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**SUBJECT: Technical Memo #2, Existing Deficiencies
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. The purpose of this analysis is to identify existing deficiencies based on existing operations analysis.

Existing Operations Analysis can be found in Technical Memo #2, Appendix A, with supporting work in Appendices B (Traffic Counts), C (Inventory), D (Crash Data), E (Balanced Volumes), F (Select Link Analysis), G (Operations Analysis) , H (MMLOS), and I (Methodology Memorandum, previously provided as Appendix A to Technical Memorandum #1).

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Summary

Traffic volume in the study area, and in particular through the SPUI interchange, has increased more quickly than expected. The SPUI was built in 2009 with a projected 20 year facility life. 2019 counts in the PM peak hour exceeded the IAMP forecast 2030 PM peak volumes, with TEV (total entering vehicles) at 118% of the forecast 2030 volumes. The 2019 volumes also showed more travel between the interchange and points north along I-5, rather than the IAMP 2030 forecasts having more travel between the interchange and points south along I-5. A Walmart Supercenter that was not foreseen in the IAMP future land use planning was added midway along Center Drive in 2012. Development south of Garfield on Center was also not anticipated in the original interchange project for the SPUI; this was assumed to remain undeveloped.

Select link analysis indicates that half of the Exit 27 off-ramp traffic volume comes from short freeway trips of eight miles or less: northbound from the three interchanges to the south (Exit 24, Exit 21, and Exit 19); and southbound from the interchange to the north (Exit 30, three miles away) with an additional 26% of the volume from the next interchange to the north, Exit 33..

The Barnett Road at Highland Drive intersection meets the City of Medford LOS standard of E, but $V/C > 1$ indicates that the intersection is over capacity: During the AM peak hour of 7:30 – 8:30 am, the northbound right at this intersection backs up into the Single Point Urban Interchange (SPUI), and can lead to the southbound off-ramp backing-up onto the I-5 mainline. In the PM peak hour of 4:30 – 5:30 pm, there is high volume westbound on Barnett Road turning left to proceed south on Highland Drive and into the SPUI interchange.

Rear-end and sideswipe overtaking made up 65% of the crashes, which are typical collision types as vehicles approach intersections or congestion. Turning crashes also were prevalent: 29% of the intersection crashes; 18% of the segment crashes. More than 44% of the crashes were intersection or intersection related; most crashes occurred in 3 pm – 6 pm afternoon commute hours. Safety improvement opportunity areas were identified where congestion was noted in operations analysis and observations:

- Barnett Road/Highland Drive intersection
- I-5 southbound off-ramp
- I-5 southbound mainline approaching the ramps, and going through the interchange
- I-5 northbound between the off and on-ramps
- OR 99 segment north of the intersection with Stewart Avenue, and segment of Stewart Avenue west of OR 99
- Garfield Street from Center Drive, through the SPUI, and up to the intersection with Highland Drive
- Barnett Road west of Stewart Avenue (where westbound it is approaching a major intersection with OR 99)
- Barnett Road east of Ellendale Drive to Hilldale Avenue.

For multi-modal facility users, pedestrian multimodal level of services (MMLOS) degrades when traffic volumes increase. The level of service (LOS) criteria for both pedestrians and bicyclists 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.

