OR62 Expressway at Vilas Road: Interchange Area Management Plan Traffic Analysis

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EXECUTIVE SUMMARY

The purpose of this analysis is to support ODOT Region 3 in the preparation of an Interchange Area Management Plan (IAMP) for a new interchange located at OR62 Expressway and Vilas Road. In the 2012 "I-5 to Dutton Road Final Environmental Impact Statement" (FEIS) it was proposed to build a new highway from the I-5/OR62 Interchange in Medford to approximately Dutton Road north of White City in Jackson County. In 2009, the Oregon Legislature enacted the Jobs and Transportation Act (JTA) which earmarked funds for the OR62 project. These funds are insufficient to cover the entire project, so it is analyzed in two phases defined in the bullet points below.

- Phase 1(JTA Build) extends north only to the southern boundary of White City connecting to existing OR62 at an intersection (not an interchange).
- Phase 2 (Full/SD Build) extends north to Dutton Road north of White City connecting with an interchange.

The first phase of the project (JTA Build) is currently under construction and is expected to be completed in 2019. This study focuses exclusively on the feasibility and potential implications of an interchange with OR62 at Vilas Road.

The project is located on the northern edge of Medford within the urban growth boundary; however, Vilas Road is maintained by Jackson County. The study area is bounded to the west by Hamrick Road, to the east by Crater Lake Avenue, to the north by Wilson Road, and to the south by Commerce Drive.

The JTA build (Phase 1 as defined above) is included in <u>all</u> scenarios, including those that are described as "No-build". The JTA funds are already committed to the project so they are included in the "No-build" scenario. Also included are all planned RTP Tier 1 improvements in the project area and vicinity. These planned improvements are in the Rogue Valley Metropolitan Plan Organization (RVMPO) 2009-2034 RTP. Here "No-build" only indicates that no OR62/Vilas Road interchange is built.

<u>No-build/No-mitigation</u> (NBNM) represents the base conditions for the project area. No interchange is included. No modifications are made. The lane geometry, intersection control type, and bike/pedestrian facilities are left as is, but Tier 1 projects are included.

<u>Scenario 0 Tier 1 No-build</u> is a replica of the NBNM scenario except that the lane geometry and bike / pedestrian facilities <u>are</u> modified attempting to meet standards.

<u>Scenario 0 Tier 2 No-build</u> is a replica of the NBNM scenario except that the lane geometry and bike / pedestrian facilities <u>are</u> modified attempting to meet city and county standards. Additionally, the Tier 2 projects within the study area are included.

The Two-lane or Four-lane Vilas Road scenarios include either two or four through lanes on Vilas Road. The Tight Diamond or Roundabout scenarios model one of these interchange types.

Two geometry changes are required for all scenarios beyond the NBNM and are assumed in the analysis:

- Peace Lane will need to be realigned with Airway Drive and signalized.
- Crater Lake Avenue is realigned 1,000 feet to the east of the current location.

The 30th highest hour volumes used in this analysis were developed mostly using the 24 hour and 16 hour 2014 counts previously taken for the FEIS, the Jackson County TSP, and local development projects.

To create the future year 2040 volumes, the existing 2015 DHV was post-processed using RVMPO v4.2 travel demand model. At intersections where counts were not available, such as on the new OR62 bypass route, the volumes from the 2035 SD Full Build Synchro file from the FEIS analysis were used. These 2035 volumes are also adjusted to future year 2040 to match the rest of the segments in this process. The post-processing followed the National Cooperative Highway Research Program (NCHRP) Report 255/765 guidelines.

In 2040, for both the Tight Diamond and the Roundabout Interchange Scenarios, almost all of the mainline free-flow segments, ramps, and merge/diverge sections are projected to meet the ODOT Highway Design Manual (HDM) volume-to-capacity (v/c) standards.

The intersections of Hamrick Road and Table Rock Road with Biddle Road are over capacity in almost every scenario. This intersection is a standalone issue with or without any Vilas Road interchange improvements. The build scenarios do lower the v/c and LOS, but generally not enough to meet standards.

In the NBNM scenario queuing problems are mainly westbound on Vilas Road, essentially across the entire study area. The No-build with mitigations scenarios improve the queuing in some locations, but not others. Generally the queuing issues just get shifted around without a single solution existing to mitigate all of the issues; however, adding four-lanes to Vilas Road and including the Tier 2 projects decreases the network delay and total travel time as well as increasing the speed.

The unsignalized, like the signalized, Roundabout Scenario intersection v/c and LOS are very similar to the Tight Diamond Scenarios outside of the ramp terminals. None of the roundabout scenarios are viable because of over-capacity issues at one or both ramp terminals. Within the NBNM scenario, all of the unsignalized intersections are over capacity and have an LOS F.

Consistent across most scenarios, there is significant queuing between the northbound and southbound ramps extending east and west. In the case of the Tight Diamond Interchange with the JTA Build, the four-lane Vilas Road increases the northbound and

southbound queues on Hamrick Road because it is held at two-lanes and cannot accommodate the additional capacity created by four-lanes on Vilas Road. In the case of the Full Build, four-lanes on Vilas Road significantly improves the queues both eastbound and westbound on Vilas Road. The Vilas Road intersections with Crater Lake Avenue and Crater Lake Highway are also shorter. This is caused by the increased capacity the through lanes add. The OR62 interchange introduces significant intersection blockage.

Without the inclusion of the Tier 2 projects, the two-lane Vilas Road scenarios are not viable. They consistently function poorly due to queues backing up along the entire length of Vilas Road, often extending west beyond Table Rock Road and all the way to Pine Street / Biddle Road and east to Crater Lake Avenue.

The NBNM scenario has the most crashes of the no-build scenarios. The JTA Build crash occurrence slightly increases with the addition of the Tier 2 projects, while the Full Build scenario crash frequency is decreased when Tier 2 projects are included. Excluding the No-build scenarios, the Full Build four-lane Vilas Road Tier 2 Roundabout Scenario has the lowest predicted crash frequency. The larger capacity produced by the four-lane Vilas Road scenarios results in higher crash frequencies due to the higher volumes. The addition of the Tier 2 projects may have been expected to increase the crash frequencies due to the added roadway mileage; however, the projects actually caused traffic to be better distributed across the increased route options thereby lowering the effective volume present at each segment. Because the crash analysis output is largely driven by traffic volume, the inclusion of the Tier 2 projects reduces the predicted crash frequency in most scenarios.

A Multimodal Level of Service Analysis was used to determine the need and potential for multimodal mitigations. Adding a sidewalk generally improves the pedestrian LOS to C or better, except for along Pine Street / Biddle Road, Table Rock Road, and Crater lake Highway. Separated multi-use paths are suggested for these locations. The transit LOS is poor because it is determined by limited frequencies. Frequencies are partly determined on funding and land use density, so this reflects the best available service.

Overall, the Full Build four-lane Vilas Road Tier 2 Tight Diamond Scenario has the best results in all measures. Although the No-build scenarios (both Tier 1 and Tier 2) were not the very best functioning scenarios, they improved over the NBNM and performed very well. Both have zero blocked intersections and only five or six blocked turn storage bays which is about a 50% improvement from the NBNM. The overall network travel time is slightly better with the inclusion of the Tier 2 projects. No-build Tier 2 has the lowest overall network travel time of any scenario. The number of locations over capacity is decreased from four to three in No-build Tier 1 and to two in No-build Tier 2.

The worst functioning scenario is the Full Build Two-lane Vilas Road Roundabout which creates conditions worse than the NBNM. With only two through lanes on Vilas Road and without the additional network created by the inclusion of the Tier 2 projects, coupled with the roundabout interchange, extremely long queues and significant

intersection and turning bay blockages exist. The JTA Build Four-lane Vilas Road Tight Diamond also performs poorly. Generally, the Tier 2 scenarios perform better than Tier 1.

With no-mitigation, the entire study area will have extensive queuing and congestion. All scenarios function better with the inclusion of the Tier 2 projects. Vilas Road should be widened to four through lanes as this significantly improves functionality. Therefore, the scenarios with those characteristics are good options. The No-build scenarios are also viable options with the lowest crash rates, shortest overall network travel times, low intersection and turning bay blocking and only a couple of locations exceeding capacity.

BACKGROUND INFORMATION

The purpose of this analysis is to support ODOT Region 3 in the preparation of an Interchange Area Management Plan (IAMP) for a new interchange located at Oregon 62 Expressway and Vilas Road. In the 2012 "I-5 to Dutton Road Final Environmental Impact Statement" (FEIS) it was proposed to build a new highway from the Interstate 5/ OR62 Interchange in Medford to approximately Dutton Road north of White City in Jackson County. This analysis has built on and remained consistent with the FEIS as much as possible. In 2009, the Oregon Legislature enacted the Jobs and Transportation Act (JTA) which earmarked funds for the OR62 project. These funds are insufficient to cover the entire project, so it is analyzed in two phases defined in the bullet points below. Both phases will be a four-lane, access-controlled bypass extending north from near I-5 in Medford and include grade separation with free-flowing movements at the southern terminus.

- Phase 1(JTA Build) extends north only to the southern boundary of White City connecting to existing OR62 at an intersection (not an interchange).
- Phase 2 (Full/SD Build) extends north to Dutton Road north of White City connecting with an interchange.

The first phase of the project (JTA Build) is currently under construction and is expected to be completed in 2019. The project goals include reducing congestion and improving safety on existing OR62 in Medford and north through White City by redirecting traffic to the bypass. This study focuses exclusively on the feasibility and potential implications of an interchange with OR62 at Vilas Road.

The project is located on the northern edge of Medford within the urban growth boundary; however, Vilas Road is maintained by Jackson County (Figure 1). The study area is bounded to the west by Hamrick Road, to the east by Crater Lake Avenue, to the north by Wilson Road, and to the south by Commerce Drive (Figure 2).

