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Date: March 31, 2021

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SUBJECT: Technical Memo #3, Appendix A: Future No Build 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; see the section on Multimodal Analysis for details of the transit routes.

Figure A-1: Project Study Area

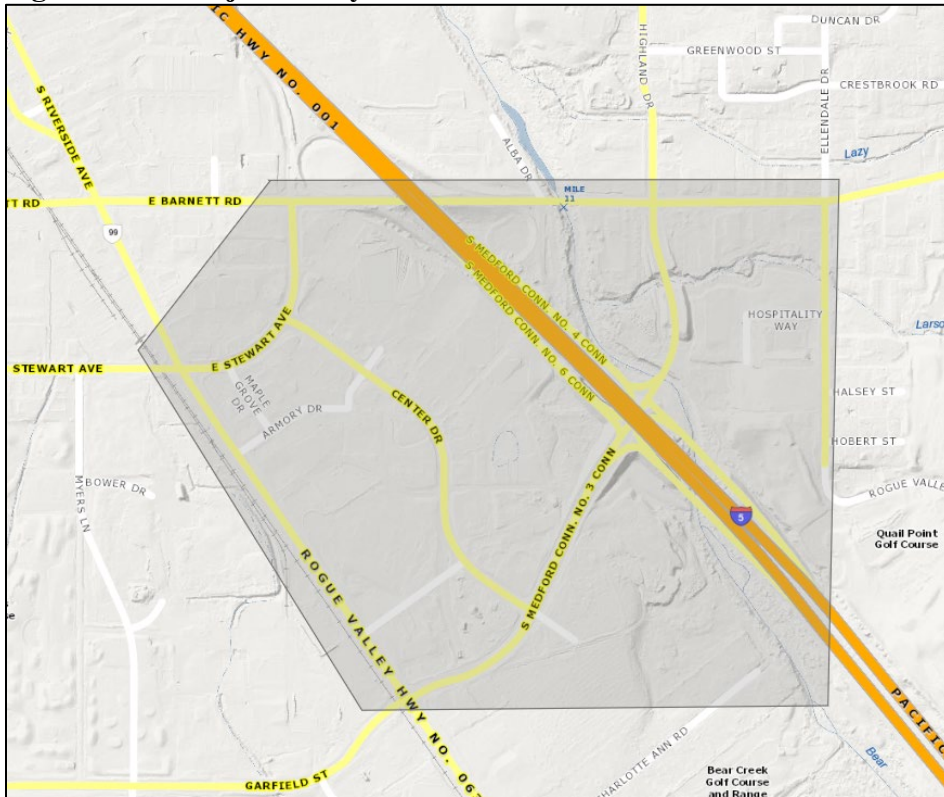


Figure A-2: Roadway Functional Classification

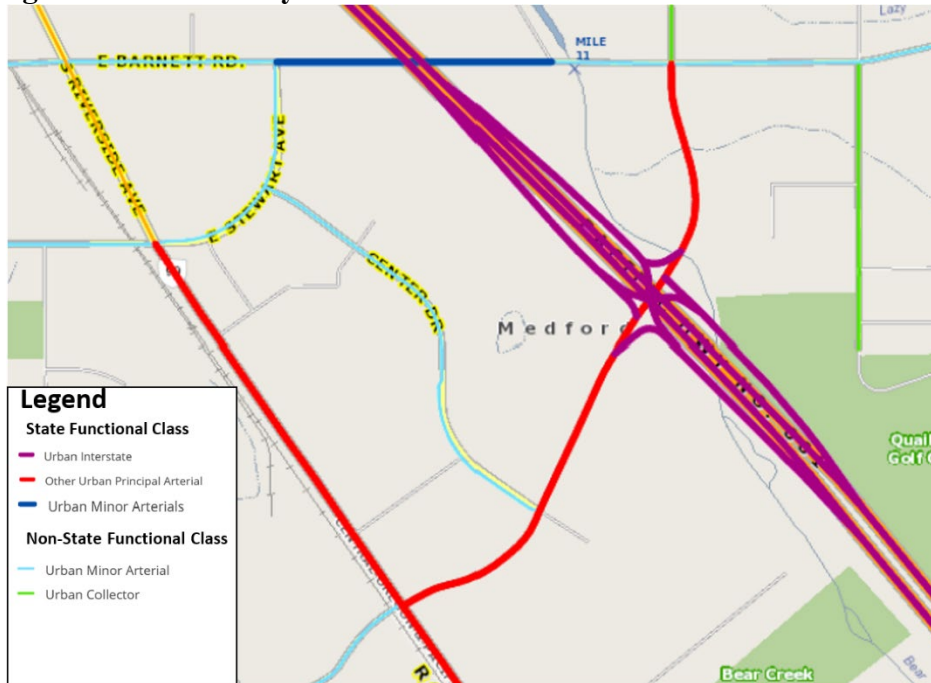
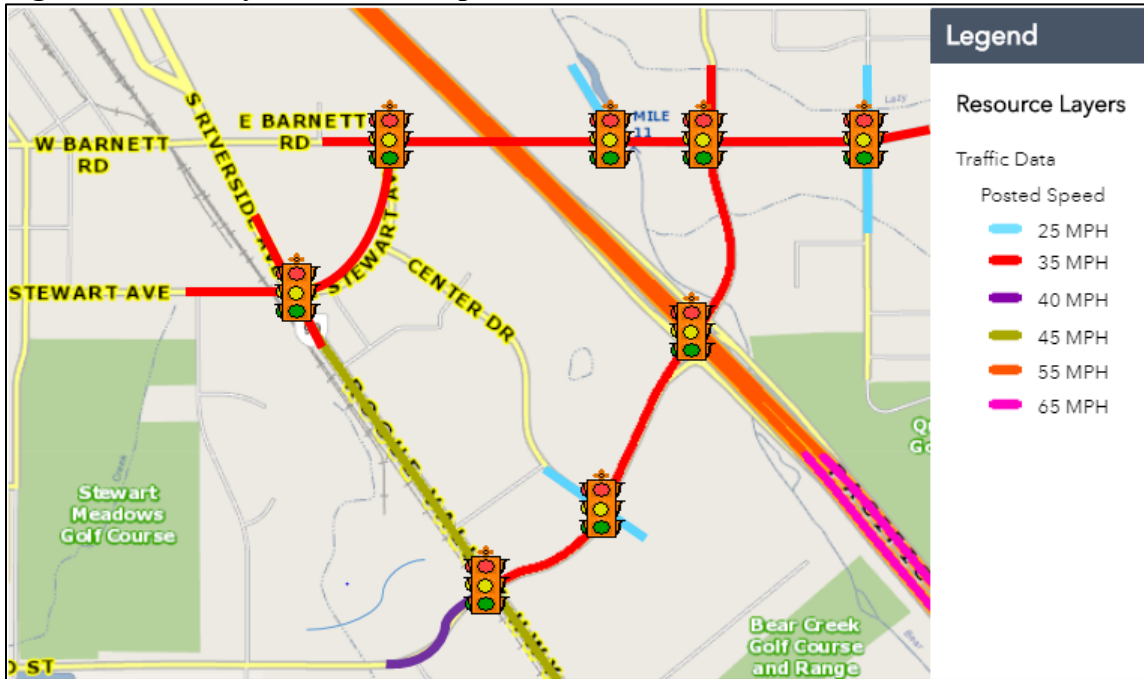


Figure A-3 shows the posted speed limits and traffic control at the study intersections.