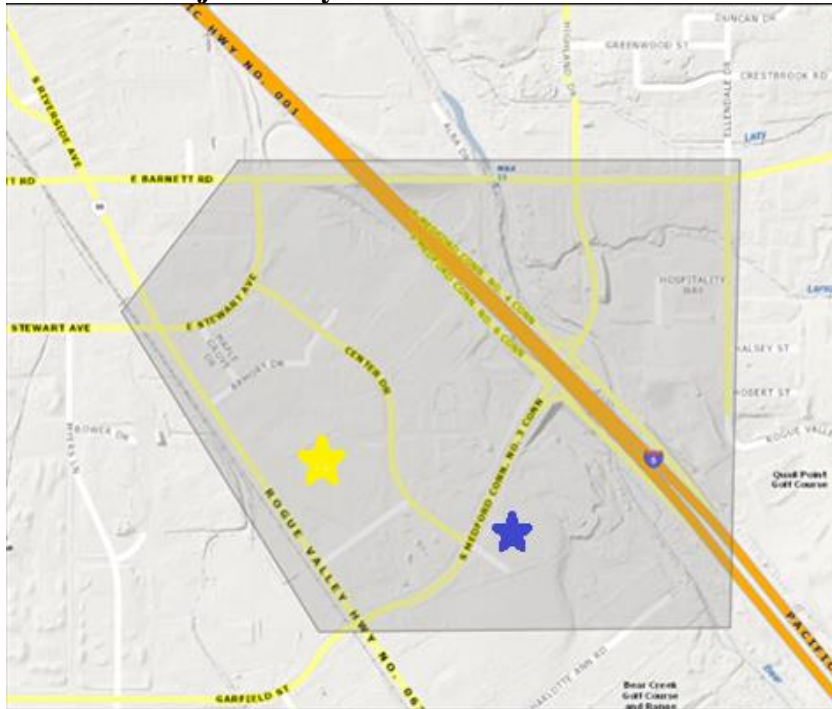
OR 99 from Stewart Avenue south to Charlotte Ann Road had LOS E: speed is higher on this facility, volumes are high, and there is no sidewalk on the west side where there is a railroad track running parallel to OR 99. Bicycle MMLOS indicates that bicyclists would find it uncomfortable to traverse more than half of the study area segments. Segments of Stewart Avenue and Barnett Road with neither bike lane nor shoulder and multiple driveway conflicts rated the poorly. Higher speeds (45 mph) on OR 99 degraded the bicycle LOS, despite having bike lanes in both directions between Garfield Street and Stewart Avenue. Transit service is on a limited set of segments, and travels in only one direction for Route 24.

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. Exhibit 1 below shows the study area extent, an area of commercial development.

Motorized vehicles dominate the transportation modes in the study area. Center Drive, a quarter of a mile to the south of the Exit 27 interchange, connects Stewart Avenue to Garfield Street, with major traffic generators of shopping, places to eat, banking, hotels, and other services. A Walmart Supercenter, denoted by the yellow star in Exhibit 1 below, 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, location depicted by a blue star in Exhibit 1, was also not anticipated in the original interchange project for the SPUI; this was assumed to remain undeveloped.

Exhibit 1: Project Study Area



Yellow star is location of WalMart;

Blue star is location of development south of Garfield Street on Center Drive.

Observed issues

There is an observed current deficiency regarding the I-5 Exit 27 southbound off ramp backing up onto the freeway mainline on weekdays for approximately 20 – 30 minutes during the AM peak hour, which presents a safety hazard and increased risk of crashes if mainline traffic approaches at speed too high to stop without colliding with vehicles.

During the morning peak hour, 7:30 – 8:30 am, there is high volume heading north on Garfield, planning to turn right (east) onto Barnett. The southbound off ramp has dual left turn lanes, but the left of those two lanes is underutilized, presumably because drivers want to stage themselves in the rightmost lane for the upcoming right turn at Barnett. This can cause blockage of the northbound off ramp, such that drivers cannot progress into the rightmost lane. This problem is observed typically ~ 7:30 am, and typically lasts for ~20 minutes. Major attractors/generators to the northeast of the study area are St. Mary's School, the Rogue Valley Manor planned unit development, and the Asante Medical Center hospital, along with other medical offices and supporting businesses around the hospital.

In the afternoon peak hour, 4:30 – 5:30 pm, there is high volume turning left from westbound Barnett Road to go south on Highland Drive / Garfield Street to the SPUI interchange at Exit 27. During the afternoon peak, southbound ramp back-ups can also occur intermittently onto the freeway mainline. At this time of day it is due to high right turn volume off the ramp,

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progressing to Center and beyond to the intersection with OR 99. Recent striping changes at the OR 99/Garfield intersection have improved operations at that intersection.

