

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) 986-4112 FAX (503) 986-4174

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**TO: Don Morehouse, Region 3 Planning
Dick Converse, RVCOG**

**FROM: Joseph Meek III PE, PTOE, Transportation Analyst
Transportation Planning Analysis Unit**

SUBJECT: DRAFT: Rogue River Technical Memorandum #5 Future 2040 No-build Conditions

This memo analyzes Rogue River's 2040 future-no-build conditions. This will provide an overview of future transportation system operations and deficiencies. This analysis includes an evaluation of the study intersections. Analysis results will identify future transportation system needs for motorized and non-motorized travel modes.

In the 2040 future conditions analysis, there were intersections exceeding volume-to-capacity (V/C) targets or standards, especially the I5 interchange and downtown area. There will be substantial queuing impacts and safety related issues on the I5 off-ramps and Depot Street starting at OR99 going through the interchange area and up to the Pine & Main Street intersection. Heavier traffic conditions will make walking and bicycling less comfortable and transit potentially less reliable.

Background

The City of Rogue River is in Jackson County along I5 and OR99 and is part of the Middle Rogue Metropolitan Planning Organization (MRMPO). In July 2011, Rogue River's population was 2,140. This is projected to grow 40% to 3,975 by 2040 by Portland State University's Center for Population Research, stated in Technical Memorandum #3. The city has expanded south beyond manmade and natural barriers of railroad tracks, an interstate, and a river. The I5/Depot Street interchange is crammed in between the Central Oregon and Pacific railroad tracks and the Rogue River which becomes a series of restrictive barriers in close proximity to each other. To add to this there are streets that are crammed in very close on either side. OR99 is on the other side

of the river. Pine/Classick Dr is even closer and a difficult barrier to cross. This leads to safety risks, traffic operations issues, and problems in future planning.

The City has developed from south of the Rogue River and stretched north beyond the city limits to build the high school on East Evans Creek Road (Pine Street in Rogue River). The main street of the community is the east/west oriented Foothill Boulevard/E Main Street/W Main Street. This is connected to I5 and OR99 by way of Depot Street.

Evaluation Criteria and Analysis

Intersection operations analysis results were compared to ODOT and the county standards and targets to assess performance and potential improvement. The City appears not to have traffic operational standards, so a v/c ratio of 0.95 was used, equivalent to both a state district-level highway v/c target in the Oregon Highway Plan (OHP) and Jackson County's inside-MPO standard. Jackson County and ODOT use volume to capacity (V/C) ratios, which compare traffic volume entering an intersection to theoretical capacity of an intersection. A v/c ratio of 1.0 indicates an intersection operating at capacity, while a v/c ratio over 1.0 indicates an intersection's capacity is exceeded.

The 1999 OHP mobility standards (amended in 2015) were used to evaluate v/c ratios for state highways in an MPO. Under the OHP, the maximum acceptable V/C ratio for I5 and the interchange ramp terminals is 0.85 and 0.95 for OR99. Jackson County uses V/C standard of 0.95 for intersections within an MPO.

The intersection operations analysis was conducted using SIDRA Version 7 software, with Highway Capacity Manual (HCM) 2010 methodologies. Signalized intersection V/C's were calculated using the critical volume to capacity ratio process described in HCM 2010. The I5 mainline segments and merge/diverge areas were analyzed with HCS 2010. Queuing was developed using the SIDRA software.

Volume Development

The 2040 volumes were grown from the 2016 30th highest hour volumes developed in Technical Memorandum #4. This aggregates the 2016 existing year conditions with the through trip growth and separate estimates of residential, commercial and industrial growth to compute the 2040 future volumes. See Appendix A for calculations and volume components for developing 2040 volumes.

The background through trip growth is based on historical Jackson County counts and ODOT's Future Volume Tables. These were taken approximately where the study area roadways cross the Urban Growth Boundary (UGB).

The residential, industrial, and commercial growths were based on differences between the 2040 and 2016 values in Technical Memorandum #3. New single family homes, manufactured homes, and apartments were placed following City zoning and direction.

