		
Crash Patterns	• Rear end crashes from following too closely		
Garfield St, SPUI to Barnett Rd(WU)		**Segment**	**Top SPIS Site**
Crash Summary	There were 10 crashes on this segment from 2013 – 2017; no fatal or serious injury crashes. All 10 crashes were rear end movement crashes; 80% occurred noon – 6 pm; most on dry pavement during daylight conditions.		
Crash Patterns	• Rear end crashes from following too closely		

Table A-16, continued

Location Description	Facility Type	Reason(s) Identified as Safety Improvement Opportunity Area
Barnett Rd west of Stewart Ave to OR99	**Segment**	**Critical Crash Rate**
Crash Summary	There were 42 crashes on this segment from 2013 – 2017. 48% were rear end movement and 43% were turning movement crashes. Most crashes occurred in the afternoon (16 from noon – 3pm; 16 from 3 pm – 6 pm). WB vehicles were 74% (31/42) of the crashes, heading towards the Barnett Road intersection with Riverside Avenue (OR 99). Most crashes were during daylight hours with dry pavement conditions. There was one injury A crash: • Sunday 1/22/2017 10pm clear, dry, dark with street lights, vehicle failed to avoid the stopped vehicle in front of them; serious injury was the driver of the stopped vehicle..		
Crash Patterns	• Rear end crashes from following too closely • Turning crashes, not yielding right away		
Barnett Rd east of Ellendale Dr to Hilldale Ave	**Segment**	**Critical Crash Rate**
Crash Summary	There were 33 crashes on the segment from 2013 – 2017; 2 in 2013, 3 in 2014, 8 in 2015, 10 in 2016, and 10 in 2017. Rear end movement crashes were 73% and 18% were turning movement crashes. More than two-thirds involved WB vehicles. . Most crashes occurred during the daylight hours during dry conditions. One crash was a serious injury crash: • Wednesday 1/7/2015 5pm during dusk on dry roads, a vehicle hit a pedestrian in the roadway whom they did not see.		
Crash Patterns	• Rear end crashes from following too closely • Turning crashes, not yielding right away		

Crash Rate

Intersection crash rates were compared to published 90th percentile crash rates in the APM; all of the intersection crash rates were less than the published rates, as shown in Table A-17. Tables A-18 through A-21 show the crash rates for the project segment areas

Table A-17: Intersection Crash Rate

Intersection	Facility Type	Crash Total (5 yrs)	Crash Rate	Published 90thPercentile Crash Rate[1]	Compared to 90th percentile crash rate
Three Legged Intersections					
Barnett Rd at Stewart Ave	3SG	13	0.25	0.51	Under
Barnett Rd at Alba Dr	3SG	6	0.13	0.51	Under
Four Legged Intersections					
Barnett Rd at Highland Dr	4SG	46	0.43	0.86	Under
Barnett Rd at Ellendale Dr	4SG	11	0.16	0.86	Under
Garfield St at Center Dr	4SG	37	0.44	0.86	Under
Riverside Ave/ OR 99 at Garfield St	4SG	34	0.38	0.86	Under
Riverside Ave/ OR 99 at Stewart Ave	4SG	32	0.42	0.86	Under

[1] Published in APM version 2, Exhibit 4-1

Table A-18: Interstate Ramp and Mainline Segment Critical Crash Rate

Segment	Five Year Crash Total	Segment Length (miles)	MVMT	Segment Crash Rate	Ref. Pop. Crash Rate	Compared to Critical Crash Rate [1,2]
I-5 SB off-ramp	5	0.36	10.01	0.50		
I-5 SB on ramp	6	0.36	5.87	1.02		
I-5 NB off-ramp	1	0.30	4.96	0.20		
I-5 NB on ramp	8	0.34	9.18	1.09		
I-5 NB south of NB off-ramp	2	1.04	53.58	0.04	0.26	Under
I-5 NB between ramps	17	0.65	22.75	0.75	0.26	Over
I-5 NB north of NB on ramp	10	1.01	62.61	0.16	0.26	Under
I-5 SB north of SB off-ramp	21	1.00	52.82	0.40	0.26	Over
I-5 SB between ramps	9	0.70	17.51	0.51	0.26	Over
I-5 SB south of SB off-ramp	5	1.00	41.32	0.12	0.26	Under

[1]Black shaded exceed critical crash rate.
[2]Grey shaded, no published nor critical crash rate to compare to.