Figure A-3: 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

Roadway	V/C Targets	
	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.

2045 Volume Development

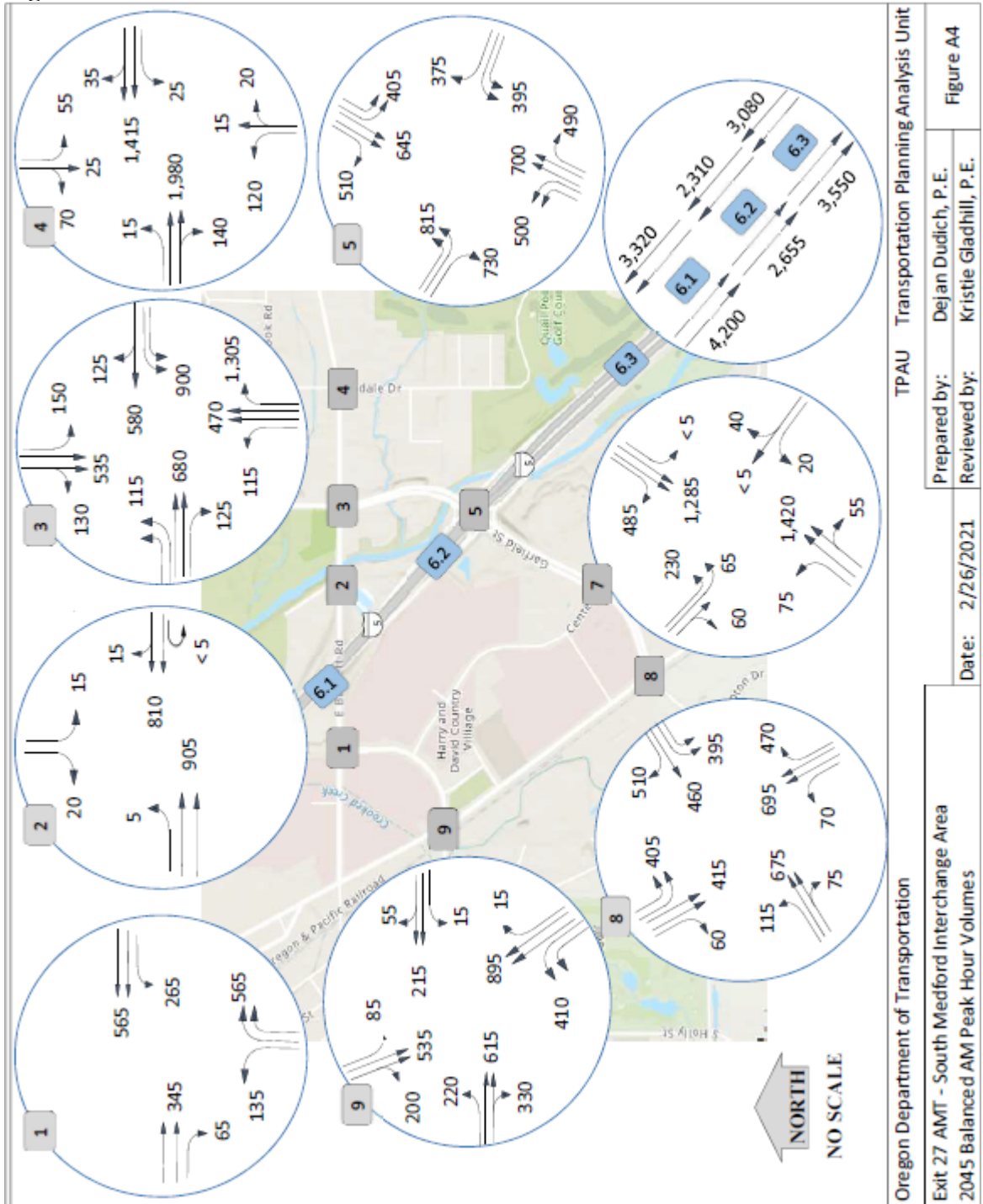
TPAU used the current Rogue Valley MPO (RVMPO, version 4.3) JEMnR (Joint Estimated Model in R) model to forecast future volumes. The current RVMPO v. 4.3 model is calibrated for PM peak hour; AM peak hour factors were developed to provide an AM peak hour scenario. It was decided to use Medford updated 2045 land use and 2045 as the future analysis year, more detail can be found in Appendix D regarding the future model scenario work.

Model volumes cannot be used directly in analysis and must be post-processed to apply the relative differences in between the model scenarios to the current volumes to create the future volumes. The overall post processing steps were:

- Load 2019 balanced volumes, and model base year (2017) and future model year (2042) link volumes.
- Compute annual growth rate for each link
- Adjust link volumes, using link annual growth rate, from the model base year (2017) to the count year (2019)
- No adjustment was needed from the model future year (2045) to the design future year (2045)
- Calculate change in link volumes by both difference and growth method, and choose which to use for each link:
 - average was used if $\leq 15\%$ change; difference value if $>15\%$ change
- Balance inflow and outflow for each intersection, splitting any difference between the inflow and outflow
- Create turn movements with the TurnsW32 software at each intersection with input of 2019 30HV movements and 2045 forecast link inflow and outflow; output of movement estimates for intersection.
- Balance output from TurnsW32 to provide balanced 2045 volumes. Check that future volume is not less than existing volume for all movements.

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 the network was not balanced between Stewart Avenue, at OR99 and Stewart Avenue at Barnett Road. Balanced volumes can be found in Figure A-4 and Figure A-5 below.