Volumes and Select Link Analysis

The Exit 27 Single Point Urban Interchange (SPUI) was built in 2009 based on a 2007 IAMP, with expected lifetime of more than 20 years. Exhibit 2 provides a comparison of the 2030 forecast volumes in the 2007 IAMP to the 2019 volumes. Traffic volume in the study area, and in particular through the SPUI interchange, has increased more quickly than expected. The total entering 30 highest hour volume (TEV) for the SPUI in the IAMP 2030 forecast was 3880 vehicles; the IAMP 2030 additional growth alternative forecast TEV was 4400 vehicles. In 2019 the AM peak TEV was 4460 vehicles, PM peak TEV was 5170 vehicles. Overall, TEV for the SPUI in 2019 already exceeded the forecast TEV at 118% of the IAMP 2030 additional growth forecast. Not only were the 2019 volumes higher than expected, they were distributed differently among the approaches to and exits from the SPUI interchange; recognize that turn storage was sized based on the IAMP forecasts.

There is high travel demand between the Exit 27 SPUI interchange and areas to the northeast, accessed to the north on Garfield Street. The IAMP 2030 forecasts expected much of this volume to be coming from and going to the south along I-5. The 2019 counts instead show higher volumes to and from the north along I-5, thus higher volumes in the southbound off ramp left turn lanes, and the right turn from southbound Garfield Street onto the northbound on-ramp.

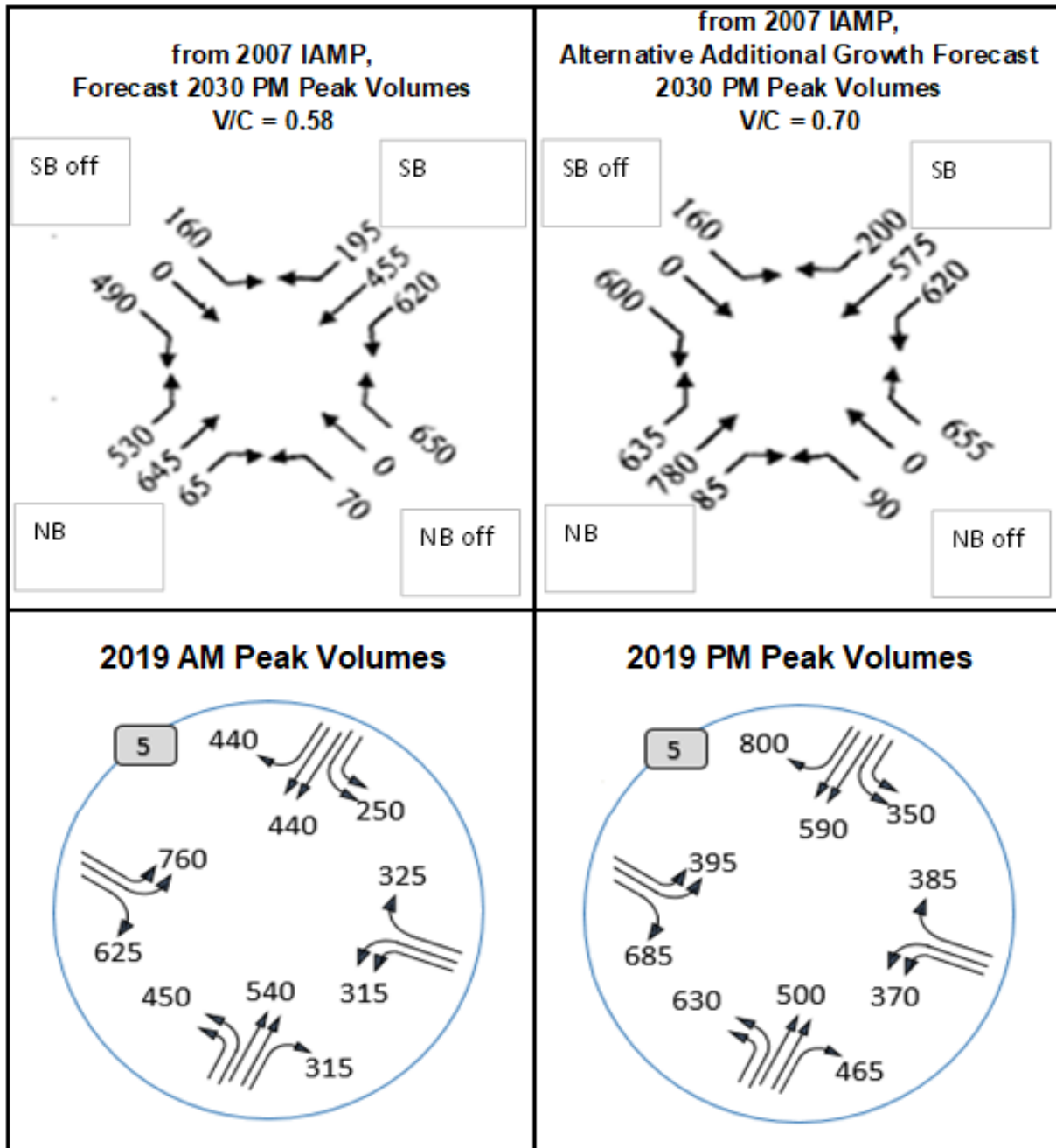
The 2030 IAMP forecasts expected the volume southbound on Garfield Street turning left to get onto southbound I-5 to be three times the right turn volume onto northbound I-5; instead the southbound right turn volumes were twice the left turn volumes in 2019 volumes; through volumes were comparable.