Residential volumes were calculated using Institute of Traffic Engineers (ITE) Trip Generation equations and then distributed to destinations.

In determining commercial and industrial growth, commuters traveling in and out of the city were split out from internal city commuters. ODOT's Statewide Integrated Model (SWIM) determined percentages of commuters traveling to Jackson County (Medford area), Josephine County (Grants Pass area) and local destinations, which determined:

- 32% of workers commuting via a vehicle go or from Jackson County
- 42% of workers commuting via a vehicle go or from Josephine County
- 26% commute locally

The commuter trips were further modified with American Community Survey (ACS) 2010-2015 commuting-to-work data for Rogue River:

- 13% walked/other
- 9% worked from home
- 8% carpooled

Commuting commercial and industrial employees going outside Rogue River were reduced by the carpool percentage. Local commercial employees were reduced by the walk/other and working from home percentages, while industrial employees were only reduced by the walk/other percentage.

SWIM determined commercial employee trip generation. The ITE Trip Generation "General Light Industrial" equation ~~was~~ converted industrial employees to trips. A combination of typical land use types (i.e. gas station, motel, specialty retail, etc.) determined the inbound/outbound percentages.

SWIM also determined distribution of trips using the 2034 future scenario. The surrounding area was split into districts indicated below. "Outside" zones are trips to anywhere else, such as to Douglas County or California. The resulting distributions were generally consistent with the ACS, commuter patterns, and local perceptions. The general trip distribution was:

- From/to rest of Jackson County (via I5 and OR99) : 28%
- From/to Josephine County (via I5 and OR99): 47%
- From/to zones south of OR99 (via OR99 in both directions) : 20%
- From/to Outside zones (via I5, both directions) : 5%

The resulting individual residential, commercial, industrial, and total 2040 volumes are shown in Appendix A.

2040 Existing Conditions Analysis Results

Preliminary Signal Warrants

Preliminary Signal Warrants (PSW) were evaluated to determine if study area intersections were eligible for potential traffic control changes including signalization.

ODOT’s Preliminary Signal Warrants (PSW) are based on Manual of Uniform Traffic Control Devices (MUTCD) Warrant 1 (Case A and B). Case A and B deal primarily with high volumes on the minor street and high volumes on the major street, respectively. Meeting preliminary signal warrants does not guarantee that a signal (or other change) will be installed. An intersection traffic control study would be needed by the appropriate jurisdiction weighing costs and benefits of such a change. For example, traffic signals can degrade a previously non-stopped major roadway while enhancing minor street operation. A traffic signal may introduce safety hazards that outweigh the benefits. In ODOT’s jurisdiction, traffic signal warrants must be met and the State Traffic Engineer’s approval obtained before a traffic signal is installed. No intersections met PSW’s for 2040; however Main & Pine Street and Pine & Depot Street are close.

Volume to Capacity ratio & Level of Service

For 2040, future volumes were evaluated to describe operating conditions. Table 1 shows v/c ratios for project area intersections; some are beyond the maximum allowable V/C ratio (0.85 or 0.95 for OHP) or 0.95 for county jurisdiction. For additional information on operation, delay-based LOS is shown.

Table 1: 2040 V/C Ratios & LOS

Intersection	LOS ¹	Highest Movement ²	V/C Ratio ³	Queue ⁴ (ft)	Agency	Standard
Depot St at Pine St	F (east)	EB	0.72	max	City	0.95
Depot St and I5 NB	B	SB	0.85	max	ODOT	0.85
Depot St and I5 SB	F	NB	0.87	max	ODOT	0.85
Depot St and OR99	E	EB	0.63	275	ODOT	0.85
Depot St and Main St	C (south)	NB	0.36	50	City	0.95
Main St and Wards Creek Rd	B (north)	SB	0.13	< 50	City	0.95
Main St and Cedar St	C (north)	SB	0.29	< 50	City	0.95
Main St and Broadway St	C (north)	SB	0.35	< 50	City	0.95
Foothill Blvd and W Evans Creek Rd	B (north)	SB	0.28	< 50	City	0.95
Main St and Pine St	E	WB	1.08	325	City	0.95
N River Rd and Classick Dr	B (east)	EB	0.13	< 50	City	0.95

¹Corresponding leg that applies to the LOS is shown.