Figure A4: 2045 Balanced AM Peak Hour Volumes



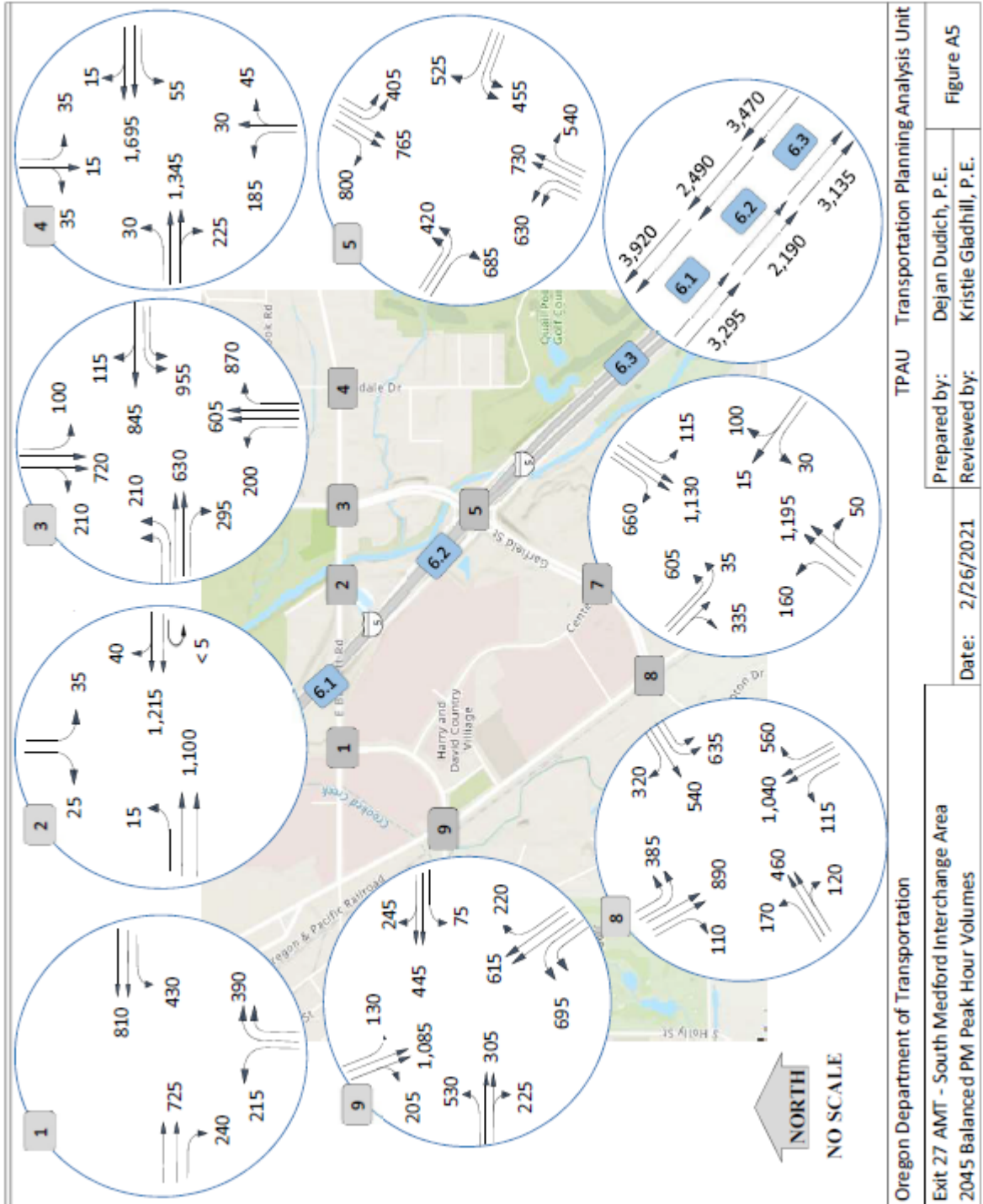
Oregon Department of Transportation
 Exit 27 AMT - South Medford Interchange Area
 2045 Balanced AM Peak Hour Volumes

TPAU Transportation Planning Analysis Unit
 Prepared by: Dejan Ducich, P.E.
 Reviewed by: Kristie Gladhill, P.E.

Date: 2/26/2021

Figure A4

Figure A5: 2045 Balanced PM Peak Hour Volumes



Oregon Department of Transportation		TPAU Transportation Planning Analysis Unit	
Exit 27 AMT - South Medford Interchange Area		Prepared by: Dejan Dudich, P.E.	
2045 Balanced PM Peak Hour Volumes		Reviewed by: Kristie Gladhill, P.E.	
Date: 2/26/2021		Figure A5	

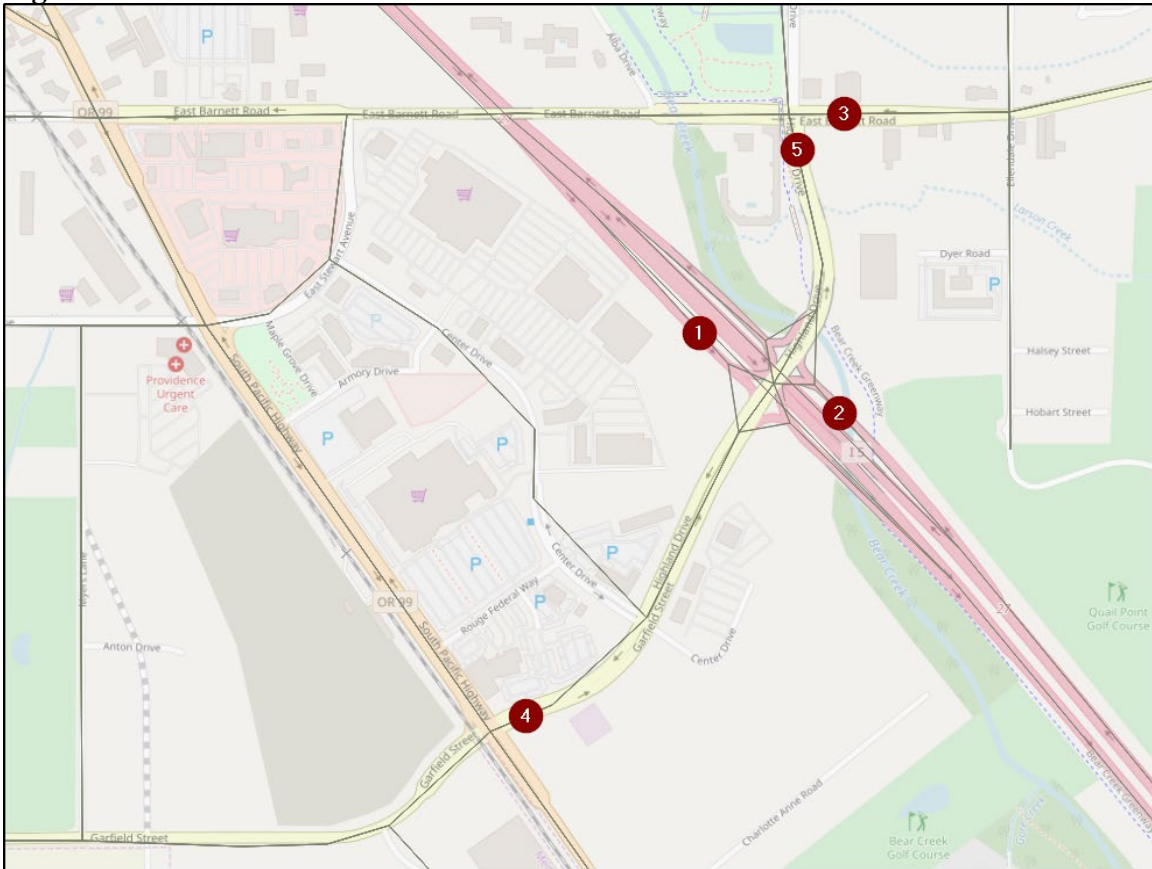
2045 Select Link Analysis

Select-link analysis, showing where trips through a selected roadway section are coming from and going to, 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 in Table A-3 and shown on a map in Figure A-6. Details of the select link analysis work can be found in Appendix B. All of these links are forecast to have higher volumes in 2045 than in 2019, see Table A-3 for the percent increase from 2019 to 2045 balanced volumes.