Figure 1: Vicinity Map

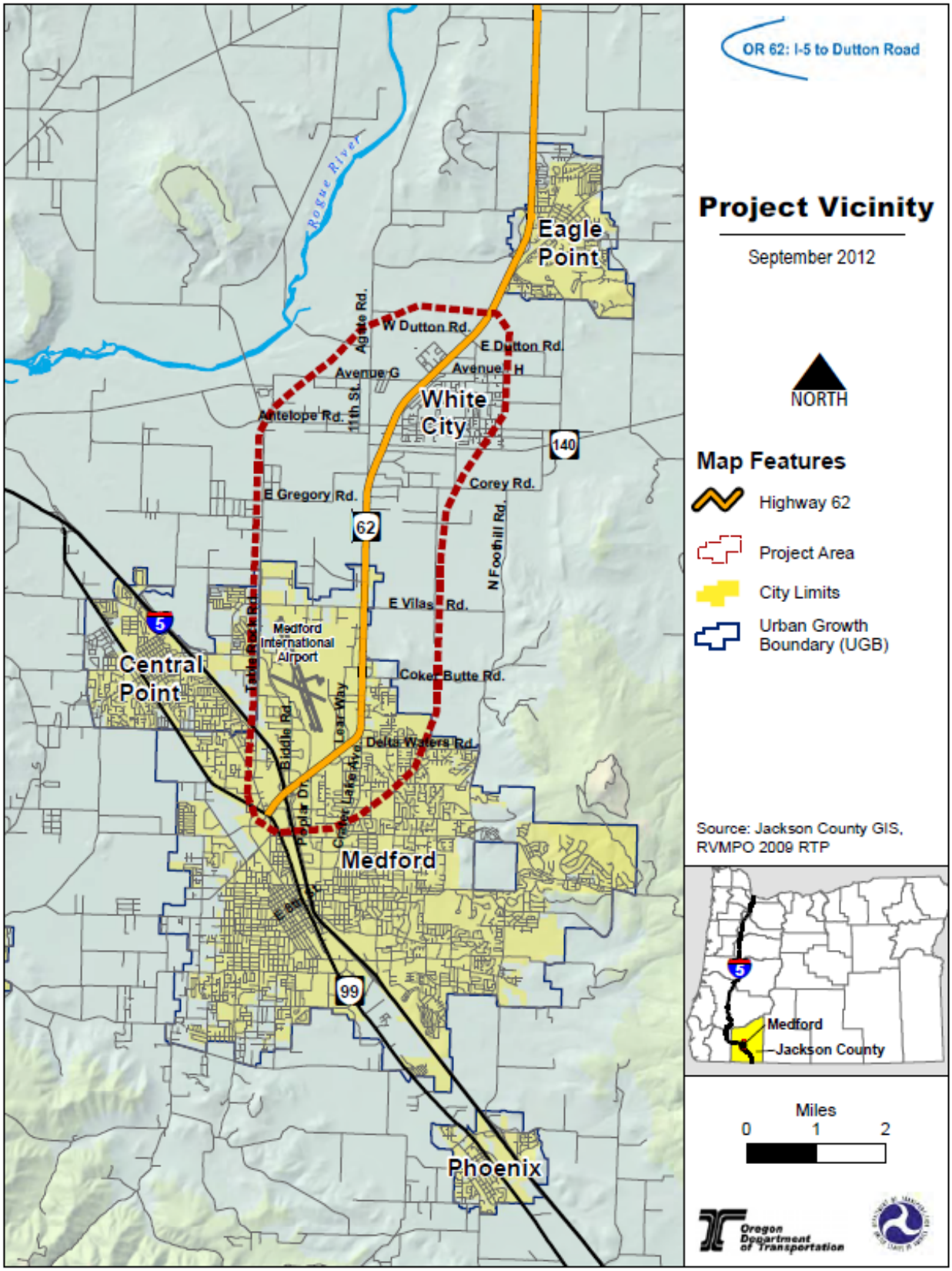
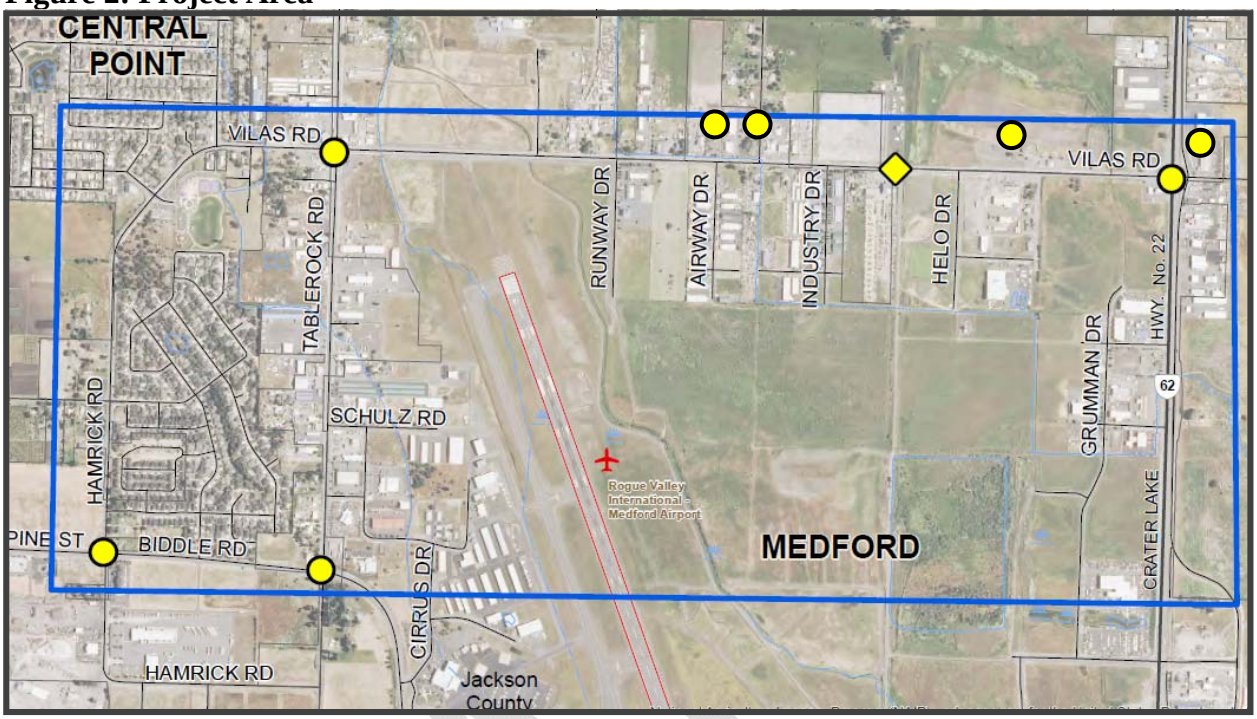


Figure 2: Project Area



Operational Standards

To evaluate the operational standards for the "No-build" scenarios, the 1999 Oregon Highway Plan (OHP) Volume to Capacity Ratio (v/c) targets for a Metropolitan Plan Organization (MPO) were used. The only intersection this causes a different v/c standard to be used than in the build scenarios is Vilas Road and Crater Lake Highway (CLH) which both have a v/c target of 0.85 for the "No-build". This is because the ramp terminals and OR62 obviously do not exist in the "No-build" scenarios and the other intersections follow county or city standards, not the ODOT Highway Design Manual (HDM).

To evaluate the "Build" Scenarios, the 2012 ODOT HDM standard of 0.75 is used for the Interstate Highways and Statewide (NHS) Expressways within an MPO when appropriate. Otherwise the Jackson County 0.95 v/c, the City of Central Point 0.90 v/c, or the City of Medford LOS D standard is used. It is possible that some intersections currently under Jackson County jurisdiction may change over time to the City of Medford due to increased volumes, future annexations, UGB expansions, etc. For this reason the LOS D requirement is considered in addition to the v/c. Table 1 summarizes the OHP, HDM, and local v/c standard/target applicable to each intersection.

Table 1: Build Scenario v/c Standards / Targets for each intersection

Intersection	Standard/Target			
	ODOT (V/C Ratio)		Local	
	OHP[1]	HDM[2]	V/C Ratio	LOS
OR62	0.85	0.75	NA	NA
Vilas Rd & Table Rock Rd	NA	NA	0.90[7]/0.95[3]	D[4]
Vilas Rd & Airway Dr/Peace Ln	NA	NA	0.95[4]	D[4]
Vilas Rd & Lear Wy	NA	NA	0.95[4]	D[4]
Vilas Rd & Crater Lake Hwy	0.85	0.75	NA	D[3]
Vilas Rd & Crater Lake Ave	NA	NA	0.95[4]	D[4]
Table Rock Rd & Biddle Rd	NA	NA	0.90[7]/0.95[3]	D[4]
Biddle Rd & Hamrick Rd	NA	NA	0.90[5]	D[3]

[1] Oregon Highway Plan. The 0.85 target applicable to most intersections is based on the classification of OR 62 as a "Freight Route on a Statewide Highway" and "Statewide Expressway" and location within a metropolitan planning organization area inside an urban growth boundary. See Table 6 of the OHP, as amended December 21, 2011. Used for all "No-build" scenarios.
[2]ODOT Highway Design Manual. Used for all build scenarios.
[3]Jackson County standard
[4]City of Medford standard
[5]Central Point standard
[7]West leg under Central Point standard 0.90

SCENARIO DEFINITIONS/DESCRIPTIONS

The IAMP traffic analysis includes 19 scenarios with unique combinations of geometry, interchange type, and level of Regional Transportation Plan (RTP) projects included. For this reason, it is critical to clearly define and name these scenarios.

The JTA build (Phase 1 as defined above) is included in all scenarios, including those that are described as "No-build". The JTA funds are already committed to the project so they are included in the "No-build" scenario. Also included are all planned RTP Tier 1 improvements in the project area and vicinity. These planned improvements are in the Rogue Valley Metropolitan Plan Organization (RVMPO) 2009-2034 RTP. The extension of Lear Way from Coker Butte Road to Vilas Road is the only Tier 1 project that creates a new intersection on Vilas Road that is included in the base "No-build" Scenario. Here "No-build" only indicates that no OR62/Vilas Road interchange is built.

No-build/No-mitigation represents the base conditions for the project area. No interchange is included. No modifications are made. The lane geometry, intersection control type, and bike/pedestrian facilities are left as is, but Tier 1 projects are included.

In all other scenarios, available mitigations were used in an attempt to meet the v/c and LOS standards/targets for all intersections. The mitigations applied to the No-build/No-mitigation scenario to create the No-build/Mitigated scenarios are listed in Appendix A.

Scenario 0 Tier 1 No-build is a replica of the No-build/No-mitigation except that the lane geometry and bike / pedestrian facilities are modified attempting to meet city and county v/c, LOS, and MMLOS standards. Also signals are added where Preliminary Signal Warrants have been met. Refer to Appendix B for map and complete list of Tier 1 projects.

Scenario 0 Tier 2 No-build is a replica of the No-build/No-mitigation except that the lane geometry and bike / pedestrian facilities are modified attempting to meet city and county v/c, LOS, and MMLOS standards. The mitigations applied to the No-build/No-mitigation scenario to create the No-build/Mitigated scenarios are listed in Appendix A. Also signals are added where Preliminary Signal Warrants have been met. Additionally, the Tier 2 projects within the study area are included (see Table 2). There are other Tier 2 projects that were added into the model runs that were not in the direct study area (Table 3). The effects of these are included. Also, refer to Appendix B for map and complete list of Tier 2 projects.

Table 2: Tier 2 Projects Within Interchange Management Study Area (IMSA)

Project No.	Location	Project Type	Proposed Project Description
626	Peace Ln – Vilas Rd to City Limits	Urban Upgrade	Upgrade to minor collector standard including one lane in each direction, bike lanes, and sidewalks
628	Lear Way - Vilas Rd to northern city limits	New Roadway	Construct new minor collector roadway (includes one lane each direction, bike lane, and sidewalk)
632	Vilas Rd – Table Rock to eastern UGB	Widening	Widen to major arterial standard including two-lanes in each direction, center turn-lane, bike lanes, and sidewalks
I39	Crater Lake Ave & Vilas Rd	Intersection	Re-align Crater Lake Ave to the east and install traffic signal
I40	Crater Lake Highway & Vilas Rd	Intersection	Monitor needs after construction of Crater Lake Highway Bypass
I44	Vilas Rd & Lear Way	Intersection	Install traffic signal or roundabout when warranted
I43[1]	Vilas Rd & Industry Dr	Intersection	Install traffic signal or roundabout when warranted

[1]This project was subsequently modified due to the FEIS for OR62 showing Industry Dr ending in a cul-de-sac south of Vilas Rd due to the proximity to the Vilas Rd interchange. Project 629 extends from Coker Butte Rd and connects to Vilas Rd via Airway Dr.

Table 3: Tier 2 Projects in Model Runs but Outside Direct IMSA

Project No.	Location	Project Type	Proposed Project Description
629[1]	International Wy – Vilas to Coker Butte	New Roadway	Construct new major arterial roadway (includes center turn-lane, bike lane, and sidewalk)
630	Springbrook Rd - Coker Butte to Vilas Rd	New Roadway	Construct new major collector roadway (includes center turn-lane, bike lane, and sidewalk)
631	East-West collector- CLH to Eastern UGB between Coker Butte and Vilas Rd	New Roadway	Construct new minor collector roadway (includes one lane each direction, bike lane, and sidewalk)

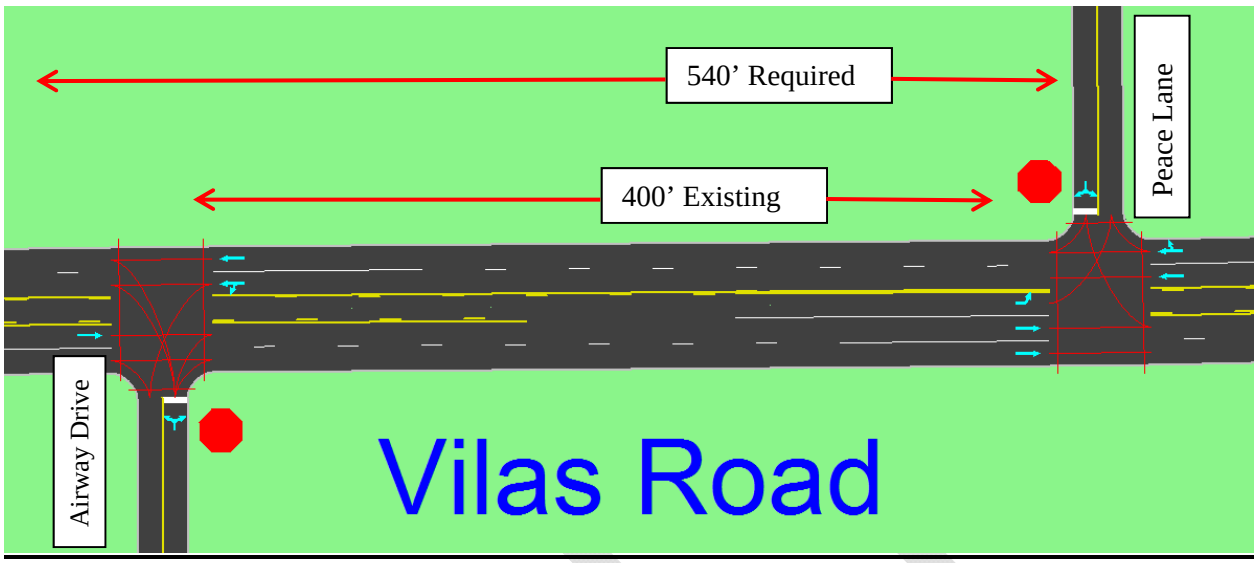
Two-lane or Four-lane Vilas Road scenarios include either two or four through lanes on Vilas Road. Because there is a Two Way Left Turn Lane (TWTL) present, the actual cross sections would be three or five lanes; however, a TWTL has no bearing on the analysis as there is no way to analyze or simulate its presence.