Table A-19: Urban Principal Arterial Segments Critical Crash Rate

Urban Principal Arterial Segment	5 Year Crash Total	Segment Length (miles)	MVMT	Segment Crash Rate	Ref. Pop. Crash Rate	Compared to Critical Crash Rate [1]
12 Riverside Ave (OR 99), Stewart Ave to Barnett Rd	31	0.21	9.19	3.37	0.87	Over
14 Riverside Ave (OR 99), Stewart Ave to Garfield St	8	0.43	19.23	0.42	0.87	Under
15 Riverside Ave (OR 99), Garfield St to Charlotte Ann Rd	8	0.25	13.35	0.60	0.87	Under
18 Garfield St, OR 99 to Center Dr (connector WU)	6	0.19	10.40	0.58	0.87	Under
19 Garfield St, Center Dr to SPUI (connector WU)	10	0.26	18.36	0.54	0.87	Under
20 Garfield St, SPUI to Barnett Rd (connector WU)	14	0.27	18.29	0.77	0.87	Under

[1]Black shaded exceed critical crash rate.

Table A-20: Urban Minor Arterial Segment Critical Crash Rate

Urban Minor Arterial Segment	5 Year Crash Total	Segment Length (miles)	MVMT	Segment Crash Rate	Ref. Pop. Crash Rate	Compared to Critical Crash Rate [1, 2]
13 Stewart Ave west of OR 99 to Myers Ln	8	0.11	4.34	1.84	1.77	Over
17 Garfield St, west of Riverside Ave to Anton Dr	3	0.14	3.60	0.83	1.77	Under
22 Barnett Rd west of Stewart Ave to OR 99	42	0.21	7.66	5.48	1.77	Over
23 Barnett Rd, Stewart Ave to Alba Dr (001BE)	9	0.30	7.47	1.21	1.77	Under
24 Barnett Rd, Alba Dr to Highland Dr	7	0.13	5.68	1.23	1.77	Under
27 Barnett Rd, Highland Dr to Ellendale Dr	22	0.21	14.05	1.57	1.77	Under
29 Barnett Rd east of Ellendale Dr to Hilldale Ave	33	0.21	12.80	2.58	1.77	Over
31 Center Dr north of Walmart entrance	9	0.30	11.57	0.78	1.77	Under
32 Center Dr south of Walmart entrance	7	0.18	6.94	1.01	1.77	Under
33 Stewart Ave, OR 99 to Center Dr	3	0.15	3.68	0.82	1.77	Under
34 Stewart Ave, Center Dr to Barnett Rd	0	0.12	3.04	0.00	1.77	Under

[1] Black shaded exceed critical crash rate.
[2] Segment lengths are comparable, so crash rate comparison is considered valid.

Table A-21: Urban Collector and Local Road Segments Critical Crash Rate

Urban Collector Segment	5 Year Crash Total	Segment Length (miles)	MVMT	Segment Crash Rate	Ref. Pop. Crash Rate	Compared to Critical Crash Rate [1,2]
25 Alba Dr north of Barnett Rd	2	0.12	0.35	5.65	3.06	Under
26 Highland Dr north of Barnett Rd to creek	8	0.10	3.38	2.37	3.06	Under
28 Ellendale Dr north of Barnett Rd to Crestbrook Rd	0	0.13	0.56	0.00	3.06	Under
30 Ellendale Dr south of Barnett Rd to Hospitality Way	1	0.13	1.16	0.86	3.06	Under

[1] Not enough of this facility type for critical crash rate, compared to Table II.
[2] Segment lengths are short, which may over inflate crash rate.