Table A-3: Select Link Balanced Volume Comparison 2019 to 2045

Select Link	Figure A-6 Location	AM Peak Hour			PM Peak Hour		
		Balanced Volume		% Increase	Balanced Volume		% Increase
		2019	2045	from 2019 to 2045	2019	2045	from 2019 to 2045
Southbound I-5 off-ramp	1	1130	1560	38%	1740	1970	13%
Northbound I-5 off-ramp	2	1305	1690	30%	1595	1900	19%
EB east leg of Barnett Rd/Highland Dr	3	1660	2135	29%	1080	1600	48%
WB east leg of Barnett Rd/Highland Dr	3	1045	1605	54%	1615	1915	19%
NB south leg of Barnett Rd/Highland Dr	5	1625	1890	16%	1280	1675	31%
SB south leg of Barnett Rd/Highland Dr	5	1130	1560	38%	1740	1970	13%
Northeast bound, northeast leg of Garfield St/OR99	4	1150	1550	35%	1140	1405	23%
Southwest bound, northeast leg of Garfield St/OR99	4	970	1365	41%	1320	1495	13%

Figure A-6: Select-Link Locations



About half of the 2045 Exit 27 off ramp traffic volume is forecast to come from short freeway trips of eight miles or less: ~40% of the southbound off-ramp volumes from the interchange to the north (Exit 30, three miles away) and another quarter to a third from Exit 33; and northbound from the three interchanges to the south (Exit 24, Exit 21, and Exit 19).

More than half the traffic volume off the Exit 27 southbound off ramp is forecast to go southbound (AM peak 53%, PM peak 54%). More than 40% of the traffic volume is forecast to head to eastbound Barnett Road (AM peak 43%, PM peak 41%).

The Exit 27 northbound off ramp is forecast to get roughly half 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 is forecast to primarily go to the north (AM peak 69%, PM peak 66%), splitting between westbound, northbound, and eastbound directions from there.

2045 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 as part of the existing conditions work. 2045 balanced volumes were used for future no build operational analysis. Operational analysis software output sheets can be found in Appendix D. Future no build operational analysis results are summarized in Tables A-4, A-5, and A-6. Facility types include 3SG (three-legged signalized intersection), 4SG (four-legged signalized intersection), and SPUI.

Intersection Analysis

Table A-4 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 1.0 to match their standards. The three intersections under the jurisdiction of ODOT have the Oregon Highway Plan V/C standard and LOS shown. Table A-4 shows that the future no build analysis indicates more of the study area intersections will be failing to meet their respective standards during both AM and PM peak hours than was seen in existing conditions.

Table A-4: 2045 Future No Build Conditions 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	D ¹	N/A	0.62	0.90	WBL	WBL
Barnett Rd at Alba Dr	3SG	D	A ¹	A ¹	N/A	0.38	0.48	EBT	WBT
Barnett Rd at Highland Dr	4SG	E	F¹	F¹	N/A	1.53	1.39	NBR	WBL
Barnett Rd at Ellendale Dr	4SG	D	D ¹	D ¹	N/A	0.99	0.80	EBT	WBT
Garfield St / I-5 Exit 27 Interchange	SPUI	N/A	F	D	0.85	1.35	0.84	EBR	SBR
Garfield St at Center Dr	4SG	N/A	F	D	0.95	1.00	0.82	EBL	WBT
Garfield St at OR 99	4SG	N/A	E	F	0.95	0.92	1.01	EBT	WBT/ NWT
OR99 at Stewart Ave	4SG	E	D ¹	F¹	N/A	0.93	1.52	EBT	SET

¹ LOS for comparison to the Medford standard is computed with PHF set = 1.0 for all movements throughout the network.
LOS is F when V/C > 1.0 per HCM Exhibit 16-3

The I-5 Exit 27 interchange was already failing the OHP V/C standards during AM peak in the existing conditions analysis; in the future no build conditions AM Peak V/C has increased to 1.35. 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 interchange. The southbound off-ramp eastbound left movement vehicles preferentially use the rightmost of the two left-turn 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. Critical movements based on the Synchro analysis have shown to follow the same trend as seen in the existing conditions.

The intersection of Garfield Street at Center Drive is now also failing to meet the V/C standard in the AM peak with a V/C of 1.0; there is queueing with traffic backing up on the three primary approaches: westbound from the SPUI, eastbound toward the SPUI, and southbound on Center Drive. During the AM Peak the westbound approach can be seen backing all the way up to SPUI, additionally the southbound and eastbound approaches are seen to be backing up which is likely due to the congestion at the SPUI spilling back into this intersection.

The intersection of Garfield Street and OR 99 during the PM Peak has a V/C of 1.01 (OHP V/C standard is 0.95). Large volumes going north along OR99 cause blockage to the south past Charlotte Ann Road. Nearly a third of the northbound volume turns right on Garfield Street and likely heads for the interchange; with the remaining two thirds continuing north to the intersection at Stewart Avenue.

The future no build analysis has shown that most of the intersections will still meet the City of Medford LOS standards in 2045. However, Highland Drive at Barnett Road fails the Medford LOS standard by dropping to LOS F in both AM and PM peak periods. During the AM Peak the northbound volume turning right to get to destinations to the east backs up into the interchange. This also contributes to the southbound and westbound approaches at Highland Drive and Barnett Road experiencing storage bay blockage and upstream queue spillback. During the PM peak, the southbound and westbound approaches experience extensive storage bay blocking and queue spillback as drivers leave the medical center and school areas. OR 99 at Stewart Avenue fails the Medford LOS criterion in the PM peak period. During the PM peak the southbound and eastbound approaches experience both storage bay blockage and upstream blockage to Greenwood Street to the north, Ellendale Drive to the east; due to large volumes. Additionally the northbound approach experiences an average queue that almost extends into the upstream intersection of OR 99 and Garfield Street.