²The Highest Movement describes queues

³Black cells are V/Cs at or exceeding standard

⁴Black cells are queues that block other intersections

Table 2 shows the v/c for mainline I5 and the merge and diverge areas of the ramps. Under normal operation I5 should perform quite well, as seen in Table 2; no locations were over the 0.85 maximum OHP v/c target. Analysis worksheets are in Appendix B.

Table 2: 2040 Mainline & Merge/Diverge v/c for I5 at Rogue River Interchange

Section	V/C
NB north of interchange	0.28
SB north of interchange	0.28
NB Diverge from I5	0.62
SB Diverge from I5	0.61
NB between ramps	0.23
SB between ramps	0.23
NB Merge onto I5	0.67
SB Merge onto I5	0.65
NB south of interchange	0.28
SB south of interchange	0.28

Average Daily Traffic to Capacity Ratio

With high volume to capacity ratios on Depot and Pine Streets and potential extensive queuing, peak spreading was investigated. This is when more traffic is on the roadway network than can be handled in a single peak hour and traffic spreads into adjacent hours. Adjacent peak hours will still be busy. Any spreading to occur in Rogue River would spread later beyond the 3:30-4:30 PM system peak hour as the school release time limits this from moving earlier in the day. The ADT/C ratio measures the potential of peak spreading and impact of congestion. The ADT/C is the ratio of daily traffic to capacity (capacity is defined by intersection approach). The highest approach ADT/C is reported for each intersection, except for Depot and Pine Street as the Classick Drive ADT/C was excessively high due to a very low approach capacity.

Table 3: 2040 ADT/C Ratio:

Intersection	Highest ADT/C
Depot St at Pine St	7.01
Depot St and I5 NB	10.36
Depot St and I5 SB	9.10
Depot St and OR99	6.31
Depot St and Main St	10.76
Main St and Wards Creek Rd	1.17
Main St and Cedar St	2.94
Main St and Broadway St	5.80
Foothill Blvd and W Evans Creek Rd	3.43
Main St and Pine St	12.94
N River Rd and Classick Dr	1.30

The ADT/C methodology was developed for FHWA (i) and has been used by ODOT for the statewide congestion management system. It is a higher level of congestion rating compared to queuing. ADT/C thresholds are as shown in Table 4.

ADT/C ratios of 6.75 – 10.75 are more of the standard peak “15-min” typical urban congestion that stays within a single hour. Peak spreading is more likely to occur once the ADT/C exceeds 10.75 when speeds decrease for good portions of the peak hour. Peak spreading is occurring with ADT/C’s of 15.25 or greater.

Table 4: ADT/C Congestion Level Thresholds

Level	Condition	Description	Lower ADT/C	Upper ADT/C
1	Uncongested	No decrease in speeds during the peak hour.	0.00	6.75
2	Uncongested to Moderately		6.75	8.25
3	Moderately Congested	Speeds decrease slightly during portions of the peak hour.	8.25	9.25
4	Moderately to Congested		9.25	9.75
5	Congested	Speeds decrease significantly during portions of the peak hour.	9.75	10.75
6	Congested to Very		10.75	12.25
7	Very Congested	Speeds decrease substantially for substantial portions of the peak hour.	12.25	13.75
8	Very to Extremely		13.75	15.25
9	Extremely Congested	Speeds decrease substantially for more than the peak hour.	15.25	24.00

Peak spreading was investigated and while peak hours will be heavy through the entire hour, trips will likely not delay to another hour. Main & Pine Street’s high potential for extended congestion, reflected in queuing and ADT/C, merits investigation for improvements.