Tight Diamond or Roundabout scenarios model one of these interchange types. In the tight diamond the new OR62 bypass will cross over Vilas Road with a tight diamond interchange including signals at the ramp terminals. The Roundabout interchange will generally have the same footprint, but with roundabouts replacing the signals.

For all scenarios except the No-build/No-mitigation:

- Peace Lane has been realigned to intersect with Vilas Rd at Airway Drive. This was done because the feasibility of signalizing Airway Drive and/or Peace Lane at Vilas Road was assessed using a functional area application – geometric adequacy calculation performed according to the Analysis Procedures Manual (APM) v2 4.8 as diagramed in Figure 3. The individual intersections would cease to function without the realignment because there is not physically enough linear space between the two intersections to accommodate the required turn lanes. Overlapping functional areas would lead to operational difficulties and potential safety issues as there would be multiple driver decision points too close together. Figure 3 depicts a two-lane Vilas Road scenario and the left turn lanes are at maximum length with the 400 feet of linear space available. This is not sufficient to accommodate the necessary acceleration, reaction distance, legal turn signal distance (by the Oregon Vehicle Code), and deceleration. See Appendix C for details of this analysis.
- Crater Lake Avenue is realigned 1,000 feet to the east of the current location. Although this is a Tier 2 project (I39), it was determined to be necessary in order to allow the intersections of Crater Lake Avenue and Crater Lake Highway (current OR62) with Vilas Road to function. In the current configuration the intersections are only 140 feet apart. The intersections cease to function at this close proximity.
- In all scenarios except “No-build/No-mitigation” the lane geometry and bike / pedestrian facilities are modified attempting to meet v/c, LOS, and MMLOS standards. Also signals are added where preliminary signal warrants have been met.

Figure 3: Airway Drive and Peace Lane Geometric Adequacy



Scenarios Naming Convention

The following naming convention has been implemented to aid in communication regarding the large number of scenarios and will be used throughout the rest of the document and is shown in Table 4 below.

S_Scenario#_T_RTP Project Tiers Included_R(if it is a roundabout interchange, blank for tight diamond)

For Example, Scenario 1 including the Tier 2 projects with a tight diamond interchange would be S1T2.

Table 4: Scenario Names and Descriptions

Name	OR 62 Phase	# of Vilas Rd through lanes	Interchange Type	RTP Projects Included
No-build/No-mitigation	JTA	2	None	Tier 1
S0T1	JTA	2	None	Tier 1
S1T1	JTA	2	Tight Diamond	Tier 1
S2T1	JTA	4	Tight Diamond	Tier 1
S3T1	Full	2	Tight Diamond	Tier 1
S5T1	Full	4	Tight Diamond	Tier 1
S0T2	JTA	2	None	Tier 2
S1T2	JTA	2	Tight Diamond	Tier 2
S2T2	JTA	4	Tight Diamond	Tier 2
S3T2	Full	2	Tight Diamond	Tier 2
S5T2	Full	4	Tight Diamond	Tier 2

Name	OR 62 Phase	# of Vilas Rd through lanes	Interchange Type	RTP Projects Included
S1T1R	JTA	2	Roundabout	Tier 1
S2T1R	JTA	4	Roundabout	Tier 1
S3T1R	Full	2	Roundabout	Tier 1
S5T1R	Full	4	Roundabout	Tier 1
S1T2R	JTA	2	Roundabout	Tier 2
S2T2R	JTA	4	Roundabout	Tier 2
S3T2R	Full	2	Roundabout	Tier 2
S5T2R	Full	4	Roundabout	Tier 2

VOLUME DEVELOPMENT

Seasonal Adjustment Factor

The 30th Highest Hour Volumes used in this analysis were developed using mostly the 24 hour and 16 hour 2014 counts previously taken for the FEIS, the Jackson County TSP, and local development projects by the Region 3 Traffic Section. It was necessary to request additional peak 3-hour turning movement counts at the intersections of Airway Drive and Industry Drive with Vilas Road in November, 2017 in order to include the RTP Tier 2 projects. Table 5 depicts a summary of the traffic counts and the actual counts are available in Appendix D.

Table 5: Traffic Count Summary

Intersection	Count Date	Count Type
OR62 & Vilas Rd	6/19/14	16-hr video
Table Rock Rd & Biddle Rd	6/17/14 – 6/18/14	24-hr video
Hamrick Rd & Biddle Rd	6/17/14 – 6/18/14	24-hr video
Table Rock Rd & Vilas Rd	6/17/14	16-hr video
Airway Dr & Vilas Rd	11/1/17	3-hr video
Industry Dr & Vilas Rd	11/1/17	3-hr video

The intersections will be analyzed using a system peak hour determined by the 2012 Final Environmental Impact Statement (FEIS), 4:15 pm – 5:15 pm. An on-site Automatic Traffic Recorder (ATR) is not available, so to seasonally adjust to the 30th Highest Hour Volumes the ATR Characteristic Table Method is employed. ATRs are identified with similar characteristics to the site. The project area's AADT in the Transportation Volume Table must be within +/- 10% of the ATR's AADT. When no comparable ATR is available, the Seasonal Trend Table is used to factor counts taken outside of the peak period. The study area demonstrates a commuter trend. Table 6 summarizes the seasonal trend factors used.

The Transportation Volume Tables (TVT) are referenced to average an ADT percentage for the peak month and also for the count month. Five years of data is analyzed. The high and low values are removed and the remaining three years are averaged Appendix D (removed values are greyed out). To calculate the seasonal adjustment factor, the peak month value is divided by the count month value.

The 2016 Seasonal Factor Table is used to calculate the Commuter Trend factor applicable at the previously defined legs. The seasonal factor for the count period is divided by the seasonal factor for the peak period. Seasonal factors are given for the 1st and 15th of each month, so it is necessary to interpolate to the date of the counts (June 17 and June 19), but for the 2017 counts the value can be used directly (November 1). The relevant tables and calculations for the Volume Development are in Appendix D.

Table 6: Seasonal Factors

Intersection	Leg	Seasonal Adjustment Source	Seasonal Factor
Table Rock Rd & Biddle Rd	East	Eugene - Meadowview ATR 20-024	1.02
	West		
	North	Seasonal Trend Table	1.05
	South		
Hamrick Rd & Biddle Rd	East	Eugene - Meadowview ATR 20-024	1.02
	West	West Beltline ATR 20-028	1.01
	North	Seasonal Trend Table	1.05
	South		
Table Rock Rd & Vilas Rd	East	Seasonal Trend Table	1.05
	West		
	North		
	South	Eugene - Meadowview ATR 20-024	1.02
CLH & Vilas Rd	East	Seasonal Trend Table	1.05
	West		
	North	West Beltline ATR 20-028	1.01
	South	Clackamas 03-017 and Gresham 26-003(Averaged)	1.025
Airway Dr / Industry Dr & Vilas Rd	East	Seasonal Trend Table	1.05
	West		
	North		
	South		

Historical Factors (Factoring to Current Year)

The 2014 and 2017 traffic counts were also adjusted to a common 2015 base year to create inputs for the future volume development. The Future Volume Table was used for the OR62 segments. Historic Jackson County counts were used to develop growth factors for remaining non-state roadways. The remaining roadways were factored back to 2015 from 2017 using the 2017 and 2042 RVMPO model volume outputs. The calculations and growth factors used are in Appendix D.

2040 Future Volume Development

The existing 2015 DHV was post-processed using the RVMPO v 4.2 travel demand model to create 2040 volumes. The current RVMPO v4.2 model is referenced to obtain volumes in order to create factors to calculate future volumes for all scenarios. At intersections where counts are not available, such as on the new OR62 bypass route, the 2035 SD Full Build Synchro file from the FEIS analysis is referenced for the link-based 30th highest hour volumes by summing the turning volumes. These 2035 volumes are also adjusted to future year 2040 to match the rest of the segments in this process. The post-processing followed the National Cooperative Highway Research Program

(NCHRP) Report 255/765 guidelines which created initial 2040 volumes for each study area roadway segment. These initial volumes were balanced at each intersection so the inflows and outflows matched. Turn movements were created using a combination of select-link analyses from the RVMPO model and a turn matrix balance application. Finally, the demand hour volumes (DHV) were balanced across the study area trying to keep the patterns from the FEIS intact as much as possible for consistency. The 2040 DHV's were also converted into average annual daily traffic (AADT) for use in the crash analysis. The future volume development processes are detailed in Appendix E. See Appendix F for the 2040 DHV's.

ANALYSIS RESULTS

Tight Diamond Scenarios

Mainline & Merge/Diverge/Weave Segments

In 2040, almost all of the mainline free-flow segments, ramps, and merge/diverge sections in the study section are projected to be operating acceptably which can be seen in Table 7. HCS 2010 freeway modules are used to determine the v/c on these segments. These analysis outputs are available in Appendix G. Only on the OR62 northbound mainline north of the interchange the v/c is slightly elevated for the JTA Build Tier 1, two and four-lane Vilas Road scenarios. This is an analysis of an afternoon peak period, so higher v/c may be caused by the increased afternoon northbound commuter traffic to White City exacerbated by the concentration of the traffic without the additional travel routes created by the Tier 2 projects and the Full Build.

Table 7: Year 2040 OR62 Mainline and Merge/Diverge/Weave v/c ratios[1]

OR 62 Segment and Merge/Diverge Location										
Scenario	**Mainline South of Interchange**		**Mainline North of Interchange**		**Between Ramps**		**Diverge - Off Ramps**		**Merge - On Ramps**	
	NB	**SB**	**NB**	**SB**	**NB**	**SB**	**NB**	**SB**	**NB**	**SB**
JTA Build										
	+2 Lane Vilas Rd									
S1T1	0.50	0.32	**0.79**	0.53	0.45	0.28	0.48	0.51	0.73	0.30
S1T2	0.50	0.32	0.71	0.58	0.45	0.28	0.49	0.61	0.66	0.30
	+4 Lane Vilas Rd									
S2T1	0.48	0.31	**0.78**	0.54	0.43	0.26	0.48	0.61	0.74	0.29
S2T2	0.48	0.30	0.70	0.59	0.43	0.26	0.48	0.70	0.67	0.29
Full Build										
	+2 Lane Vilas Rd									
S3T1	0.47	0.33	0.69	0.52	0.43	0.31	0.47	0.52	0.66	0.32
S3T2	0.47	0.33	0.67	0.48	0.43	0.30	0.47	0.48	0.64	0.31
	+4 Lane Vilas Rd									
S5T1	0.46	0.32	0.68	0.54	0.42	0.29	0.46	0.53	0.65	0.31
S5T2	0.45	0.32	0.66	0.49	0.41	0.29	0.45	0.49	0.63	0.30

[1]Black-shaded cells indicate that the ODOT HDM 0.75 v/c standard has been exceeded.

Signalized Intersections

Table 8 shows the v/c ratio and LOS results for all of the signalized intersections. Synchro 9 is used to determine these values and the capacity reports are available in Appendix H. The intersections of Hamrick Road and Table Rock Road with Biddle Road are over capacity in almost every scenario, the worst being the No-build/No-mitigation (NBNM). This intersection is a standalone issue with or without any Vilas Road interchange improvements. The build scenarios do lower the v/c and LOS, but generally not enough to meet standards. One issue is that widening Hamrick Road north of Biddle Road was not a possible mitigation in order to remain consistent with Central Point's desire to maintain this as a two-lane roadway. Maintaining a context-sensitive capacity on this section to be most compatible with the surrounding residential land uses in the area is a priority.

The intersection at Table Rock Road and Vilas Road also consistently exceeds v/c standards/targets caused by the higher volumes in 2040, except for scenarios S0T2, S5T1, and S5T2. The addition of the Tier 2 projects to the No-build adds more potential travel routes reducing the demand at this intersection. The additional network and connectivity created in the Full Build scenarios, as well as the four-lanes on Vilas Road distributes the high volumes.