Queue Lengths and Blockage

Tables A-5 and A-6 summarize intersection queue lengths and blockage. Figure A-7 shows the AM peak queue lengths and upstream blockage; Figure A-8 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.

At the intersection of Barnett Road and Highland Drive both AM and PM peak hours experience lengthy queues in all directions but at different times. During the AM peak the northbound approach blocks storage and backs up into the Interchange roughly 60% of the time, due to the high northbound right turn volume. The westbound approach blocks storage 68% of the time, and backs up into Barnett at Ellendale. The high westbound left turn volume may not be able to progress due to southbound Garfield being backed up all the way south to OR 99. The southbound approach blocks storage and backs up to Greenwood Street most of the time, likely due to high left turn volumes. During the PM peak westbound traffic making a left turn to head south to the interchange has storage bay blockage a third of the time. The southbound has storage bay blockage more than half the time, and queues spill back to Greenwood Street most of the time.

In the northeast corner of the study area, the intersection of Ellendale Drive and Barnett Road has eastbound, westbound, and northbound storage bay blockages in both AM and PM peaks; southbound as well during the AM peak. 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 and patients of the medical center going home at the end of the work day.

At the SPUI, spillback and upstream blockage can be seen on all approaches, extending from Barnett Road to OR 99 in the AM peak. PM peak conditions are not as bad, but the same problems are developing. During the AM peak the eastbound left turn has a high traffic volume; drivers preferentially use the rightmost lane to turn into the right northbound lane to be staged to make a right turn at Barnett Road;

Northbound traffic from the SPUI to Barnett Road shows storage bay and upstream blockage 40% or more of the time. The back-up in that northbound right lane can cause the northbound off-ramp right turns to not be able to progress through the yield, with storage bay blockage three quarters of the time, blocking access to the westbound left from the off-ramp and causing spillback onto the northbound mainline. The northbound through is also affected, with storage bay blockage extending to OR 99. During the AM peak OR 99 at Garfield Street has storage bay blockage for the southbound, northbound, and eastbound approaches; during the PM peak storage bay blockage at the northbound approach. The eastbound approach has storage bay blockage most of the time during the AM peak which results in upstream blockage 79% of the time. The southbound approach experiences storage bay blockage most of the time with resulting upstream blockages 39% of the time. For the northbound approach storage bay blockage and upstream blockage is ~70% during both AM and PM peaks.

OR 99 at Stewart Avenue has storage bay blockage for the southbound (southeast through) 69% of the time in both the AM and PM peak hours. During the AM peak the eastbound approach has storage bay blockage 30% of the time; during PM peak 88% of the time. The northbound left turn has storage bay blockage more than half the time.

Table A-5: 2045 Future No Build Conditions 95th Percentile Queue Length

Intersection	Approach	95 th percentile Queue ¹ (ft)		Upstream Blockage (AM or PM,% time, intersection blocked) ²
		AM	PM	
Barnett Rd at Stewart Ave	EB	175	300	
	WB	200	475	
	NB	150	375	
Barnett Rd at Alba Dr	EB	150	450	
	WB	125	225	
	SB	50	75	
Barnett Rd at Highland Dr	EB	500	750	PM 6%
	WB	1200	1100	AM 29%, PM 4%
	NB	1775	675	AM 61%,
	SB	1075	950	AM 81%, PM 90%
Barnett Rd at Ellendale Dr	EB	600	700	
	WB	1375	1275	AM 86%,PM 77%
	NB	700	275	AM 18%,
	SB	175	100	
Garfield St / I-5 Exit 27 SPUI	EB	2250	2150	AM 47%,PM 35%
	WB	1875	750	AM 56%,
	NB	1575	525	AM 37%,
	SB	1275	775	AM 4%,
Garfield St [E-W] / Center Dr ³	EB	1075	525	AM 41%,PM 7%
	WB	1650	1550	AM 22%,
	NB	150	150	
	SB	925	1275	AM 14%, PM 59%
Garfield St / OR 99	EB	725	475	AM 79%,
	WB	450	675	
	SEB	3425	350	AM 39%,
	NWB	1675	1300	AM 71%, PM 67%
OR 99 at Stewart Ave	EB	1425	1700	AM 79%, PM 99%
	WB	175	425	
	SEB	1375	1100	AM 39%. PM 80%
	NWB	350	2450	

Blackened box indicates 95th percentile queue > link length
¹ 95 percentile queue rounded up to nearest 25'
² Blockage >5% of the time
³ Directions at the intersection of Garfield St and Center Dr are east-west for Garfield St, N-S for Center Dr in Synchro, those directions are followed in these analysis results.

Table A-6: 2045 Future No Build Conditions Storage Bay Blockage

Intersection	Approach	Average Percent Time Blocked (5% or greater)	
		AM	PM
Barnett Rd at E. Stewart Ave	WBL		16
	NBL		27
Barnett Rd at Highland Dr	WBL	68	30
	EBT	12	26
	EBR		5
	NBR	59	
	SBL	97	
Alba Dr at Barnett Rd	SBT	9	56
	EBT		9
Barnett Rd at Ellendale Dr	SBL		8
	EBT	31	36
	WBL		5
	WBT	70	51
	NBL	58	24
Garfield St / I-5 Exit 27 SPUI	SBTR	7	
	EB	40	60
	WB	76	16
	NBT	87	12
	SBT	53	21
Garfield St [E-W] / Center Dr [N-S]	EBT	57	19
	WBT	46	36
	NBL	6	11
	NBTR	22	22
	SBL	34	62
Garfield St / OR 99	EBTR	87	19
	EBL		6
	EBT	75	7
	WBT		15
	SEL	81	
	NWT	50	78
Riverside Ave / OR 99 at Stewart Ave	NWR	71	
	EBT	30	
	EBL	19	88
	WBT		12
	SEL	5	7
	SET	69	69
	NWL		55

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



Figure A-8: PM Peak Queue Lengths and Upstream Blockage Locations



Freeway Analysis

Tables A-7 and A-8 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 exceeded during the AM peak analysis in six locations along the study areas stretch of I-5: the southbound off-ramp diverge, the north and southbound on-ramp merges, the northbound mainline downstream of the interchange, the southbound mainline upstream and downstream of the interchange. The higher V/C ratios are likely caused by the high volumes and backup of traffic from the southbound off-ramps eastbound left at the intersection of I-5 and Garfield Street onto the southbound mainline. During the PM peak the V/C standard is exceeded on four sections of northbound I-5: the northbound off-ramp diverge, the northbound on-ramp merge, and the northbound mainline both upstream and downstream of the interchange, due to high volumes.