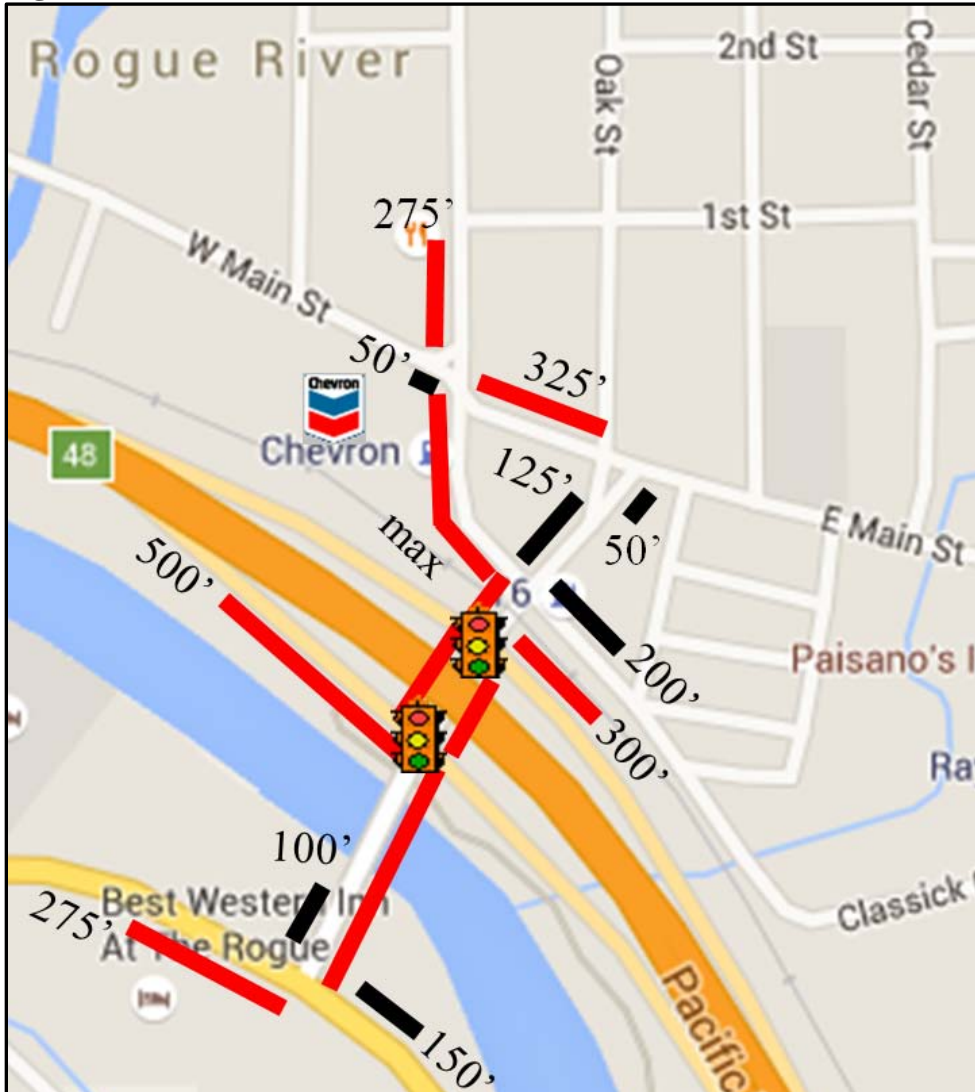
95th Percentile Queues

In addition to V/C ratios, ADT/C ratios, and LOS, the 95th percentile queues were analyzed to better understand system operation. Excessively long queues are often seen in areas where V/C ratios exceed standards. Figure 1 shows 2040 95th percentile queuing of the study area. The largest queuing concerns are:

Depot Street and Pine Street: eastbound queue extends to intersection of Main Street and Pine Street. Therefore, the southbound queue waiting for a gap in traffic may extend more than shown, affecting Depot Street.

Depot St and I5 NB: southbound and northbound queues extend to the Pine Street intersection as well as the southbound ramp. The 300 foot queue is a concern as it potentially extends into the ramp deceleration portion.