The intersection of Crater Lake Highway and Vilas Road also exceeds capacity under the NBNM scenario. These are consistently mitigated throughout the scenarios with the addition of the Tier 2 projects. In addition to the Tier 2 scenarios, one Tier 1 scenario also meets the v/c standard: Tier 1 No-build (S0T1). This is a result of the suggested improvements.

Table 8: Year 2040 Tight Diamond Scenario Signalized Intersection v/c Ratios and LOS values[1]

Scenario	Intersection								
	Vilas Rd &							Biddle Rd &	
	Table Rock Rd	Peace Ln /Airway Dr	SB Ramp	NB Ramp	Lear Wy	CLH	CLA	Hamrick Rd	Table Rock Rd
No-build[3]									
No-mitigation	**1.01 E**	NA[2]	NA	NA	NA[2]	**1.12 E**	NA[2]	**1.12 F**	**1.11 E**
S0T1	**0.95[4] D**	0.88 C	NA	NA	0.85 C	0.79 D	NA[2]	**0.92[4] D**	**0.95[4] D**
S0T2	0.79 C	0.88 D	NA	NA	0.71 B	0.81 C	NA[2]	**1.09 E**	**0.98 D**
JTA Build									
+2 Lane Vilas Rd									
S1T1	**0.94[4] D**	**1.12 F**	0.75 C	0.63 B	NA[2]	**0.80 D**	0.45 A	**0.93[4] D**	0.89 D
S1T2	**0.95[4] D**	0.99 D	0.71 B	0.53 B	0.64 C	0.58 C	NA[2]	**0.97 D**	**0.92[4] D**
+4 Lane Villas Rd									
S2T1	**1.02 D**	0.72 B	**0.85 D**	**0.77 C**	NA[2]	**0.86 D**	0.59 A	**1.09 E**	**0.96 D**
S2T2	**0.95[4] D**	0.91 C	0.66 B	0.60 B	0.54 B	0.66 C	NA[2]	**1.11 E**	**0.94[4] E**
Full Build									
+2 Lane Vilas Rd									
S3T1	**0.95[4] D**	0.96 D	0.63 B	0.58 C	NA[2]	**0.81 D**	NA[2]	**0.96 D**	0.85 D
S3T2	**0.94[4] D**	0.94 D	0.64 C	0.48 C	0.44 B	0.59 C	NA[2]	**1.00 D**	0.82 D
+4 Lane Vilas Rd									
S5T1	0.86 C	0.67 A	0.71 C	0.59 C	0.64 B	**0.77 D**	0.53 C	**0.99 D**	**0.93[4] E**
S5T2	0.85 C	0.68 C	0.68 C	0.56 B	0.43 B	0.71 C	NA[2]	0.77 C	**0.92[4] D**

[1]Black-shaded cells indicate that the ODOT HDM 0.75 v/c standard, the Jackson County 0.95 v/c standard, the City of Central Point 0.90 standard, or the City of Medford LOS D standard has been exceeded.
[2]Unsignalized intersections are listed in table X by both Major and Minor movements.
[3]No-build scenarios for Crater Lake Highway and Vilas Rd intersection uses the OHP v/c standard of 0.85. The rest of the scenarios use the HDM, City of Medford, City of Central Point or Jackson County standards.
[4]West leg at this intersection is guided by Central Point's (CP) more restrictive V/C standard of 0.90 while the other 3 legs are under Jackson County's (JC) 0.95. These cells are black-shaded because they do not meet CP's standard but they do meet JC's.

Unsignalized Intersections

Table 9 depicts the unsignalized intersection v/c ratios listed in a major movement / minor movement format. Synchro 9 is used to determine these values and the capacity reports are available in Appendix H. Within all of the NBNM scenarios all of the unsignalized intersections are over capacity and have an LOS F. Clearly the improvements that were made in the Tier 1 and Tier 2 scenarios did have a positive impact seen by the v/c drop, but the minor street LOS is still high. At almost all intersections, the LOS of the minor movement is unacceptable at E or F indicating that improvements are needed. Preliminary Signal Warrant (PSW) criteria were used to evaluate if intersections should be signalized. The output tables from the PSW analysis are in Appendix I. PSW's are from the Manual of Uniform Traffic Control Devices (MUTCD).Table 10 shows the 2040 PSW status for the unsignalized intersections in the study area. The intersection of Lear Way and Vilas Road meets the PSW in all of the Tier 2 scenarios where it becomes a four leg intersection instead of just three legs. S5T1 is the only Tier 1 scenario which meets the PSW because of the four through lanes on Vilas Road. The intersection of Crater Lake Avenue with Vilas Road meets the PSW for all of the Tier 1 projects except for S3T1. An All Way Stop Control (AWSC) was sufficient.

In the NBNM scenario Peace Lane was not realigned with Airway Drive. This resulted in Peace Lane being at capacity and Airway Drive over capacity with a v/c exceeding 2.0. This means that there are no desirable gaps on Vilas Road to turn into. Drivers would likely have to accept much shorter gaps with a higher crash potential. The Vilas Road and CLA intersection is the only one with an AWSC which causes the major movement to have a high LOS. This control type is suggested as an improvement to address the overcapacity condition existing with a Two Way Stop Control (TWSC). The nature of AWSC will introduce higher delay for the major movement (which did not have to stop before); LOS is based on delay.

Table 9: Year 2040 Tight Diamond Unsignalized Intersection Operations[1]

Scenario	v/c	LOS	Critical Movement[2]	Control
Vilas Rd & Peace Ln				
No-build/No-mitigation[5]	0.10 / 1.00	**B / F**	EBL / SBLR	TWSC[3]
Vilas Rd & Airway Dr				
No-build/No-mitigation[5]	0.13 / >2.0	**B / F**	WBLT / NBLR	TWSC
Vilas Rd & Lear Wy				
No-build/No-mitigation[5]	0.08 / 1.05	**B / F**	WBLT / NBL	TWSC
S1T1[5]	0.13 / 0.53	**A / E**	WBL / NBL	TWSC
S2T1[5]	0.09 / 0.83	**B / F**	WBL / NBL	TWSC
S3T1[5]	0.33 / 0.56	**B / F**	WBL / NBR	TWSC
Vilas Rd & Crater Lake Ave				
No-build/No-mitigation[5]	0.12 / >2.0	**A / F**	WBLTR / NBLTR	TWSC
S0T1[5]	0.90 / 0.50	**F / C**	WBTR / NBTR	AWSC[4]
S0T2[5]	0.92 / 0.22	**E / B**	WBLT / SBTR	AWSC
S3T1[5]	0.92 / 0.87	**F / E**	EBLT / NBL	AWSC
S1T2[5]	0.21 / 0.68	**A / F**	WBLT / SBLTR	TWSC
S2T2[5]	0.24 / 0.52	**A / E**	WBLT / SBTR	TWSC
S3T2[5]	0.80 / 0.27	D / B	WBLT / SBT	AWSC
S5T2[5]	0.89 / 0.31	**E / B**	EBT / SBTR	AWSC

[1]Values for intersection are listed by MAJOR movement / MINOR movement
[2]Eastbound Left (EBL), Southbound Left Right (SBLR), Westbound Left Through (WBLT), Northbound Left Right (NBLR), Northbound Left (NBL), Westbound Left (WBL), Northbound Right (NBR), Westbound Left Through Right (WBLTR), Northbound Left Through Right (NBLTR), Westbound Through Right (WBTR), Northbound Through Right (NBTR), Southbound Through Right (SBTR), Eastbound Left Through (EBLT), Southbound Left Through Right (SBLTR), Southbound Through(SBT), Eastbound Through (EBT)
[3]Two Way Stop Control (TWSC)
[4]All Way Stop Control (AWSC)
[5]Exceeds City of Medford Standard LOS D

Table 10: Year 2040 Preliminary Signal Warrants Met[1]

Scenario	Intersection		
	Vilas Rd &		
	Peace Ln /Airway Dr[2]	Lear Wy	Crater Lake Ave
No-build			
No-mitigation	**Y**	**Y**	N
S0T1	**Y**	**Y**	N
S0T2	**Y**	**Y**	N
JTA Build			
+2 Lane Vilas Rd			
S1T1	**Y**	N	**Y**
S1T2	**Y**	**Y**	N
+4 Lane Vilas Rd			
S2T1	**Y**	N	**Y**
S2T2	**Y**	**Y**[3]	N
Full Build			
+2 Lane Vilas Rd			
S3T1	**Y**	N	N
S3T2	**Y**	**Y**[3]	N
+4 Lane Vilas Rd			
S5T1	**Y**	**Y**	**Y**
S5T2	**Y**	**Y**	N

[1]Black shaded cells indicate that preliminary signal warrants (PSW's) have been met. Meeting PSW's does not guarantee that a traffic signal will be installed. Region Traffic staff will need to perform an intersection traffic control study in which the Region Traffic Engineer will forward the recommendation to the State Traffic Engineer's office. Traffic signal warrants must be met and the State Traffic Engineer's approval obtained before a traffic signal will be installed on a state highway.

[2]A Functional Area Calculation (APM v2 4.8.1) is performed to evaluate closely spaced intersections. It is determined that Peace Lane will need to be realigned with Airway Drive and signalized. See Appendix B for calculation details.

[3]This did not technically meet the PSW; however, it was well within the expected weekly 10% volume fluctuation. The small variation may be due to rounding alone. Therefore, it is considered to meet the PSW.

95th Percentile Queuing

Appendix J contains the 2040 95th percentile queuing figures for the project area. Queues shown on figures are a combination of stopped vehicles and vehicles traveling at seven or less miles per hour. The reported queues were created by averaging ten random Sim Traffic micro-simulations together. The Sim Traffic reports are available in Appendix K.

The main queuing issues in the NBNM scenario occur westbound on Vilas Road essentially across the entire study area. CLA has extremely long queues because of the

close spacing between it and Crater Lake Highway. This is mitigated in all other scenarios by the realignment. Airway Drive and Peace Lane also have very long queues because of the difficulty of turning out onto Vilas Road. The queue on eastbound Pine Street / Biddle Road toward Hamrick Road is very long because of traffic entering the study area from Central Point to the west headed to the residential area located north and east of the intersection and also to access Table Rock Road northbound. Also northbound on Table Rock Road heading north through Biddle Road.

The No-build with mitigations (S0T1 and S0T2) improve the queuing in some locations, but not others. Generally the queuing issues just get shifted around without a single solution existing to mitigate all of the issues. For example, allocating more green time to the eastbound through movement (EBT) at Pine Street / Biddle Road and Hamrick Road reduces queues on Pine Street, but this causes the southbound through movement (SBT) on Hamrick Road to have very long queues. Similarly, increasing the northbound through (NBT) green time at Table Rock Road and Biddle Road would improve the northbound queues, but cause the already long westbound to increase. Similar examples exist throughout the network. The realignment of Crater Lake Avenue significantly improves queue lengths at both Crater Lake Avenue and Crater Lake Highway. Westbound across Vilas Road still has queue lengths extending across the study area. The inclusion of the Tier 2 projects on the No-build Scenario does not significantly improve queue lengths, except Crater Lake Highway is slightly better.

An additional measure for queuing is the percent time blocked for turn storage bays and intersections. Blocking times of five percent or greater are considered significant and are included in the following tables. Together these two parameters give a comprehensive view of the queuing: queue length figures show extent of queuing and percent time blocked shows how much of the peak hour there is blockage.

In the NBNM scenario, Table Rock Road westbound blocks both Airway Drive and Peace Lane almost 10% of the time. Related to the blocked intersections, Airway Drive northbound left and right turn bays are blocked 95% of the time and Peace Lane southbound left and right are blocked 52% of the time. Similarly, Lear Way northbound left and right turn bays are blocked an average of 98% of time. The westbound left and right turn bays and southbound left turn bay at the Table Rock Road and Biddle Road intersection are blocked about 70% of the time. These results are summarized in Table 11.

Table 11: Tier 1 JTA No-build / No-mitigation Significant Turn Bay and Intersection Blockages

Intersection	Approach	Blocked Turn Bay	Blocked Intersection	Average % Time Blocked
Lear Wy & Vilas Rd	NB	NBL		98
		NBR		98
Hamrick Rd & Biddle Rd	EB	EBL		74
	NB	NBL		20
		NBR		20
	SB	SBR		37
Airway Dr & Vilas Rd	WB		Peace Ln	8
		WBL		8
	NB	NBLR		95
Crater Lake Hwy & Vilas Rd	EB	EBL		47
	NB	NBL		39
	SB	SBR		13
	WB	WBR		56
Vilas Rd & Peace Ln	SB	SBLR		52
Crater Lake Ave & Vilas Rd	WB	WBLTR		53
	NB	NBLTR		29
Table Rock Rd & Vilas Rd	EB	EBL		11
		EBR		43
	WB		Airway Dr	5
		WBL		45
		WBR		60
Table Rock Rd & Biddle Rd	EB	EBL		22
	WB	WBL		74
		WBR		64
	SB	SBL		72
	NB	NBL		5
		NBR		64

With mitigations, both the Tier 1 and Tier 2 No-build scenarios improve as seen in Tables 12 and 13. There are no blocked intersections. The realignment and signalization of the Airway Drive / Peace Land and Vilas Road intersection significantly reduces the northbound and southbound turn lane percent time blocked. The Table Rock Road and Biddle Road intersection does still have high southbound and westbound percent blocked time.