**Table A-7: 2045 Future No Build Conditions
AM Peak I-5 Freeway Operational Analysis**

Freeway Facility	Volume	Critical Movement	V/C Std	V/C
NB off-ramp, diverge	3761	v _F	0.85	0.84
SB off-ramp, diverge	5128	v _F	0.85	1.15
NB on ramp, merge	3968	v _F	0.85	0.89
SB on ramp, merge	4324	v _F	0.85	0.97
NB mainline, downstream of interchange	2027	N/A	0.85	0.92
NB mainline, past/through interchange	1410	N/A	0.85	0.64
NB mainline, upstream of interchange	1880	N/A	0.85	0.85
SB mainline, downstream of interchange	2168	N/A	0.85	0.98
SB mainline, past/through interchange	1621	N/A	0.85	0.73
SB mainline, upstream of interchange	2564	N/A	0.85	1.16
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-8: 2045 Future No Build Conditions
PM Peak I-5 Freeway Operational Analysis**

Freeway Facility	Volume	Critical Movement	V/C Std	V/C
NB off-ramp, diverge	3975	v _F	0.85	0.89
SB off-ramp, diverge	3774	v _F	0.85	0.85
NB on ramp, merge	2852	v _F	0.85	0.99
SB on ramp, merge	2509	v _F	0.85	0.80
NB mainline, downstream of interchange	2245	N/A	0.85	1.01
NB mainline, past/through interchange	1426	N/A	0.85	0.64
NB mainline, upstream of interchange	1988	N/A	0.85	0.90
SB mainline, downstream of interchange	1796	N/A	0.85	0.81
SB mainline, past/through interchange	1254	N/A	0.85	0.57
SB mainline, upstream of interchange	1887	N/A	0.85	0.85
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				

Travel time and delay

Table A-9 below shows that across the entire study area the total average travel time for all vehicles is expected to increase from 2019 to 2045 between 350% and 400%, while the total average delay is expected to increase from 450% and 550% between 2019 and 2045, a significant impact on all vehicular modes.

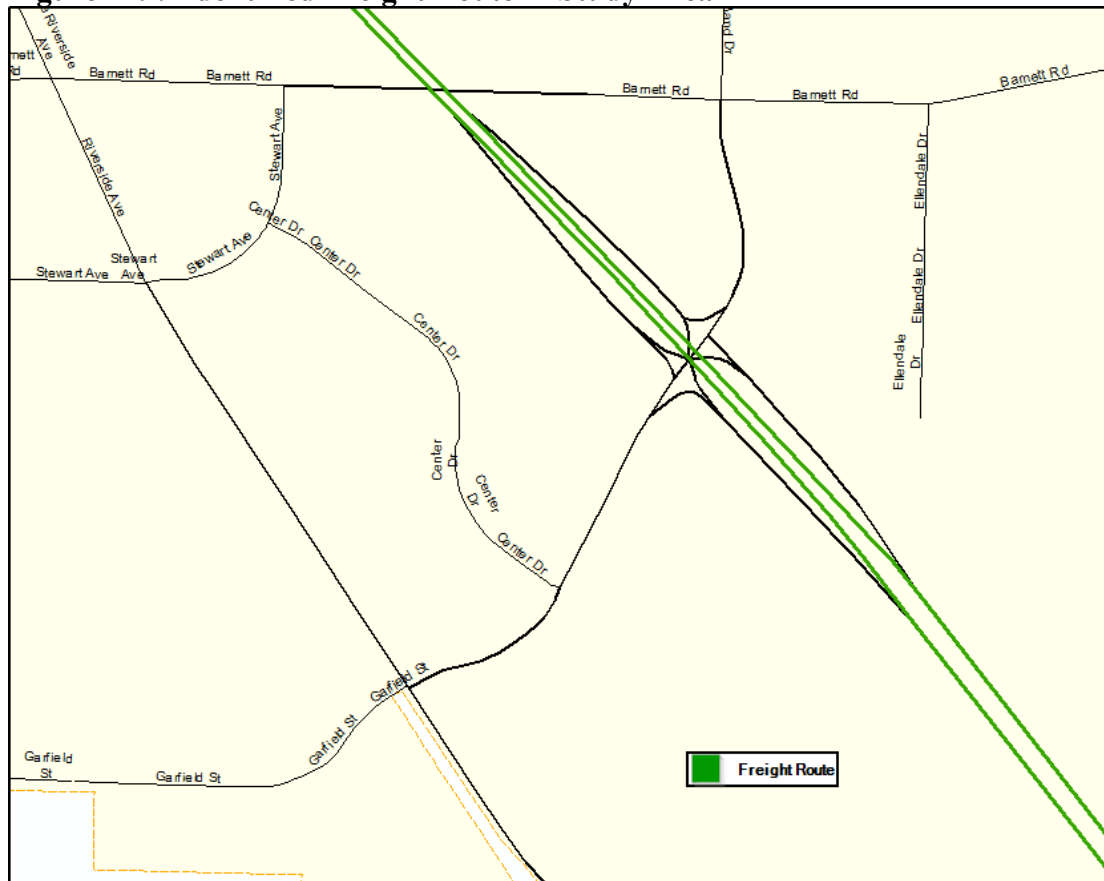
Table A-9: 2019 vs. 2045 Network Travel Time and Total Delay

<i>Travel Time and Delay rounded to nearest 5 hours</i>	2019		2045		Percent Change	
	AM	PM	AM	PM	AM	PM
Avg Travel Time (hr)	625	735	2435	2510	391%	341%
Avg Total Delay (hr)	400	455	2210	2220	556%	489%

Freight

In the project area, I-5 is a designated freight route and reduction review route as shown in Figure A-9. The SPUI design has geometry that accommodates large truck turning radius easily. Truck percentages are highest in the study area at the intersection of Garfield Street at Center Drive and at the interchange. Travel time reliability is especially critical to freight for timely delivery of goods for businesses, so the 3.5 to 4 times increase in travel time and 5 times increase in delay shown in Table A-9 will adversely impact freight.

Figure A-9: Identified Freight Route in Study Area



2045 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.

Transit Segment MMLOS

Figure A-10 shows the updated transit routes within the study area. Route 10 was removed and Route 1X was rerouted over to Center Street from Riverside Avenue. Routes 10, 24X, and 29 are planned new routes for 2045.