Northbound Garfield Street volumes in 2019 were fairly even split between going left onto northbound I-5, through to continue north on Garfield Street towards Highland Drive, and right onto southbound I-5; the forecast expected minimal right turns onto southbound I-5.

The IAMP 2030 forecast expected only 20-25% of the southbound off-ramp volume to turn left to proceed north on Garfield Street in the PM peak. In 2019, 37% of the southbound off ramp PM peak volume was turning left; in the AM peak the left turn was 55% of the off-ramp volume. Besides the turn splits being different, the 2019 AM peak southbound off-ramp volume was 182% of the IAMP 2030 alternative additional growth forecast.

Volumes to and from the south on I-5 are comparable to what was forecast, but split more evenly to the north and south of the interchange, rather than being primarily to and from the north as was forecast. Northbound I-5 off ramp volume at Exit 27, rather than being predominantly northbound as was forecast, was nearly evenly split between north and southbound heading in 2019.

Exhibit 2: Comparison of IAMP 2030 Forecast Volumes to 2019 Existing Volumes



Select link analysis indicates that more than half of the Exit 27 off-ramp traffic volume comes from short freeway trips of eight miles or less: southbound from the two interchanges to the north (Exit 30, three miles away) and Exit 33, and northbound 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, due to the local network having high demand and limited distribution options.

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. Another 26% of the Exit 27 southbound off-ramp volume enters the freeway at Exit 33. Traffic volume off the Exit 27 southbound off-ramp has a higher percentage of the traffic going northbound to the signal at Barnett Road and Highland Drive in the AM peak (46%) than in the PM peak (41%). Nearly 40% of the traffic volume is headed to eastbound Barnett Road (AM peak 40%, PM peak 37%). High volumes are seen reversing this route in the PM peak: westbound on Barnett Road turning left to go south on Highland Drive towards the Exit 27 SPUI interchange.

Of the traffic volume from the Exit 27 southbound off-ramp, 18% goes to the signal to the south on Garfield Street at Center Drive, then turns right to go north on Center Drive, to major shopping, food, and lodging attractors. More than a quarter of the Exit 27 southbound off-ramp traffic volume turns left to proceed south at the OR 99 signalized intersection.

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.

Operational Analysis

The existing conditions operational analysis shows that the Garfield Street and I-5 Exit 27 interchange AM peak V/C of 0.89 is higher than the 0.85 standard. This can be explained by looking at the 95th percentile queues and the upstream blockage at the intersection of Highland Drive and Barnett Road. During the AM peak the northbound approach to the Barnett Road/Highland Drive intersection blocks storage 59% of the time, and cause upstream blockage into the interchange a quarter of a mile away roughly 58% of the time. It should be noted that this intersection, while within the City's LOS standard of E, has $V/C > 1$, which indicates that it is over capacity and operations will be expected to worsen as volumes increase.