Table 12: S0T1 - Tier 1 JTA No-build WITH Mitigation Turn Bay and Intersection Blockages

Intersection	Approach	Blocked Turn Bay	Blocked Intersection	Average % Time Blocked
Lear Wy & Vilas Rd	NB	NBL		17
	EB	EBR		7
Hamrick Rd & Biddle Rd	EB	EBL		31
	WB	WBR		21
	SB	SBR		29
	NB	NBL		24
Airway Dr / Peace Ln & Vilas Rd	NB	NBL		56
		NBR		15
	WB	WBL		49
		WBR		49
	SB	SBR		66
		SBL		45
Crater Lake Hwy & Vilas Rd	WB	WBL		13
		WBTR		49
	SB	SBR		12
Crater Lake Ave & Vilas Rd	WB	WBTR		7
Table Rock Rd & Vilas Rd	EB	EBL		11
		EBTR		19
	WB	WBL		31
		WBR		42
Table Rock Rd & Biddle Rd	EB	EBL		45
	NB	NBL		7
	SB	SBL		50
	WB	WBL		75
		WBR		67

Table 13: S0T2 - Tier 2 JTA No-build WITH Mitigation Turn Bay and Intersection Blockages

Intersection	Approach	Blocked Turn Bay	Blocked Intersection	Average % Time Blocked
Hamrick Rd & Biddle Rd	EB	EBL		79
	WB	WBTR		51
	NB	NBLT		32
	SB	SBR		38
Airway Dr / Peace Ln & Vilas Rd	NB	NBL		72
		NBR		72
	WB	WBL		48
		WBR		48
Crater Lake Hwy & Vilas Rd	EB	EBL		18
		EBR		5
	NB	NBL		37
Crater Lake Ave & Vilas Rd	WB	WBL		16
Table Rock Rd & Vilas Rd	WB	WBL		36
	SB	SBL		5
Table Rock Rd & Biddle Rd	WB	WBR		9
	NB	NBTR		66
		NBL		5
	SB	SBL		63

Consistent across most scenarios, there is significant queuing between the northbound and southbound ramps extending east and west. In the JTA Build, the four-lane Vilas Road increases the northbound and southbound queues on Hamrick Road because it is held at two-lanes and cannot accommodate the additional capacity created by four-lanes on Vilas Road. With the Full Build, four-lanes on Vilas Road significantly improves the queues both eastbound and westbound on Vilas Road. The Vilas Road intersections with Crater Lake Avenue and Crater Lake Highway are also shorter. This is caused by the increased capacity the through lanes add.

Four-lane Vilas Road is more affected by JTA vs Full Build than the two-lane. The two-lane already has long queues so there is less room for notable impacts.

The OR62 interchange introduces significant intersection blockage in S1T1 as depicted in Table 14. Westbound on Vilas Road is blocked from Airway Drive / Peace Lane, through both the southbound and northbound ramps, through Lear Way about 20% of the time. Eastbound Vilas Road is blocked from the northbound ramps through the southbound ramps, Airway Drive / Peace Lane about 10% of the time, and from Airway Drive / Peace Lane through Table Rock Road 57%. There is potential for significant difficulties in interchange operation with this scenario. The high turn bay percent time blocked at the

Table Rock Road and Vilas Road intersection corresponds to the blocked intersections: EBR, WBL, NBR, and SBL are blocked 57 – 85% of the peak hour.

Table 14: S1T1- JTA Build Two-lane Vilas Road Turn Bay and Intersection Blockages

Intersection	Approach	Blocked Turn Bay	Blocked Intersection	Average % Time Blocked
Lear Wy & Vilas Rd	NB	NBL		64
	WB	WBL		33
Hamrick Rd & Biddle Rd	EB	EBL		48
	SB	SBR		42
Airway Dr / Peace Ln & Vilas Rd	EB		Table Rock Rd	57
		EBL		47
	WB		SB Off Ramp	19
		WBL		23
	NB	NBR		68
		NBL		12
	SB	SBL		90
Crater Lake Hwy & Vilas Rd	NB	NBL		59
	SB	SBR		6
Table Rock Rd & Vilas Rd	EB	EBL		7
		EBR		85
	WB	WBL		57
	NB	NBR		72
	SB	SBL		76
Biddle Rd & Table Rock Rd	SB	SBL		42
NB Ramps	EB		SB Ramps	10
		EBL		14
	WB		Lear Wy	20
SB Ramps	EB		Airway Dr / Peace Ln	8
	WB		NB Ramps	20
	SB	SBR		36

The widening of Vilas Road from two through lanes to four in S2T1 reduces the extent of the westbound time blocked, seen in Table 15. The blocked intersections extend only from the southbound ramps through Lear Way, still about 20% of the time. There still would be significant operational impacts at the interchange because of the potential queue blockages in the eastbound direction. Eastbound Vilas Road remains relatively unchanged with blocked intersections from the northbound ramps through the southbound ramps and Airway Drive / Peace lane about 10% of the time and extending to

Table Rock Road 52% of the peak hour. The Table Rock Road and Vilas Road intersection blocked turn bay percentages however, are improved.

Table 15: S2T1 - JTA Build Four-lane Vilas Road Turn Bay and Intersection Blockages

Intersection	Approach	Blocked Turn Bay	Blocked Intersection	Average % Time Blocked
Lear Wy & Vilas Rd	NB	NBL		45
		NBR		45
Hamrick Rd & Biddle Rd	EB	EBL		70
	WB	WBR		5
	SB	SBR		66
Airway Dr / Peace Ln & Vilas Rd	EB		Table Rock Rd	52
		EBL		65
		EBR		73
	WB	WBL		6
		WBR		8
	NB	NBR		60
		NBL		21
	SB	SBL		41
Table Rock Rd & Vilas Rd	EB	EBL		49
		EBR		26
	WB	WBL		15
		WBR		39
	NB	NBR		47
	SB	SBL		55
Table Rock Rd & Biddle Rd	EB	EBL		54
	SB	SBL		28
NB Ramps	EB		SB Ramps	22
	WB		Lear Wy	20
SB Ramps	EB		Airway Dr / Peace Ln	35
	WB		NB Ramps	6
	SB	SBR		8

S3T1 introduces the Full Build, which changes the blockage dynamics from S1T1, the other two-lane Vilas Road Scenario. This is seen by the results in Table 16. The westbound Vilas Road blocked intersections increase including at and between the ramp terminals. Blockage begins at Airway Drive, similar to S1T1, and extends through the southbound and northbound ramps about 25% of the time, then through Lear Way 44%, Crater Lake Highway 53%, and all the way through Crater Lake Avenue 33% of the peak

hour. Eastbound Vilas Road blocked time decreases. The northbound ramp intersection blocks the southbound ramp intersection 25% of the peak hour and the intersection with Airway Drive / Peace Lane blocks the Table Rock Road intersection 13%. The intersection at Lear Way and Vilas Road has significant blocked turn bays: WBL 53% and NBL 70%.

Table 16: S3T1- Full Build Two-lane Vilas Road Turn Bay and Intersection Blockages

Intersection	Approach	Blocked Turn Bay	Blocked Intersection	Average % Time Blocked
Lear Wy & Vilas Rd	WB		Crater Lake Hwy	53
		WBL		53
	NB	NBL		70
		NBR		17
Hamrick Rd & Biddle Rd	EB	EBL		43
	SB	SBR		60
		SBL		38
Airway Dr / Peace Ln & Vilas Rd	EB		Table Rock Rd	13
	WB		SB Ramps	19
	NB	NBL		22
		NBR		12
	SB	SBL		10
Crater Lake Hwy and Vilas Rd	WB		Crater Lake Ave	33
		WBL		8
	NB	NBL		57
	SB	SBR		38
		SBL		5
Vilas Rd & Crater Lake Ave	NB	NBL		43
	WB	WBL		24
		WBR		24
	SB	SBR		27
Table Rock Rd & Vilas Rd	WB	WBL		26
	EB	EBL		5
	NB	NBR		14
	SB	SBL		25
Table Rock Rd & Biddle Rd	SB	SBL		43
NB Ramps	EB		SB Ramps	25
	WB		Lear Wy	44
		WBR		20
SB Ramps	WB		NB Ramps	28
	SB	SBR		14

S5T1 is unique with eastbound queuing on Biddle Road from Table Rock Road to Hamrick Road 15% of the time. The only significant blocked intersection along Vilas Road in this scenario is at the northbound ramp terminal back to the southbound ramp terminal 50% of the time. Table 17 summarizes these results.

Table 17: S5T1 - Full Build Four-lane Vilas Road Turn Bay and Intersection Blockages

Intersection	Approach	Blocked Turn Bay	Blocked Intersection	Average % Time Blocked
Lear Wy & Vilas Rd	NB	NBL		8
Hamrick Rd & Biddle Rd	EB	EBL		30
	SB	SBR		54
Crater Lake Hwy and Vilas Rd	WB	WBL		6
	SB	SBR		9
Vilas Rd & Crater Lake Ave	NB	NBL		13
Table Rock Rd & Vilas Rd	WB	WBL		46
	SB	SBL		14
Table Rock Rd & Biddle Rd	EB		Hamrick Rd	15
		EBL		88
	SB	SBL		48
NB Ramps	EB		SB Ramps	50

The addition of the Tier 2 projects in S1T2 reduces the blockage time of some elements as demonstrated in Table 18. For example, the eastbound queue at the northbound ramps to the southbound ramps and then from Airway Drive / Peace Lane to Table Rock Road is slightly elevated at 20%, while in S1T1 Table Rock Road is blocked almost 60% of the peak hour. Westbound on Vilas Road is blocked from Airway Drive / Peace Lane through the southbound and northbound ramp intersections about 10% of the time. S1T1 westbound blockage continues through Lear Way and is present 20% of the time. Table Rock Road and Vilas Road SBL turn bay is blocked 94% of the time while several turn bays at this intersection are significantly blocked without the Tier 2 projects.

Table 18: S1T2 - JTA Build Two-lane Vilas Road Tier 2 Turn Bay and Intersection Blockages

Intersection	Approach	Blocked Turn Bay	Blocked Intersection	Average % Time Blocked
Lear Wy & Vilas Rd	NB	NBL		12
	WB	WBL		21
		WBR		21
Hamrick Rd & Biddle Rd	EB	EBL		21
	SB	SBR		52
Airway Dr / Peace Ln & Vilas Rd	EB		Table Rock Rd	19
		EBL		5
	WB		SB Ramps	13
		WBL		27
	NB	NBL		55
		NBR		22
	SB	SBL		19
		SBR		9
Table Rock Rd & Vilas Rd	EB	EBL		19
	WB	WBL		33
	NB	NBR		54
	SB	SBL		94
		SBR		19
Table Rock Rd & Biddle Rd	EB	EBL		50
	SB	SBL		44
NB Ramps	EB		SB Ramps	23
SB Ramps	WB		NB Ramps	10
	SB	SBR		36

The S2T2 addition of four through lanes continues to improve the percent blocked time as depicted in Table 19. The only significant blocked intersections occur on westbound Vilas Road which is blocked from Table Rock to Airway Drive / Peace Lane 32%, through the southbound ramp 19% and northbound ramp 10%. The southbound ramp has a critical issue with blockage 54% of the time.

Table 19: S2T2 - JTA Build Four-lane Vilas Road Tier 2 Turn Bay and Intersection Blockages

Intersection	Approach	Blocked Turn Bay	Blocked Intersection	Average % Time Blocked
Lear Wy & Vilas Rd	EB	EBL		5
Hamrick Rd & Biddle Rd	EB	EBL		46
	SB	SBR		61
Airway Dr / Peace Ln & Vilas Rd	WB		SB Ramps	19
		WBR		47
	NB	NBR		5
	SB	SBR		21
Table Rock Rd & Vilas Rd	EB	EBL		20
	WB		Airway Dr / Peace Ln	32
		WBL		40
		WBR		8
	SB	SBL		45
Table Rock Rd & Biddle Rd	EB	EBL		24
	SB	SBL		44
NB Ramps	WB	WBR		28
SB Ramps	WB		NB Ramps	10
	SB	SBR		28
			SBT	54

As seen in Table 20, S3T2 has significant intersection blockage westbound on Vilas Road from Airway Drive / Peace Lane through the southbound and northbound ramps about 10% of the time continuing through to Lear Way about 30% of the time. Eastbound between the ramps is blocked 33% of the peak hour which could lead to significant operational difficulties with the interchange operation. The SBR turn bay on the southbound ramp is blocked 7% of the time.