Figure A-10: RVTD (Rogue Valley Transit District) Transit Routes in Study Area

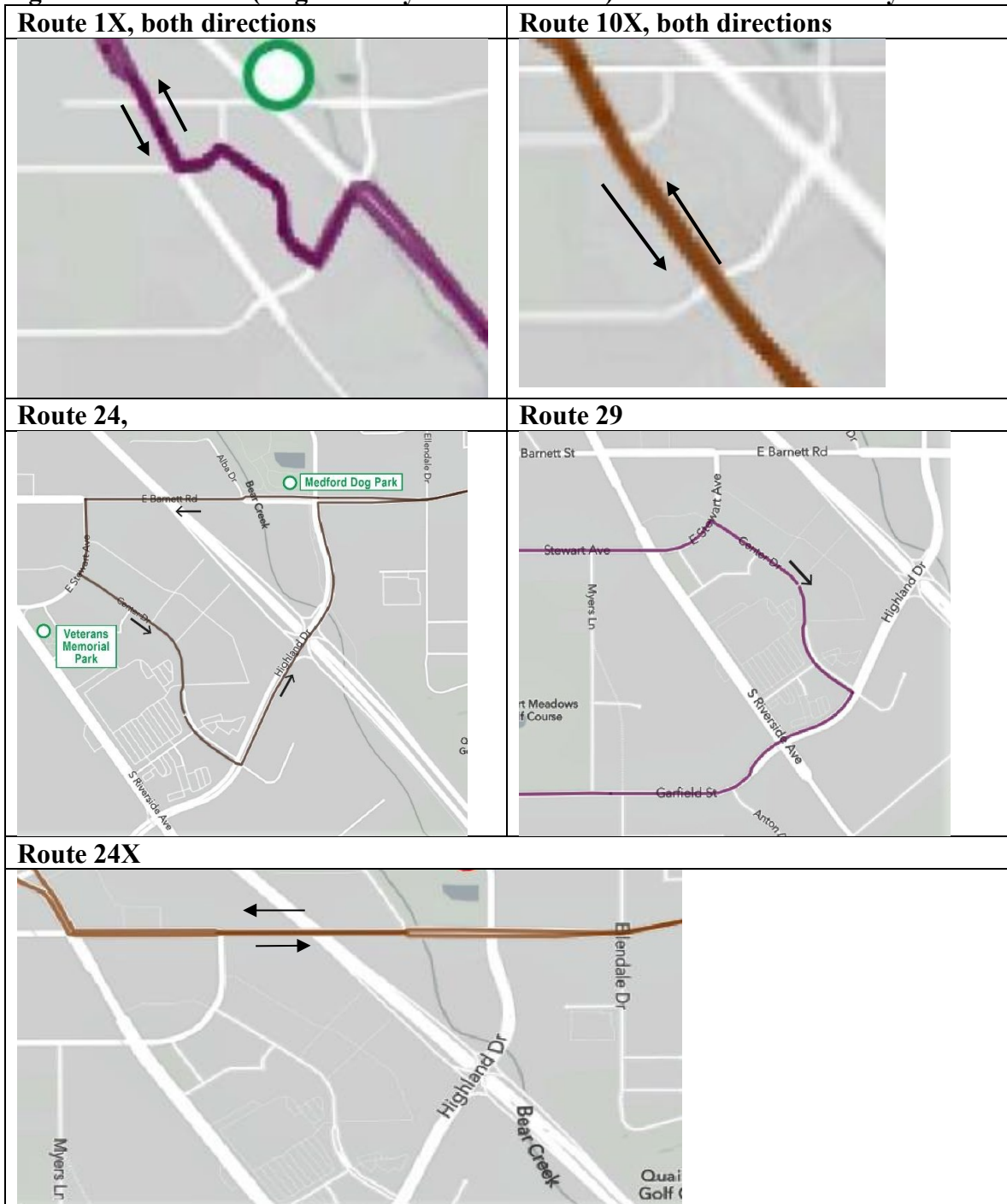


Table A-10 has the Transit MMLOS results for the study area. Overall, transit service is only available on a limited set of segments in the study area. The Transit LOS, where service is available, was generally at LOS C or LOS D, with travel speed generally making the difference. Segments with only Route 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-10: Segment Transit MMLOS (only for segments that have Transit service)

Roadway	Dir	From-To	2019 LOS		2045 LOS	
			AM	PM	AM	PM
Barnett Rd	EB	OR 99 to Stewart Ave ³			B	B
Barnett Rd	WB	Stewart Ave to OR 99	D	D	B	B
Stewart Ave	NB	OR 99 to Center Dr	C	C	C	C
Stewart Ave	SB	Center Dr to OR 99	C	C	E	C
Stewart Ave	EB	Myers Ln to OR 99 ³			D	F
Stewart Ave	SB	Barnett Rd to Center Dr ³			C	C
Barnett Rd	WB	Alba Dr to Stewart Ave	D	D	B	B
Barnett Rd	EB	Stewart Ave to Alba Dr ³			B	B
Barnett Rd	WB	Highland Dr to Alba Dr	D	D	B	B
Barnett Rd	EB	Alba Dr to Highland Dr ³			B	B
Barnett Rd	EB	Highland Dr to Ellendale Dr	C	C	B	B
Barnett Rd	WB	Ellendale Dr to Highland Dr	D	D	B	B
Barnett Rd	EB	Ellendale Dr to Hilldale Ave	C	C	B	B
Barnett Rd	WB	Hilldale Ave to Ellendale Dr	D	D	B	B
Highland Dr	NB	SPUI to Barnett Rd	C	C	C	C
Garfield St	EB	Center Dr to SPUI	B	C	C	C
Garfield St	WB	SPUI to Center Dr	E	F	F	D
Center Dr	NB	Garfield St to Rogue Credit Union Ln	C	C	E	C
Center Dr	SB	Rogue Credit Union Ln to Garfield St	C	C	B	B
Garfield St	EB	OR 99 to Center Dr ^{2,3}	C	C		
Garfield St	WB	Center Dr to OR 99 ²	C	C	D	F
Garfield St	WB	OR 99 to Anton Dr			D	F
OR 99	NB	Charlotte Ann Rd to Garfield St	D	D	B	B
OR 99	SB	Garfield St to Charlotte Ann Rd	D	D	B	B
OR 99	NB	Garfield St to Stewart Ave	F	F	B	B
OR 99	SB	Stewart Ave to Garfield St	E	E	B	B
OR 99	NB	Stewart Ave to Barnett Rd	C	C	A	A
OR 99	SB	Barnett Rd to Stewart Ave	C	C	A	A

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

3 No transit service has medium grey shading.

To encourage transit ridership, RVTB (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.

Pedestrian and Bicycle Segment MMLOS

The sidewalks and crossings the study area are in good condition, and are assumed to continue to be in good condition in 2045. 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. The City of Medford has designated the Larson Creek Trail as the bicycle facility for Barnett Road from Ellendale Drive east to N. Phoenix Road in their 2018 TSP update. These facilities 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 2045 segment pedestrian MMLOS, found in Table A-11 for 2019 and 2045, AM peak and PM peak, generally did not change from 2019 to 2045. There are certain segments where the future no build MMLOS is expected to be worse than it was in existing conditions, due to higher traffic volumes: Barnett Rd between Highland Drive and Hilldale Avenue; Highland Drive between Barnett Road and the SPUI; Garfield Street between OR 99 and Anton Drive and eastbound from OR 99 to Center Drive in the AM peak.