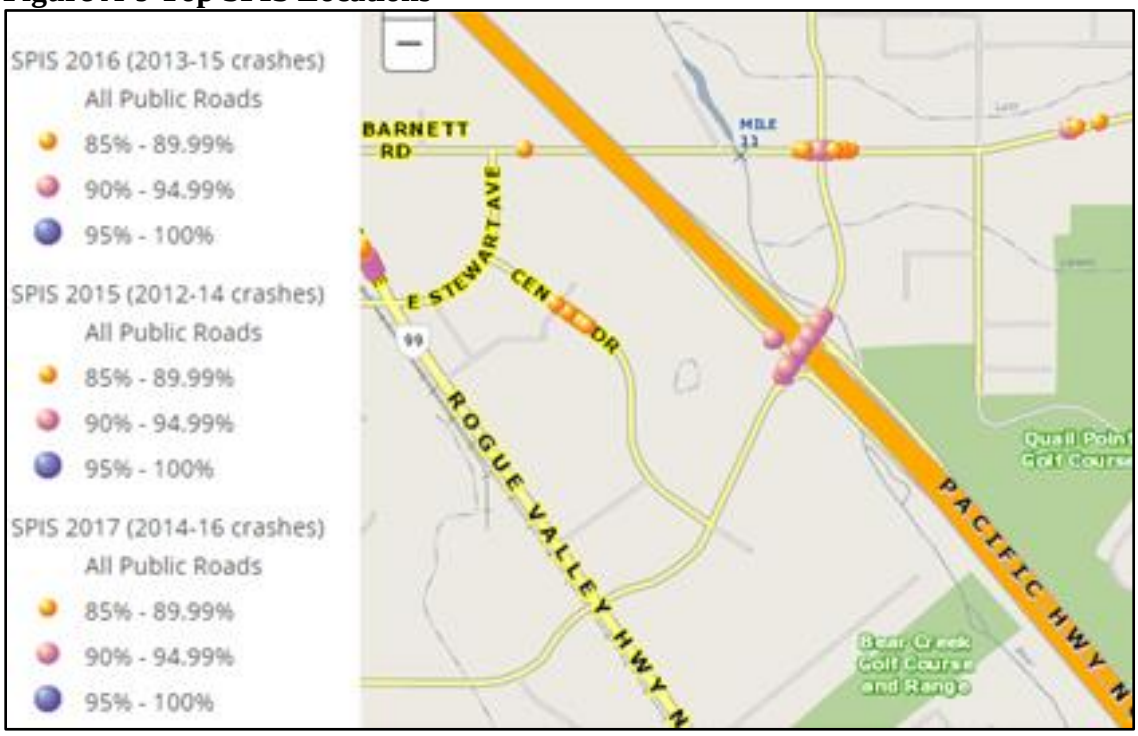
Top SPIS Sites

There was no top 5% and four (4) top 10% SPIS sites in the study area in the last five years (using the last three SPIS lists), see Table A-22 and Figure A-9.

Table A-22: Top SPIS Sites

Location	2015 SPIS (2012-2014 crashes)	2016 SPIS (2013-2015 crashes)	2017 SPIS (2014-2016 crashes)
Intersection of Barnett Rd at Highland Dr			Top 10%
SB I-5 Off Ramp		Top 10%	
I-5 Exit 27 Overcrossing	Top 10%		
OR 99 north of Stewart Ave	Top 10%		
Barnett Rd east of Ellendale Dr to Hilldale Ave			Top 10%

Figure A-9 Top SPIS Locations



Roadway Departure

The September 2017 "Oregon Roadway Departure Implementation Plan Update" based on 2009 – 2015 crash data identified sites with roadway departure crashes. There were no roadway departure sites identified

2012 Intersection Safety Implementation Plan

The 2012 "Oregon Intersection Safety Implementation" report evaluated intersections statewide, based on 2005-2010 crash data, resulting in an inventory of intersections that could be improved with low cost countermeasures to reduce crashes. This report identified the ramp terminal intersections in the study area for basic signing and marking improvements; enhanced signing treatments; and hot spot improvements including turn modifications, new or upgraded lighting, and high friction surface.

The 2012 Intersection report identified the intersection of Barnett at Stewart Avenue as needing improvement, based on 2005-2010 crash data. The Exit 27 SPUI interchange was under construction and in use in 2009. Prior to that construction, the southbound off-ramp intersected with Barnett Road at Stewart Avenue; so the intersection flagged in the 2012 Intersection Plan report was a different facility (4SG ramp terminal) than the current 3SG, lower traffic volume intersection.