Table 20: S3T2 - Full Build Two-lane Vilas Road Tier 2 Turn Bay and Intersection Blockages

Intersection	Approach	Blocked Turn Bay	Blocked Intersection	Average % Time Blocked
Lear Wy & Vilas Rd	NB	NBL		51
		NBR		51
	SB	SBR		25
	WB	WBR		42
		WBL		42
Hamrick Rd & Biddle Rd	EB	EBL		51
	SB	SBR		61
		SBL		61
Airway Dr / Peace Ln & Vilas Rd	WB		SB Ramps	9
	NB	NBL		83
		NBR		15
Crater Lake Hwy & Vilas Rd	NB	NBL		8
Table Rock Rd & Vilas Rd	EB	EBL		20
	WB	WBL		18
	NB	NBR		8
	SB	SBL		16
Table Rock Rd & Biddle Rd	SB	SBL		40
NB Ramps	EB		SB Ramps	33
	WB		Lear Way	28
SB Ramps	WB		NB Ramps	14
	SB	SBR		7

With the inclusion of Tier 2 projects and four through lanes on Vilas Road, the blockages are further improved as seen in Table 21. The only significant intersection blockage occurs eastbound on Vilas Road between the interchange ramps 29% of the peak hour which is about half of what was seen in S5T1.

Table 21: S5T2 - Full Build Four-lane Vilas Road Tier 2 Turn Bay and Intersection Blockages

Intersection	Approach	Blocked Turn Bay	Blocked Intersection	Average % Time Blocked
Hamrick Rd & Biddle Rd	SB	SBR		42
Airway Dr / Peace Ln & Vilas Rd	EB	EBL		10
	WB	WBL		6
	NB	NBL		20
Table Rock Rd & Vilas Rd	SB	SBL		23
	WB	WBL		8
Table Rock Rd & Biddle Rd	EB	EBL		45
	WB	WBR		6
	SB	SBL		51
NB Ramps	EB		SB Ramps	29

Crash Analysis Summary

The purpose of the crash analysis is to determine the relative predicted crash frequency amongst the scenarios. The following tables depict the total crashes for each Tight Diamond Interchange Scenario. The total is a sum of the Fatal and Injury (FI) and the Property Damage Only (PDO) crashes. The Highway Safety Manual (HSM) predictive spreadsheet tool for urban / suburban arterials is used for intersections and segments outside of the interchange. The Enhanced Interchange Safety Analysis Tool (ISATe) is used for the OR62 mainline segments, the ramps, and ramp terminals. The HSM and ISATe tables are in Appendix L. The arterial and interchange predicted crashes were summed and are reported in Table 22 below. The No-mitigation Scenario has the most crashes of the No-build Scenarios. The JTA Build crash occurrence slightly increases with the addition of the Tier 2 projects, while the Full Build scenario crash frequency is decreased when Tier 2 projects are included.

Table 22: Total Predicted Crash Frequency (crashes/year)

Tier 1 Scenario	Source	Total	FI[4]	PDO[3]
No-build/No-mitigation	HSM[1]	83.7	26.5	57.2
	Total	83.7	26.5	57.2
S0T1	HSM	70.3	22.2	48.1
	Total	70.3	22.2	48.1
S1T1	ISATe[2]	34.6	12.1	22.5
	HSM	69.3	22.1	47.3
	Total	103.9	34.1	69.8
S2T1	ISATe	38.6	13.8	24.8
	HSM	81.0	25.5	55.5
	Total	119.6	39.3	80.3
S3T1	ISATe	29.9	10.0	19.9
	HSM	71.8	22.8	49.0
	Total	101.7	32.9	68.8
S5T1	ISATe	34.0	12.1	21.9
	HSM	77.9	24.5	53.4
	Total	112.0	36.6	75.4
Tier 2 Scenario	**Source**	**Total**	**FI**	**PDO**
S0T2	HSM	68.5	21.5	47.0
	Total	68.5	21.5	47.0
S1T2	ISATe	35.2	12.1	23.2
	HSM	70.9	22.5	48.4
	Total	106.2	34.6	71.6
S2T2	ISATe	39.0	13.8	25.2
	HSM	80.7	25.5	55.2
	Total	119.7	39.2	80.4
S3T2	ISATe	27.7	9.3	18.4
	HSM	63.4	20.1	43.4
	Total	91.1	29.4	61.8
S5T2	ISATe	30.7	10.8	19.9
	HSM	74.6	23.4	51.1
	Total	105.3	34.3	71.0

[1]HSM is the Highway Safety Manual predictive spreadsheet tool for urban / suburban arterials and is used for intersections and segments outside of the interchange.
[2]ISATe is the Enhanced Interchange Safety Analysis Tool used for the OR 62 mainline segments, the ramps, and ramp terminals.
[3]PDO is Property Damage Only
[4]FI is Fatal and Injury in the HSM tool and the sum of fatal, incapacitating injury, non-incapacitating injury, and possibly injury fields in the ISATe tool.

As expected, the Tier 1 and Tier 2 No-build Scenarios produce the lowest crash frequency at 70.3 and 68.5 crashes per year respectively. There are 40% less crashes in the Tier 2 No-build than the Tier 2 JTA build +4 lane Vilas Rd (T2S2 the scenario with the highest predicted crash rate). Excluding the No-build scenarios, the S5T2R has the lowest predicted crash rate. The T2 No-build has 20% less predicted crashes than this lowest value.

Multimodal Level of Service Analysis

For this analysis the APM v2 Chapter 14 Simplified Multimodal Level of Service (MMLOS) is applied. This is based on the HCM 2010 MMLOS methodologies. The Simplified MMLOS Calculator spreadsheet tool available on the ODOT Planning and Technical Guidance webpage is used. The directional characteristics of each segment within the study area are entered to reflect the current conditions using Google Earth, including parameters such as number of lanes, sidewalk width, speed limit, and directional volume. A directional Pedestrian, Bicycle, and Transit LOS or LOS range is output for each segment. When the LOS was below D (E or F) potential multimodal mitigations were considered. The v/c or queue length mitigation recommended for several facilities is to widen the roadway. Although a sidewalk probably should be included with the widening, it may not. The no-build scenario will be analyzed without a sidewalk and the build cases will be assumed to include the needed six-foot wide sidewalk. The existing bike lane will be included.

In summation, if a segment is recommended to be widened, then bike/ped facilities will be assumed to be included. If no widening occurs, Google Earth will be used to document "as-is" conditions; however, even with no widening it is assumed that bike/ped facilities will be added between the ramp terminals and between the Airway Drive / Peace Lane and Lear Way intersections.

Along Airway Drive, a five-foot wide sidewalk is present along both the east and west sides of the developed section. The north and south ends of the segment are undeveloped and a sidewalk is not present. This will be reported as no sidewalk because that would be the most restrictive characteristic along the entire roadway. Peace Lane has been realigned with Airway Drive. Currently there are no sidewalks, but here it will also be assumed that they will be included. The construction of Lear Way both north and south of Vilas Road is assumed to include sidewalks.

Adding a sidewalk generally improves the pedestrian LOS to C or better, except for along Pine Street / Biddle Road, Table Rock Road, and Crater Lake Highway. This is because the LOS is driven by two-lanes of traffic in each direction with higher posted speeds and volumes.

To improve the bicycle LOS, first a bike lane or paved shoulder was added. While this did help on some roadway sections, a shoulder is only appropriate for rural areas and a bike lane is a minimal accommodation, not very acceptable by most users; facilities with

greater separation are preferred. When this did not improve the LOS, a separated shared use path is suggested. The Shared Path Calculator spreadsheet tool is used to evaluate the resulting LOS. The following assumptions are made in the use of this calculator:

- Literature suggests a 20% factor to cover the peak period. The study area has a low bike and ped volume which does not have a large variance between intersections. For this reason, it is assumed that adding a separated multi-use path will have the same effect on the LOS on all segments. The bike and pedestrian LOS becomes an A wherever this mitigation is implemented.
- Directional Split = 0.52 based on actual counts as well as APM guidance to use 0.50 – 0.55.
- PHF=1
- 12' path width
- No marked centerline

A separated multi-use path is the recommended mitigation along Pine Street / Biddle Road from the west project limit to the east project limit on the north side of the roadway. It creates a useful eastward extension from the existing north-south Bear Creek Greenway. A separated path is needed along Table Rock Road from Biddle Road to the North project limit; however, this is probably not feasible because the roadway is completely developed by commercial and industrial use. Crater Lake Highway (CLH) is similarly developed, but a Tier 2 project proposes a re-alignment of Crater Lake Avenue 1,000 feet to the east of its current location running parallel to CLH. This would provide an ideal spot to locate the recommended separated multi-use path.

The Rogue Valley Transportation District (RVTD) route schedules are used to populate the transit tab to calculate the transit schedule speed and frequency inputs. See Appendix M for route schedules and methodology documentation. The transit LOS is poor because it is determined by limited frequencies. Service every hour or so will always have a low LOS. CLH has a higher LOS because service is offered twice per hour. Frequencies are partly determined on funding and land use density, so this reflects the best available service and does not imply that the service is "bad".

As can be seen in Table 23, segments in the No-build / Not Mitigation Scenario are primarily at an unacceptable LOS level. With the mitigation strategy described in the preceding paragraphs, it is possible to improve every segment to an acceptable LOS, with the exception of Table Rock Road from Biddle Road north to the North Project Limit (Table 24). The recommended mitigation by segment and the MMLOS output tables are in Appendix N.

Table 23: No-build / No-Mitigation Simplified MMLOS Segment LOS Output Summary[1]

Roadway	Dir	From-To	Pedestrian LOS	Bicycle LOS	Transit LOS
Vilas Rd	W	E Project Limit-Crater Lake Ave	C-E	**F**	
Vilas Rd	E	Crater Lake Ave-E Project Limit	C-E	**F**	
Vilas Rd	W	Crater Lake Ave-Crater Lake Hwy	**E**	**F**	
Vilas Rd	E	Crater Lake Hwy-Crater Lake Ave	**E**	**F**	
Vilas Rd	W	Crater Lake Hwy-Lear Wy	C	C-D	
Vilas Rd	E	Lear Wy-Crater Lake Hwy	**E**	C-D	
Vilas Rd	W	Lear Wy-Peace Ln	**E**	C-D	
Vilas Rd	E	Peace Ln-Lear Wy	C	C-D	
Vilas Rd	W	Peace Ln-Airway Dr	**E**	C	
Vilas Rd	E	Airway Dr-Peace Ln	**E**	C	
Vilas Rd	W	Airway Dr-Table Rock Rd	C	C-D	
Vilas Rd	E	Table Rock Rd-Airway Dr	**E**	C-D	
Vilas Rd	W	Table Rock Rd-W Project Limit	C	C-D	
Vilas Rd	E	W Project Limit-Table Rock Rd	C-E	C-D	
Pine St/Biddle Rd	W	E Project Limit-Table Rock Rd	**E**	**F**	**F**
Pine St/Biddle Rd	E	Table Rock Rd-E Project Limit	**E**	**F**	**F**
Pine St/Biddle Rd	W	Table Rock Rd-Hamrick Rd	**E**	**E-F**	
Pine St/Biddle Rd	E	Hamrick Rd-Table Rock Rd	**E**	**E-F**	
Pine St/Biddle Rd	W	Hamrick Rd-W Project Limit	**F**	C-E	
Pine St/Biddle Rd	E	W Project Limit-Hamrick Rd	**E**	**E-F**	
Hamrick Rd	N	S Project Limit-Pine St/Biddle Rd	B	C	
Hamrick Rd	S	Pine St/Biddle Rd-S Project Limit	B-C	B	
Hamrick Rd	N	Pine St/Biddle Rd-Beebe Rd	**E**	C-D	
Hamrick Rd	S	Beebe Rd-Pine St/Biddle Rd	**E**	C-D	
Table Rock Rd	N	S Project Limit-Biddle Rd	**E**	C-D	