Spill back and upstream blockage can be seen on three of the SPUI interchange approaches. During the AM peak the southbound off-ramp eastbound left turn has a high traffic volume, preferentially using the rightmost lane to turn into the rightmost northbound lane to be staged for a right turn at Barnett Road only a quarter of a mile to the north; there is storage bay blockage from this 17% of the time. The back-up in that northbound right lane up to Barnett Road can cause the right turn from the northbound off-ramp to not be able to progress through the yield, with storage bay blockage 88% of the time blocking access to the westbound left storage bays which can block onto the northbound mainline 56% of the time.

Safety Improvement Areas

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 time frame; only 8% of crashes were in the 6 am – 9 am time frame. 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 Exhibit 3. Appendix A Tables A-14 to A-16 show detailed crash summary information for the safety improvement opportunity areas listed in Exhibit 3.

At the intersection locations, the prevalent crash patterns were turning crashes, not yielding right away and rear end crashes from following too closely. Delay leads to driver impatience and can lead to risky gap acceptance for making turns. The intersection crashes have a higher proportion of occurrence during the PM hours when the majority of traffic is heading westward toward the setting sun which may be making it more difficult for drivers to see slowing, stopped, or turning vehicles ahead.

On freeway segments the shared crash pattern was rear end crashes. Of particular concern in this study area would be interchange off-ramp back-ups that spill back onto the mainline. These back-ups can result in slowing or stopped vehicles close to or on the mainline of I-5, which can take drivers by surprise, with inadequate warning time to allow them to slow down quickly enough to avoid rear end crashes.

The most common crash pattern among crashes on segments was found to be rear end crashes resulting from vehicles following too closely.

Exhibit 3: Existing Conditions Safety Improvement Opportunity Areas

Safety Improvement Opportunity Areas	Facility Type	Critical Crash Rate	Top 10% SPIS Site	2012 Intersection Plan Report
Barnett Rd at Stewart Ave	3SG ¹			● ²
Barnett Rd at Highland Ave	4SG ¹		●	
I-5 SB off ramp (WX, WY ³)	Segment		●	
I-5 NB mainline (Rd 2) between ramps	Segment	●		
I-5 SB mainline (Rd 1) north of SB off ramp	Segment	●		
I-5 SB mainline (Rd 1) between ramps	Segment	●		
Riverside Ave (OR 99), Stewart Ave north to Barnett Rd	Segment	●	●	
Stewart west of OR 99 to Myers Ln	Segment	●		
Garfield St, Center Dr to SPUI (WU ³)	Segment		●	
Garfield St, SPUI to Barnett Rd (WU ³)	Segment		●	
Barnett Rd west of Stewart Ave to OR 99	Segment	●		
Barnett Rd east of Ellendale Dr to Hilldale Ave	Segment	●	●	

¹ 3SG (three-legged signalized intersection), 4SG (four-legged signalized intersection)

² 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.

³ WX, WY, and WU are connector identifiers.

Multimodal Analysis

The multimodal analysis was done for the study area utilizing tools based on HCM methodologies for pedestrians, bicyclists, transit, and intersections. 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.

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 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 pedestrian LOS generally scored at LOS C in the study area for both AM and PM analysis time periods. There is a clear pattern of segments switching between LOS C and LOS E between AM and PM peak hours as the directional traffic volume increases in certain directions making it uncomfortable for pedestrians. 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. The section that received the lowest LOS scores in the study area was 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 scores were generally split between ranges C-E and E-F. This indicates that bicyclists would find it uncomfortable to traverse more than half of the study area segments. 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 were rated LOS F in both directions and shared 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 unsignalized conflicts for traffic entering or departing from the commercial buildings along the segment.

Intersection MMLOS was calculated per APM version 2 section 14.16. 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.

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. 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.

The Transit LOS, where service was 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.

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.

Contact Information

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