Multimodal Analysis

Multimodal analysis was done in the study area utilizing tools based on HCM methodologies for pedestrians, bicycles, transit, and intersections. LOS is based on index point totals from the applicable elements, such as geometrics and speeds (by either adding or subtracting). Generally, the LOS criteria can be interpreted as:

- LOS A or B: Conditions should be generally acceptable for the users
- LOS C or D: Some issues exist that may make the users uncomfortable
- LOS E or F: Significant issues exist that will make the majority of the users feel uncomfortable. It is likely that this facility will deter users to some degree.

Multimodal Level of Service- Segments

The pedestrian, bicycle, and transit MMLOS segment analysis methodologies are simplified re-estimated versions from the original Highway Capacity Manual methods, and can be found in Sections 14.10 and 14.11 of the APM version 2. These have less variables than the full HCM methodology, but have retained or enhanced the overall accuracy by using probability-based ranges, which estimate the probability that a user will choose a given LOS (or a range) to represent their perception of the facility. The segment MMLOS inputs are speeds, volumes, lanes and provided pedestrian or bicycle facilities; it was calculated using the SimpMMLOS_Calc_v1.xlsx calculator tool provided by TPAU. Segment MMLOS analysis only includes the roadway segments between intersections.

Table A-23 has the Transit MMLOS results for the study area. Overall, transit service is only available on a limited set of segments in the study area. The Transit LOS, where service is available, was generally at LOS C or LOS D, with travel speed generally making the difference. Segments with only Route 1X service, which runs hourly, had LOS of E or F: OR 99 between Stewart and Garfield and Garfield WB from the SPUI to Center Drive.

Table A-23: Segment Transit MMLOS (only for segments that have Transit service)

Roadway	Dir	From-To	Transit LOS	
			AM	PM
Barnett Rd	WB	Stewart to OR 99	D	D
Stewart	NB	OR 99 to Center	C	C
Stewart	SB	Center to OR 99	C	C
Barnett Rd	WB	Alba to Stewart	D	D
Barnett Rd	WB	Highland to Alba	D	D
Barnett Rd	EB	Highland to Ellendale	C	C
Barnett Rd	WB	Ellendale to Highland	D	D
Barnett Rd	EB	Ellendale to Hilldale	C	C
Barnett Rd	WB	Hilldale to Ellendale	D	D
Highland	NB	SPUI to Barnett	C	C
Garfield	EB	Center to SPUI	B	C
Garfield	WB	SPUI to Center	E	F
Center	NB	Garfield to Rogue Credit Union Ln	C	C
Center	SB	Rogue Credit Union Ln. to Garfield	C	C
Garfield	EB	OR 99 to Center[2]	C	C
Garfield	WB	Center to OR 99[2]	C	C
OR 99	NB	Charlotte Ann to Garfield	D	D
OR 99	SB	Garfield to Charlotte Ann	D	D
OR 99	NB	Garfield to Stewart	F	F
OR 99	SB	Stewart to Garfield	E	E
OR 99	NB	Stewart to Barnett	C	C
OR 99	SB	Barnett to Stewart	C	C

1 Black-shaded cells indicate that the multimodal LOS D analysis threshold has been exceeded.
2 Route 1x stops at this location were added in December of 2019

To encourage transit ridership, RVTD (Rogue Valley Transportation District) provides the Rogue Regional Medical Center (RRMC) with support for their new Transportation Options program. This program began in 2018 and was required by the City of Medford. Asante now employs a part-time Employee Transportation Coordinator to assist employees with using transportation alternatives. RVTD also works with Medical Eye Center, Rogue Valley Manor and St. Mary's school on voluntary Transportation Options programs. RVTD coordinated and staffed the South Gateway Transportation Management Association from 2001-2005 with fledgling participation. The TMA was dissolved after voluntary attempts to gain participation in Transportation Demand Management strategies were not realized.

The sidewalks and crossings the study area are in good condition, and bike lanes are included on many of the study area roadways. A multi-use path along the Bear Creek parkway provides grade separated passage north-to-south for pedestrians and bicyclists, with connection to the network at Barnett Road and Highland Drive. These facilities is have a positive effect on level of service, but as shown in the following sections, other factors lower the level of service in the study area.