The bicycle MMLOS, found in Table A-12, did not change between the base year of 2019 and the future year of 2045.

Table A-11: Segment Pedestrian MMLOS

Roadway	Dir	From-To	2019 LOS ¹		2045 LOS ¹	
			AM	PM	AM	PM
Barnett Rd	EB	OR 99 to Stewart Ave	B-C	C	B-C	C
Barnett Rd	WB	Stewart Ave to OR 99	C	C	C	C
Stewart Ave	NB	OR 99 to Center Dr	C	B-C	C	C
Stewart Ave	SB	Center Dr to OR 99	B-C	C	B-C	C
Barnett Rd	EB	Stewart Ave to Alba Dr	C	C	C	C
Barnett Rd	WB	Alba Dr to Stewart Ave	C	C	C	C
Alba Dr	NB	Barnett Rd to Road's end	B	B	B	B
Alba Dr	SB	Road's end to Barnett Rd	B	B	B	B
Barnett Rd	EB	Alba Dr to Highland Dr	C	C	C	C
Barnett Rd	WB	Highland Dr to Alba Dr	C	C	C	C
Highland Dr	NB	Barnett Rd to Greenwood St	B	B	B	B
Highland Dr	SB	Greenwood St to Barnett Rd	C	C	C	C
Barnett Rd	EB	Highland Dr to Ellendale Dr	E	C	E	E
Barnett Rd	WB	Ellendale Dr to Highland Dr	C	E	E	E
Ellendale Dr	NB	Barnett Rd to Crestbrook Rd	B-C	B-C	B-C	B-C
Ellendale Dr	SB	Crestbrook Rd to Barnett Rd	B-C	B-C	B-C	B-C
Ellendale Dr	NB	Hospitality Way to Barnett Rd	B	B	B	B
Ellendale Dr	SB	Barnett Rd to Hospitality Way	B	B	B	B
Barnett Rd	EB	Ellendale Dr to Hilldale Ave	E	C	E	C
Barnett Rd	WB	Hilldale Ave to Ellendale Dr	C	C	C	E
Highland Dr	NB	SPUI to Barnett Rd	E	C	E	E
Highland Dr	SB	Barnett Rd to SPUI	C	E	E	E
Garfield St	EB	Center Dr to SPUI	C	E	E	E
Garfield St	WB	SPUI to Center Dr	C	E	E	E
Center Dr	NB	Garfield St to Rogue Credit	C	C	C	C
Center Dr	SB	Rogue Credit Union Ln to	B	B	B	B
Center Dr	NB	Parking to Garfield St	B	B	B	B
Center Dr	SB	Garfield St to Parking	B-C	B-C	B-C	B-C
Garfield St	EB	OR 99 to Center Dr	C	C	E	C
Garfield St	WB	Center Dr to OR 99	C	C	C	C
Garfield St	EB	Anton Dr to OR 99	E	C-E	E	E
Garfield St	WB	OR 99 to Anton Dr	C-E	E	E	E
OR 99	NB	Charlotte Ann Rd to Garfield	E	E	E	E
OR 99	SB	Garfield St to Charlotte Ann	E	E	E	F
OR 99	NB	Garfield St to Stewart Ave	E	E	E	E
OR 99	SB	Stewart Ave to Garfield St	E	E	E	E
OR 99	NB	Stewart Ave to Barnett Rd	C	C	C	C
OR 99	SB	Barnett Rd to Stewart Ave	B-C	C	B-C	C
Stewart Ave	NB	Center Dr to Barnett Rd	C	C	C	C
Stewart Ave	SB	Barnett Rd to Center Dr	B-C	C	B-C	C
Stewart Ave	EB	Myers Ln to OR 99	C	C	C	C
Stewart Ave	WB	OR 99 to Myers Ln	C	C	C	C

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

Table A-12: Segment Bicycle MMLOS (AM/PM)

Roadway	Dir	From-To	2019 & 2045 LOS ^{1,2}
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 ³	EB	Alba Dr to Highland Dr	E-F
Barnett Rd ³	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 ³	NB	SPUI to Barnett Rd	C-E
Highland Dr ³	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.

² No bicycle LOS changes occurred between 2019 and 2045.

³Bear Creek Greenway Bike Path parallels this route and provides a safer/less stressful alternative.

Multimodal Level of Service- Intersections

For the future no-build, no changes are expected for the factors that feed into the intersection MMLOS, so there are no changes are expected. Table A-13 shows the 2019/2045 intersection MMLOS results.

**Table A-13: 2019 and 2045 Future No-build 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 cyclists 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.

Summary

The major problem in the AM peak is that the interchange will not be able to handle the volumes during that time period. This will cause upstream blockages onto the I-5 mainline from both the northbound and southbound off ramps. There will also be upstream blockages in both north and southbound directions extending the entire length of Garfield Street from Barnett Road to OR 99. Additional upstream blockage will be a problem in the northeast portion of the study area: Highland Drive headed south into the Barnett Road/Garfield Street intersection; Barnett Road from Garfield Street upstream past Ellendale Drive and beyond the study area extent. On the western side of the study area, OR 99W southbound from Barnett Road down to Garfield Street is expected to have upstream blockage as well as OR 99 northbound at Garfield Street. This will make traffic movement through the study area difficult during the AM peak hour.

In the PM peak, operations will not be quite as bad as in the AM peak, but showing some of the same problem areas: Barnett Road at Garfield will be failing the Medford LOS standard, and have upstream blockages on Highland Drive headed south into the Barnett Road/Garfield Street intersection; and on Barnett Road from Garfield Street upstream past Ellendale Drive and beyond the study area extent. The interchange southbound off ramp will be causing upstream blockage onto the I-5 mainline. Center Drive will have blockages on the east and north legs. OR 99 will have northbound blockages south of the Garfield Street intersection; at the Stewart Avenue intersection there will be long northbound queues, and upstream blockage on eastbound Stewart Avenue, coming from the direction of the Stewart Meadows housing development and Providence Medical offices.

Select link analysis indicates that about half of the Exit 27 off-ramp traffic volume is forecast to come from short freeway trips of eight miles or less: roughly 40% of the southbound off-ramp volumes comes from the Exit 30 interchange three miles to the north and roughly another quarter comes from Exit 33. Nearly half the northbound off-ramp volume at Exit 27 comes from the three interchanges to the south (Exit 24, Exit 21, and Exit 19). This indicates that local traffic is using the I-5 freeway through this area for short trips, this likely due to the lack of an efficient arterial system which then leads to longer travels times between points and leads to drivers utilizing I-5 to minimize that travel time.

MMLOS for bicyclists and pedestrians will worsen due to higher volumes. Transit MMLOS will be affected by changes in scheduled routes, in some locations improving, while worsening in others.

Contact Information

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