Figure 1: 95th Percentile Queues



Depot St and I5 SB: southbound and northbound queues extend 700 and 800 feet respectively. This means the queue goes from intersection ramp to intersection ramp (both directions). This also means there is a queue that spills back to OR99. The 500 foot queue up the ramp is a significant concern as it may extend into the ramp deceleration portion.

Depot St and Main St: with only a minor delay at one intersection, there will be continuous standing traffic from OR99 to Main Street (entire length of Depot Street). The queue from Pine Street and Main Street will affect operation of this intersection.

The constrained interchange section can cause a number of operational issues. Any kind of incident or delay (parking operation or large truck turning) on Depot Street or a train crossing can quickly create congestion up the ramps and onto I5 mainline. Extending

queues into the ramp deceleration portion or mainline traffic is a safety issue. Drivers may have to prematurely brake or brake harder than expected. This would increase the potential of rear-end crashes. The southbound off-ramp is more likely to have this problem more often than the northbound direction.

Southbound ramp terminal geometry is tight enough that trucks turning left can interfere with vehicles waiting in the left turn lane to head south on I5. The ramp is between I5 and the Rogue River Greenway and the Rogue River.

Non-Motorized Operations

The pedestrians and bicyclists counted from 3:00 to 5:00 p.m. were updated with the 40% population growth rate (Technical Memorandum #3) from 2016 to 2040, Tables 5 and 6. There is a base level of use on the pedestrian and bicycle system throughout the City even in the highest vehicular volume areas.

Table 5: Pedestrian Crossings

Intersection	Pedestrian Crossings 3-5PM peak period			
	North	East	South	West
Depot St at Pine St	0	4	0	3
Depot St and I5 NB	1	10	0	10
Depot St and I5 SB	3	6	4	8
Depot St and OR99	0	1	3	3
Depot Stand Main St	11	7	8	48
Main St and Wards Creek Rd	4	0	N/A	3
Main St and Cedar St	36	17	N/A	3
Main St and Broadway St	14	4	N/A	14
Foothill Blvd and W Evans Creek Rd	5	15	N/A	0
Main St and Pine St	14	13	39	20
N River Rd and Classick Dr	6	N/A	0	0

Bicycle, pedestrian, and transit are largely influenced by adjacent modes. Without any planned projects, there is no difference between the 2016 and 2040 conditions. As traffic congestion grows comfort of bicyclists and pedestrians will decrease. Congestion at the interchange and surrounding roadways may cause issues with transit schedule.

Table 6: Bicycle Movements

Intersection	Bicycles Entering Volumes 3-5PM peak period			
	North	East	South	West
Depot St at Pine St	0	0	4	1
Depot St and I5 NB	1	0	4	N/A
Depot St and I5 SB	1	N/A	4	0
Depot St and OR99	11	4	0	0
Depot St and Main St	0	0	1	1
Main St and Wards Creek Rd	1	0	N/A	1
Main St and Cedar St	No Data	No Data	N/A	No Data
Main St and Broadway St	0	1	N/A	3

Foothill Blvd and W Evans Creek Rd	3	0	N/A	1
Main St and Pine St	0	0	0	1
N River Rd and Classick Dr	0	N/A	0	0

Summary

There are intersections beyond the maximum allowable v/c ratios in 2040 specifically at the interchange and along Pine Street. None of these intersections meet PSWs. Queuing and congestion along Pine and Depot Streets are extensive. This may cause issues on I5 off-ramps as drivers may need to brake prematurely, increasing the potential of crashes. Increasing vehicular flows will mean decreased bicycle and pedestrian comfort as well as less reliable transit service.

If you have any questions, please feel free to contact me at 503-986-4112.

cc: Peter Schuytema, TPAU
 Brian Dunn, TPAU
 Michael Baker, Region 3 Planning
 Dan Dorrell, District 8 Traffic
 File

(i) Estimating the Impacts of Urban Transportation Alternatives, Participant’s Notebook, FHWA/NHI December, 1995.