The segment pedestrian MMLOS, found in Table A-24, is generally at LOS C in the study area for both the AM and PM analysis time periods. However there is a clear pattern that segments switch between LOS C and LOS E due to traffic volumes. An example of this can be seen at the segment of Barnett Road between Highland Drive and Ellendale Drive: during the AM peak traffic is heavier in the EB directions as drivers head to work or to the school and the reverse is true during the PM peak as drivers leave those locations. At each of those times the corresponding direction has a LOS of E which indicates that it is uncomfortable for pedestrian users. Another example of this switching pattern is seen for the Garfield Street segment between the SPUI and Center Drive. This segment has a stable LOS E during the PM peak in both directions, due to the high vehicular traffic volumes during the PM peak as people either head home from work or go to the retail shops off Center. The LOS is C during the AM peak when vehicular traffic volumes are lower, likely because fewer drivers are going to shop or using this route to get to work.

The locations which scored the best pedestrian LOS were the segment of Alba Drive from Barnett Road to the roads end; Highland Drive between Barnett Road and Greenwood Street, and Center Drive both north and south of Garfield Street. These locations received a score of LOS B due to the low speed and low volume, along with wide sidewalks that help distance the pedestrians from the roadway. The worst section of the study area is along OR 99, segments from Charlotte Ann Road north to Stewart Avenue, scored as LOS E for both AM and PM peak time periods. OR 99 is a higher speed and high volume facility. Additionally it lacks a paved sidewalk on the west side which is likely due to the proximity of the railroad tracks parallel to the west OR 99.

The bicycle MMLOS, found in Table A-25, is generally split between ranges C-E and E-F. This indicates that bicyclists would find it uncomfortable to traverse more than half of the segments. OR 99 and Garfield Street are both high volume roadways with posted speeds of 35 – 45 mph on OR 99, 35 mph on Garfield traversing the SPUI I-5 interchange. Stewart Avenue and Barnett Road segments include a significant number of driveways, thus increased potential for conflicts with vehicles, which requires more caution from bicyclists. Bicycle LOS is the same for AM and PM peak, as there is no volume factor.
The worst segments for bicyclists were Stewart Avenue between Myers Lane and OR 99, Stewart Avenue between OR 99 and Center Drive, Barnett Road between Ellendale Drive and Hilldale Avenue, and OR 99 between Stewart Avenue and Garfield Street. These four segments are rated LOS F in both directions and share characteristics such as a high volume of traffic, generally higher speeds, and driveway conflicts. Additionally these segments do not provide bike lanes for bicyclists. The benefit of having bike lanes on the OR 99 segments south of Stewart Avenue is tempered by the higher speed (45 mph, the highest speed in the study area), high volumes, and the right in right out traffic for the various commercial buildings along the segment.

The segment with the best bicycle MMLOS (LOS B) was Center Drive between Garfield Street and Rogue Credit Union Lane, where there are bike lanes and no driveway conflicts.