Roadway	Dir	From-To	Pedestrian LOS	Bicycle LOS	Transit LOS
Table Rock Rd	S	Biddle Rd-S Project Limit	**E**	C-D	
Table Rock Rd	N	Biddle Rd-Vilas Rd	**E**	**E-F**	**F**
Table Rock Rd	S	Vilas Rd-Biddle Rd	**E**	**E-F**	**F**
Table Rock Rd	N	Vilas Rd-N Project Limit	**E**	**E-F**	**F**
Table Rock Rd	S	N Project Limit-Vilas Rd	**E**	**E-F**	**F**
Airway Dr	N	S Project Limit-Vilas Rd	B-C	**F**	
Airway Dr	S	Vilas Rd-S Project Limit	B-C	**F**	
Peace Ln	N	Vilas Rd-N Project Limit	C-E	**F**	
Peace Ln	S	N Project Limit-Vilas Rd	C-E	**F**	
Lear Wy	N	S Project Limit-Vilas Rd	B-C	C-D	
Lear Wy	S	Vilas Rd-S Project Limit	B-C	C-D	
Crater Lake Hwy	N	S Project Limit-Vilas Rd	**E**	C-E	C
Crater Lake Hwy	S	Vilas Rd-S Project Limit	**E**	C-E	C
Crater Lake Hwy	N	Vilas Rd-N Project Limit	**E**	C-E	C
Crater Lake Hwy	S	N Project Limit-Vilas Rd	**E**	**E-F**	C
Crater Lake Ave	N	S Project Limit-Vilas Rd	C-E	**F**	
Crater Lake Ave	S	Vilas Rd-S Project Limit	**E**	**F**	
Crater Lake Ave	N	Vilas Rd-N Project Limit	C-E	**F**	
Crater Lake Ave	S	N Project Limit-Vilas Rd	C-E	**F**	

Table 24: No-build / WITH Mitigation Simplified MMLOS Segment LOS Output Summary[1]

Roadway	Dir	From-To	Pedestrian LOS	Bicycle LOS	Transit LOS
Vilas Rd[3]	W	E Project Limit-Crater Lake Ave	C-E	C-D	
Vilas Rd[3]	E	Crater Lake Ave-E Project Limit	C-E	C-D	
Vilas Rd[2, 3]	W	Crater Lake Ave-Crater Lake Hwy	C	C-D	
Vilas Rd[2, 3]	E	Crater Lake Hwy-Crater Lake Ave	C	C-D	
Vilas Rd	W	Crater Lake Hwy-Lear Wy	C	C-D	
Vilas Rd	E	Lear Wy-Crater Lake Hwy	C	C-D	
Vilas Rd[2]	W	Lear Wy-Peace Ln/Airway Dr	C	C-D	
Vilas Rd[2]	E	Peace Ln/Airway Dr-Lear Wy	C	C-D	
Vilas Rd	W	Peace Ln/Airway Dr-Table Rock Rd	C	C-D	
Vilas Rd[2]	E	Table Rock Rd-Peace Ln/Airway Dr	C	C-D	
Vilas Rd	W	Table Rock Rd-W Project Limit	C	C-D	
Vilas Rd	E	W Project Limit-Table Rock Rd	C-E	C-D	
Pine St/Biddle Rd[4]	W	E Project Limit-Table Rock Rd	A	A	**E**
Pine St/Biddle Rd[4]	E	Table Rock Rd-E Project Limit	A	A	**E**
Pine St/Biddle Rd[4]	W	Table Rock Rd-Hamrick Rd	A	A	
Pine St/Biddle Rd[4]	E	Hamrick Rd-Table Rock Rd	A	A	
Pine St/Biddle Rd[4]	W	Hamrick Rd-W Project Limit	A	A	
Pine St/Biddle Rd[4]	E	W Project Limit-Hamrick Rd	A	A	
Hamrick Rd_3	N	S Project Limit-Pine St/Biddle Rd	B	B	
Hamrick Rd	S	Pine St/Biddle Rd-S Project Limit	B-C	B	
Hamrick Rd	N	Pine St/Biddle Rd-Beebe Rd	C	C-D	

Roadway	Dir	From-To	Pedestrian LOS	Bicycle LOS	Transit LOS
Hamrick Rd	S	Beebe Rd-Pine St/Biddle Rd	C	C-D	
Table Rock Rd	N	S Project Limit-Biddle Rd	C	C-D	
Table Rock Rd	S	Biddle Rd-S Project Limit	C	C-D	
Table Rock Rd	N	Biddle Rd-Vilas Rd	**E**	**E-F**	**F**
Table Rock Rd	S	Vilas Rd-Biddle Rd	**E**	**E-F**	**F**
Table Rock Rd	N	Vilas Rd-N Project Limit	**E**	**E-F**	**F**
Table Rock Rd	S	N Project Limit-Vilas Rd	**E**	**E-F**	**F**
Airway Dr[3]	N	S Project Limit-Vilas Rd	B-C	C-D	
Airway Dr[3]	S	Vilas Rd-S Project Limit	B-C	C-D	
Peace Ln[3]	N	Vilas Rd-N Project Limit	C-E	C-D	
Peace Ln[3]	S	N Project Limit-Vilas Rd	C-E	C-D	
Lear Wy	N	S Project Limit-Vilas Rd	B-C	C-D	
Lear Wy	S	Vilas Rd-S Project Limit	B-C	C-D	
Crater Lake Hwy[4]	N	S Project Limit-Vilas Rd	A	A	C
Crater Lake Hwy[4]	S	Vilas Rd-S Project Limit	A	A	C
Crater Lake Hwy[4]	N	Vilas Rd-N Project Limit	A	A	B
Crater Lake Hwy[4]	S	N Project Limit-Vilas Rd	A	A	B
Crater Lake Ave[3]	N	S Project Limit-Vilas Rd	C-E	C	
Crater Lake Ave[3]	S	Vilas Rd-S Project Limit	C	C	
Crater Lake Ave[3]	N	Vilas Rd-N Project Limit	C-E	C	
Crater Lake Ave[3]	S	N Project Limit-Vilas Rd	C-E	C	

[1]Black-shaded cells indicate that the LOS is E or worse.

[2]A sidewalk is added to these segments, outside of generalized assumptions, to improve LOS.

[3]A bicycle lane/shoulder is added to these segments, outside of generalized assumptions, to improve LOS.

[4]A shared use bike path is added using the Shared Path Calculator tool to determine new LOS.

The MMLOS analysis was performed for all of the scenarios and those tables are shown in Appendix N. The summary of the build MMLOS improvements are:
S1T1 requires a separated path on Hamrick Road from Biddle Road to Beebe Road.

S2T1 requires a separated path on Vilas Road from Table Rock Road to the east project limits, excluding the segment between the interchange ramps.

S3T1 did not require the separated multi use path for the entire length of Vilas Road, only from the west project limits to the northbound ramps and for the westbound section between CLA and CLH. Also on CLH, a separated path is only really needed southbound from north project limits to Vilas Road.

S5T1 requires a separated multi use path on Vilas Road between CLA and Table Rock Road. The separate path along Biddle Road is only required between Hamrick Road and Table Rock Road. Similar to S1T1, a lane is needed southbound on Hamrick Road from Beebe Road to Biddle Road. Also, similar to S3T1, on CLH a separated path is only really needed southbound from north project limits to Vilas Road.

The inclusion of Tier 2 projects produced commensurate LOS values. In addition to the mitigations recommended in Tier 1:

No-build (S0T2) requires a separated path on Lear Way both north and south of Vilas Road.

S1T2 requires a separated path on Vilas Road between Lear Way and the southbound ramp. On Lear Way it is needed only on the section north of Vilas Road. CLH also only needs the separated path north of Vilas Road. Vilas Road requires a separated path on the section between CLA and CLH.

S2T2 requires a separated path on Vilas Road from the west project limits to CLH (except between the ramps).

S3T2 does not require the separate path on Vilas Road (except between the ramps and between CLA and CLH). Also on CLH, a separated path is only really needed southbound from north project limits to Vilas Road.

S5T2 requires a separated multi use path on Vilas Road between CLA and the west project limit. East of CLA, adding a sidewalk and a shoulder produces an acceptable LOS. Similar to S1T2 a lane is needed southbound on Hamrick Road from Beebe Road to Biddle Road. Also, similar to S3T2, on CLH a separated path is only really needed southbound from north project limits to Vilas Road. A separated path on Lear Way both north and south of Vilas Road is required.

The output table for each individual scenario can be seen in Appendix N.

Other Operational Performance Measures

The Overall Simulation Measures of Effectiveness (MOE) is a network level assessment of the functionality of each scenario. Lower values for Travel Time (TT), Delay, and Number of Stops indicate higher efficiency while a higher value for Speed indicates a more efficient scenario. As can be seen in Table 25, the Tier 1 and Tier 2 projects and

proposed mitigations improve the efficiency of the NBNM scenario for every MOE except for Number of Stops. S0T1 has a 6% increase in stops and S0T2 has an 11% increase. This is expected because the Number of Stops increase as more roadways are added or more control is added such as AWSC or new signals, which stop traffic flows which previously did not stop. T2 is slightly better than T1.

Table 25: Year 2040 Tight Diamond Scenario Overall Simulation Measures of Effectiveness[1]

Scenario	Travel Time (vehicle-hours)	Speed (mph)	Delay (vehicle-hours)	Number of Stops
No-build				
No-mitigation	1,600	14	1,000	20,200
S0T1	1,200	19	600	21,400
S0T2	1,100	21	500	22,500
JTA Build				
+2 Ln Vilas Rd				
S1T1	1,800	18	1,000	28,100
S1T2	1,600	20	800	31,300
+4 Ln Vilas Rd				
S2T1	2,200	15	1,400	28,000
S2T2	2,100	15	1,300	24,500
Full Build				
+2 Ln Vilas Rd				
S3T1	1,800	18	1,000	28,400
S3T2	1,600	20	850	23,700
+4 Ln Vilas Rd				
S5T1	1,700	21	1,700	28,100
S5T2	1,400	25	550	22,600

[1]A stop is recorded every time a vehicle drops below 7 mph (crawl speed). A vehicle might have multiple stops on a single intersection approach.

Roundabout Scenarios

Mainline & Merge/Diverge/Weave Segments

The roundabout scenarios only affect surface street intersections, so they have no effect on the OR62 mainline segment and merge/diverge sections. See Table 7.

Signalized Intersections

The Roundabout scenario signalized v/c and LOS results are nearly identical to the Tight Diamond scenarios. Table 26 shows the v/c ratio results for all of the signalized intersections. The intersections of Hamrick Road and Table Rock Road with Biddle Road are still over capacity in almost every scenario, the worst being the NBNM. As previously mentioned, one issue is that widening Hamrick Road north of Biddle Road was not a potential mitigation in order to remain consistent with Central Point's desire to maintain this as a two-lane roadway. Maintaining a context-sensitive capacity on this section to be most compatible with the surrounding residential land uses in the area is a priority. The intersection at Table Rock Road and Vilas Road exceeds v/c standards/targets caused by the higher volumes in 2040 in every scenario except for S5T1R. The additional network and connectivity created in the Full Build scenario, as well as the four-lanes on Vilas Road, distributes the high volumes reducing the demand at this intersection. The intersection of CLH exceeds the standards for all Tier 1 scenarios. The addition of the Tier 2 projects creates new north – south routes so the demand at this intersection is reduced.

Table 26: Year 2040 Roundabout Scenario v/c ratios and LOS for signalized intersections[1]

Scenario	Intersection								
	Vilas Rd &							Biddle Rd &	
	Table Rock Rd	Peace Ln /Airway Dr	SB Ramp	NB Ramp	Lear Wy	CLH	CLA	Hamrick Rd	Table Rock Rd
JTA Build									
+2 Lane Vilas Rd									
S1T1R	**0.94[3] D**	**1.07 E**	NA[2]	NA[2]	0.71 B	**0.80 D**	0.45 A	**0.93[3] D**	0.89 D
S1T2R	**0.95[3] D**	0.99 D	NA[2]	NA[2]	0.64 C	0.58 C	NA[2]	**0.97 D**	**0.92[3] D**
+4 Lane Villas Rd									
S2T1R	**1.01 D**	0.85 B	NA[2]	NA[2]	NA[2]	**0.86 D**	0.66 A	**1.09 E**	**0.96 D**
S2T2R	**0.95 E**	0.94 C	NA[2]	NA[2]	0.55 B	0.65 C	NA[2]	**1.11 E**	**0.96 E**
Full Build									
+2 Lane Vilas Rd									
S3T1R	**0.95[3] D**	1.00 D	NA[2]	NA[2]	NA[2]	**0.85 D**	NA[2]	**0.96 D**	0.85 D
S3T2R	**0.94[3] D**	0.95 D	NA[2]	NA[2]	0.45 B	0.64 C	NA[2]	**1.00 D**	0.82 D
+4 Lane Vilas Rd									
S5T1R	0.86 C	0.77 B	NA[2]	NA[2]	0.62 B	**0.85 C**	0.53 C	**1.00 D**	**0.96 E**
S5T2R	**0.93[3] D**	0.75 B	NA[2]	NA[2]	0.43 A	0.69 C	NA[2]	0.76 C	**0.92[3] D**

[1]Black-shaded cells indicate that the ODOT HDM 0.75 v/c standard, the Jackson County 0.95 v/c standard, the City of Central Point 0.90 standard, or the City of Medford LOS D standard has been exceeded.
[2]Unsignalized intersections are listed in table 24 by both major and minor movements.
[3]West leg at this intersection is guided by Central Point's (CP) more restrictive v/c standard of 0.90 while the other 3 legs are under Jackson County's (JC) 0.95. These cells are black-shaded because they do not meet CP's standard but they do meet JC's.