Table A-24: Segment Pedestrian MMLOS

Roadway	Dir	From-To	Pedestrian LOS	
			AM	PM
Barnett Rd	EB	OR 99 to Stewart Ave	B-C	C
Barnett Rd	WB	Stewart Ave to OR 99	C	C
Stewart Ave	NB	OR 99 to Center Dr	C	B-C
Stewart Ave	SB	Center Dr to OR 99	B-C	C
Barnett Rd	EB	Stewart Ave to Alba Dr	C	C
Barnett Rd	WB	Alba Dr to Stewart Ave	C	C
Alba Dr	NB	Barnett Rd to Road's end	B	B
Alba Dr	SB	Road's end to Barnett Rd	B	B
Barnett Rd	EB	Alba Dr to Highland Dr	C	C
Barnett Rd	WB	Highland Dr to Alba Dr	C	C
Highland Dr	NB	Barnett Rd to Greenwood St	B	B
Highland Dr	SB	Greenwood St to Barnett Rd	C	C
Barnett Rd	EB	Highland Dr to Ellendale Dr	**E**	C
Barnett Rd	WB	Ellendale Dr to Highland Dr	C	**E**
Ellendale Dr	NB	Barnett Rd to Crestbrook Rd	B-C	B-C
Ellendale Dr	SB	Crestbrook Rd to Barnett Rd	B-C	B-C
Ellendale Dr	NB	Hospitality Way to Barnett Rd	B	B
Ellendale Dr	SB	Barnett Rd to Hospitality Way	B	B
Barnett Rd	EB	Ellendale Dr to Hilldale Ave	E	C
Barnett Rd	WB	Hilldale Ave to Ellendale Dr	C	C
Highland Dr	NB	SPUI to Barnett Rd	**E**	C
Highland Dr	SB	Barnett Rd to SPUI	C	**E**
Garfield St	EB	Center Dr to SPUI	C	**E**
Garfield St	WB	SPUI to Center Dr	C	**E**
Center Dr	NB	Garfield St to Rogue Credit Union Ln	C	C
Center Dr	SB	Rogue Credit Union Ln to Garfield St	B	B
Center Dr	NB	Parking to Garfield St	B	B
Center Dr	SB	Garfield St to Parking	B-C	B-C
Garfield St	EB	OR 99 to Center Dr	C	C
Garfield St	WB	Center Dr to OR 99	C	C
Garfield St	EB	Anton Dr to OR 99	E	C-E
Garfield St	WB	OR 99 to Anton Dr	C-E	E
OR 99	NB	Charlotte Ann Rd to Garfield St	E	E
OR 99	SB	Garfield St to Charlotte Ann Rd	E	E
OR 99	NB	Garfield St to Stewart Ave	E	E
OR 99	SB	Stewart Ave to Garfield St	E	E
OR 99	NB	Stewart Ave to Barnett Rd	C	C
OR 99	SB	Barnett Rd to Stewart Ave	B-C	C
Stewart Ave	NB	Center Dr to Barnett Rd	C	C
Stewart Ave	SB	Barnett Rd to Center Dr	B-C	C
Stewart Ave	EB	Myers Ln to OR 99	C	C
Stewart Ave	WB	OR 99 to Myers Ln	C	C

[1] Black-shaded cells indicate that the multimodal LOS D analysis threshold has been exceeded.

Table A-25: Segment Bicycle MMLOS

Roadway	Dir	From-To	Bicycle LOS
Barnett Rd	EB	OR 99 to Stewart Ave	**E-F**
Barnett Rd	WB	Stewart Ave to OR 99	**E-F**
Stewart Ave	NB	OR 99 to Center Dr	**F**
Stewart Ave	SB	Center Dr to OR 99	**F**
Barnett Rd	EB	Stewart Ave to Alba Dr	**C-E**
Barnett Rd	WB	Alba Dr to Stewart Ave	**C-E**
Alba Dr	NB	Barnett Rd to Road's end	C
Alba Dr	SB	Road's end to Barnett Rd	C
Barnett Rd	EB	Alba Dr to Highland Dr	**E-F**
Barnett Rd	WB	Highland Dr to Alba Dr	**E-F**
Highland Dr	NB	Barnett Rd to Greenwood St	C-D
Highland Dr	SB	Greenwood St to Barnett Rd	**E-F**
Barnett Rd	EB	Highland Dr to Ellendale Dr	**E-F**
Barnett Rd	WB	Ellendale Dr to Highland Dr	**E-F**
Ellendale Dr	NB	Barnett Rd to Crestbrook Rd	C
Ellendale Dr	SB	Crestbrook Rd to Barnett Rd	C
Ellendale Dr	NB	Hospitality Way to Barnett Rd	C
Ellendale Dr	SB	Barnett Rd to Hospitality Way	C
Barnett Rd	EB	Ellendale Dr to Hilldale Ave	**F**
Barnett Rd	WB	Hilldale Ave to Ellendale Dr	**F**
Highland Dr	NB	SPUI to Barnett Rd	**C-E**
Highland Dr	SB	Barnett Rd to SPUI	**C-E**
Garfield St	EB	Center Dr to SPUI	**C-E**
Garfield St	WB	SPUI to Center Dr	**C-E**
Center Dr	NB	Garfield St to Rogue Credit Union Ln	B
Center Dr	SB	Rogue Credit Union Ln to Garfield St	B
Center Dr	NB	Parking to Garfield St	C
Center Dr	SB	Garfield St to Parking	C
Garfield St	EB	OR 99 to Center Dr	**C-E**
Garfield St	WB	Center Dr to OR 99	**C-E**
Garfield St	EB	Anton Dr to OR 99	**C-E**
Garfield St	WB	OR 99 to Anton Dr	**C-E**
OR 99	NB	Charlotte Ann Rd to Garfield St	**E-F**
OR 99	SB	Garfield St to Charlotte Ann Rd	**C-E**
OR 99	NB	Garfield St to Stewart Ave	**E-F**
OR 99	SB	Stewart Ave to Garfield St	**E-F**
OR 99	NB	Stewart Ave to Barnett Rd	**F**
OR 99	SB	Barnett Rd to Stewart Ave	**F**
Stewart Ave	NB	Center Dr to Barnett Rd	**E-F**
Stewart Ave	SB	Barnett Rd to Center Dr	**E-F**
Stewart Ave	EB	Myers Ln to OR 99	**F**
Stewart Ave	WB	OR 99 to Myers Ln	**F**

[1] Black-shaded cells indicate that the multimodal LOS D analysis threshold has been exceeded.

Multimodal Level of Service- Intersections

Intersection MMLOS was calculated per APM version 2 section 14.16, using the PedBikeSigInt_MMLOS_Calc_v1.1.xlsx calculator tool. Signalized intersection MMLOS worksheets can be found in Appendix H. Results are summarized in Table A-25. The factors used for assessing intersection MMLOS are the same no matter the time of day (there is no volume component).

Table A-25: 2019 Existing Conditions Study Intersections MMLOS Analysis

Intersection	Facility Type	Pedestrian MMLOS	Bicycle MMLOS
Barnett Rd at E. Stewart Ave	3SG	C	D
Barnett Rd at Alba Dr	3SG	C	C
Barnett Rd at Highland Dr	4SG	**E**	C
Barnett Rd at Ellendale Dr	4SG	C	D
Garfield St at I-5 Exit 27	SPUI	D	D
Garfield St / Center Dr	4SG	D	D
Garfield St / OR 99	4SG	**F**	D
Riverside Ave / OR 99 at E. Stewart Ave	4SG	D	**E**

The majority of intersections in the study area do not exceed the analysis threshold of LOS D. The Pedestrian LOS scores of C or D are mainly caused by the delay that pedestrians are facing crossing at the intersection, as well as the potential for both left and right turn conflicts. Bicycle LOS was rated as C or D due to the crossing distance that bicyclists face and the right turn conflicts that are possible at the intersections. Additionally, intersections like Ellendale Drive and Barnett Road see a shift in bicycle facility type, going from bike lane to shared lane on Barnett Road, that impact bicycling comfort.

Three intersections had LOS worse than D: one for Bicycle MMLOS and two for Pedestrian MMLOS. At OR 99 and East Stewart Avenue the bicycle LOS was rated E due to the lack of bicycle infrastructure and the potential for conflicts with right turning vehicles on the north, west, and east legs. . Only the south leg of the intersection has bike Lanes; the remaining legs are neither signed nor marked for shared use. The intersection at Barnett Road and Highland Drive is rated LOS E for pedestrians due to the lack of pedestrian refuge islands and potential for right turn conflicts with cars and bicyclists. However, at Barnett Road at Highland Drive, there is a grade separated (elevated) multi-use path crossing of the west leg: the north side connects with Barnett 645’ to the west at Alba Drive, plus 110’ out of direction travel; the south approach is from 325’ south of the intersection. The intersection of Garfield Street and OR 99 similarly doesn’t have pedestrian refuge islands and has potential for conflicts with right turn vehicles and bicyclists. Additionally this intersection has a railroad crossing traversing the west leg, has no crosswalk on that same leg, and is missing further sidewalks on the west side of both the South and North legs.

Contact Information

If you have any questions please contact Dejan Dudich at 503-986-3515, email: dejan.dudich@odot.state.or.us.