Unsignalized Intersections

All of the roundabouts analyzed in the scenarios have two circulating lanes, but the bypass lanes vary by scenario. S1T2R has no slip lanes. All of the others have a bypass lane on the southbound approach. Scenarios S1T1R and S1T2R both also have a bypass lane on the westbound approach. Scenario S2T1 has bypass lanes also on the eastbound and northbound approaches and S1T1R has them on the eastbound and westbound approaches at the southbound terminal and on the westbound and northbound approaches

at the northbound terminal. See Appendix A for layout and Appendix F for design hour volumes. Table 27 depicts the unsignalized intersection v/c ratios listed in a major movement / minor movement format.

Table 27: Year 2040 Roundabout Unsignalized Intersection Operations[1,7]

Scenario	v/c	LOS	Critical Movement[3]	Control
Vilas Rd & Lear Wy				
S2T1R[6]	0.09 / 0.83	**B / F**	WBL / NBL	TWSC[4]
S3T1R[6]	0.33 / 0.56	**B / F**	WBLT / NBR	TWSC
Vilas Rd & Crater Lake Ave				
S3T1R[6]	0.92 / 0.87	F / E	EBLT / NBL	AWSC[5]
S1T2R[6]	0.21 / 0.68	A / F	WBLT / SBLTR	TWSC
S2T2R[6]	0.24 / 0.52	A / E	WBLT / SBTR	TWSC
S3T2R	0.80 / 0.27	D / B	WBLT / SBT	AWSC
S5T2R[6]	0.89 / 0.31	E / B	EBT / SBTR	AWSC
NB Ramps[2]				
S1T1R	0.87 / 0.44	**E / C**	WB / NB	Roundabout
S2T1R	1.51 / 0.62	**F / D**	WB / NB	Roundabout
S3T1R	0.87 / 0.50	D / D	EB / NB	Roundabout
S4T1R	1.11 / 0.71	**F / E**	WB / NB	Roundabout
S1T2R	0.80 / 0.79	**C / F**	EB / NB	Roundabout
S2T2R	**0.98 / 0.94**	**E / F**	EB / NB	Roundabout
S3T2R	0.77 / 0.53	C / D	EB / NB	Roundabout
S5T2R	**0.94 / 0.69**	**F / E**	WB / NB	Roundabout
SB Ramps[2]				
S1T1R	**1.06 / 1.66**	**F / F**	EB / SB	Roundabout
S2T1R	**1.27 / >2.0**	**F / F**	EB / SB	Roundabout
S3T1R	**0.89 / 1.43**	**D / F**	EB / SB	Roundabout
S4T1R	**1.10 / >2.0**	**F / F**	EB / SB	Roundabout
S1T2R	**0.98 / 1.63**	**F / F**	EB / SB	Roundabout
S2T2R	**1.16 / >2.0**	**F / F**	EB / SB	Roundabout
S3T2R	**0.81 / 1.01**	**C / F**	EB / SB	Roundabout
S5T2R	**0.99 / 1.48**	**F / F**	EB / SB	Roundabout

[1]Values for intersection are listed by MAJOR movement / MINOR movement
[2]v/c target for Roundabouts = 0.85
[3]Southbound (SB), Westbound Left Through (WBLT), Northbound (NB), Northbound Left (NBL), Westbound Left (WBL), Northbound Right (NBR), Westbound Left Through (WBLT), Eastbound (EB), Westbound (WB), Southbound Through (SBT), Eastbound Left Through (EBLT), Southbound Left Through Right (SBLTR), Southbound Through Right (SBTR), Eastbound Through (EBT)
[4]Two Way Stop Control (TWSC)
[5]All Way Stop Control (AWSC)
[6]Exceeds City of Medford Standard LOS D
[7]Black-shaded cells indicate that the ODOT HDM 0.75 v/c standard, the Jackson County 0.95 v/c standard, the City of Central Point 0.90 standard, the City of Medford LOS D standard has, or the 0.85 Roundabout Standard been exceeded.

The unsignalized, like the signalized, Roundabout scenarios intersection v/c and LOS are very similar to the Tight Diamond scenarios outside of the ramp terminal intersections. Even with the maximum amount of possible improvements, none of the roundabout scenarios have acceptable operations at the southbound ramp terminal and most also do not have acceptable operations at the northbound terminal.

At almost all intersections, the LOS of the minor movement is unacceptable at E or F indicating that improvements are needed. Preliminary Signal Warrant (PSW) criteria were used to evaluate if intersections should be signalized. PSW's are from the Manual of Uniform Traffic Control Devices (MUTCD). Table 28 shows the 2040 PSW status for the unsignalized intersections in the study area. The intersection of Crater Lake Avenue with Vilas Road is unsignalized in all of the Tier 2 scenarios. This is caused by the increased network connectivity moving some of the volume away from this intersection.

Table 28: Year 2040 Preliminary Signal Warrants Met[1]

Scenario	**Intersection** Vilas Rd & Peace Ln /Airway Dr[2]	Lear Wy	Crater Lake Ave
No-build			
No-mitigation	**Y**	**Y**	N
S0T1	**Y**	**Y**	N
S0T2	**Y**	**Y**	N
JTA Build			
+2 Lane Vilas Rd			
S1T1	**Y**	N	**Y**
S1T2	**Y**	**Y**	N
+4 Lane Villas Rd			
S2T1	**Y**	N	**Y**
S2T2	**Y**	**Y**[3]	N
Full Build			
+2 Lane Vilas Rd			
S3T1	**Y**	N	N
S3T2	**Y**	**Y**[3]	N
+4 Lane Vilas Rd			
S5T1	**Y**	**Y**	**Y**
S5T2	**Y**	**Y**	N

[1]Black shaded cells indicate that preliminary signal warrants (PSW's) have been met. Meeting PSW's does not guarantee that a traffic signal will be installed. Region Traffic staff will need to perform an intersection traffic control study in which the Region Traffic Engineer will forward the recommendation to the State Traffic Engineer's office. Traffic signal warrants must be met and the State Traffic Engineer's approval obtained before a traffic signal will be installed on a state highway.
[2]A Functional Area Calculation (APM v2 4.8.1) is performed to evaluate closely spaced intersections. It is determined that Peace Lane will need to be realigned with Airway Drive and signalized. See Appendix C for calculation details.
[3]This did not technically meet the PSW; however, it was well within the expected weekly 10% volume fluctuation. The small variation may be due to rounding alone. Therefore, it is considered to meet the PSW.

95th Percentile Queuing

Appendix J contains the 2040 95th percentile queuing figures for the project area. The queues were created by averaging ten random Sim Traffic micro-simulations together.

A roundabout at the interchange ramps generally causes long queues as they are over capacity at one or both ramp terminals. It is unlikely that the interchange will function under these conditions, so none of the roundabout scenarios are viable alternatives. Without the inclusion of the Tier 2 projects, the two-lane Vilas Road scenarios are not viable. They consistently function poorly due to queues backing up along the entire length of Vilas Road, often extending west beyond Table Rock Road and all the way to Pine Street / Biddle Road and east to Crater Lake Avenue.

As seen in Table 29, S1T1R has very high blockage times. Westbound Vilas Road has blocked intersections beginning at Airway Drive / Peace Lane through the ramps 38% of the time and extending through CLH 20 % of the time. Eastbound Vilas Road blocks the southbound ramp 82% of the time, through Airway Drive / Peace Lane 5%, and extending through Table Rock Road 68% of the time. Airway Drive / Peace Lane and Vilas Road intersection also has extensive turn bay blockage: EBL and EBR 66% of the time, SBL and SBR 96% and 69% of the time respectively. Also, the intersection of Table Rock Road and Vilas Road has a blocked turn bay at the WBL 65%, NBR 74%, and SBL 79% of the time.

Table 29: S1T1R – JTA Build Two-lane Vilas Road Roundabout Scenario Turn Bay and Intersection Blockages

Intersection	Approach	Blocked Turn Bay	Blocked Intersection	Average % Time Blocked
Lear Wy & Vilas Rd	WB		Crater Lake Hwy	20
Hamrick Rd & Biddle Rd	EB	EBL		63
	SB	SBR		41
Airway Dr / Peace Ln & Vilas Rd	EB		Table Rock Rd	68
		EBL		66
		EBR		66
	WB		SB Off Ramp	38
	NB	NBL		17
		NBR		61
	SB	SBL		96
		SBR		69
Crater Lake Hwy & Vilas Rd	NB	NBL		86
	SB	SBR		21
Crater Lake Ave & Vilas Rd	WB	WBTR		6
Table Rock Rd & Vilas Rd	EB	EBL		8
		EBTR		23
	WB	WBL		65
	NB	NBR		74
	SB	SBL		79
		SBTR		44
Biddle Rd & Table Rock Rd	SB	SBL		34
NB Ramps	EB		SB On Ramp	82
	WB		Lear Wy	14
SB Ramps	EB		Airway Dr / Peace Ln	5
	WB		NB On Ramp	10

Similar to the Tight Diamond Scenarios, the widening of Vilas Road from two through lanes to four in S2T1R reduces the extent of the westbound time blocked seen in Table 30. There is not significant westbound intersection blockage. Eastbound only extends from the northbound ramps to the southbound ramps 7% of the time, but the Airway Drive / Peace Lane intersection is blocked 95% of the peak hour. The eastbound intersection blockage extends all the way to Table Rock Road 42% of the time. The Airway Drive / Peace Lane and Table Rock Road intersections with Vilas Road turn bay blockages are improved.

Table 30: S2T1R – JTA Build Four-lane Vilas Road Roundabout Scenario Turn Bay and Intersection Blockages

Intersection	Approach	Blocked Turn Bay	Blocked Intersection	Average % Time Blocked
Lear Way & Vilas Rd	NB	NBL		27
Hamrick Rd & Biddle Rd	EB	EBL		64
	SB	SBR		65
Airway Dr / Peace Ln & Vilas Rd	EB		Table Rock Rd	42
Crater Lake Hwy & Vilas Rd	NB	NBL		7
Table Rock Rd & Vilas Rd	WB	WBL		19
	EB	EBTR		21
	NB	NBR		15
	SB	SBL		53
Biddle Rd & Table Rock Rd	EB	EBL		48
	SB	SBL		23
NB Ramps	EB		SB Ramps	7
	WB	WBTR		11
SB Ramps	EB		Airway Dr / Peace Ln	95
		EBTR		48

S3T1R introduces the Full Build, which slightly worsens the blockages demonstrated in S1T1R, the other two-lane Vilas Road Scenario. This is seen by the results in Table 31. Westbound Vilas Road blocks the SB Ramps 33%, through the NB Ramps and Lear Way 13%, Crater Lake Highway 19%, and all the way through Crater Lake Avenue 23% of the time. Eastbound on Vilas Road is blocked from the northbound ramp through the southbound ramp 9% of the time. Beginning at Airway Drive / Peace lane Table Rock Road is blocked 92% of the time, continuing the entire length of Hamrick Road to the Pine Street / Biddle Road intersection 57% of the time. There are also significant blocked turn bays. The EBL and EBR turn bays at the Airway Drive / Peace Lane intersection are blocked 73% of the time. At the Table Rock Road intersection with Vilas Road, the EBL and EBR turn bays are blocked 79% of the time, NBR 89%, and SBL 91%. This just highlights the most extreme values.

Table 31: S3T1R – Full Build Two-lane Vilas Road Roundabout Scenario Turn Bay and Intersection Blockages

Intersection	Approach	Blocked Turn Bay	Blocked Intersection	Average % Time Blocked
Lear Wy & Vilas Rd	WB		Crater Lake Hwy	19
		WBLT		58
	NB	NBL		58
		NBR		10
Hamrick Rd & Biddle Rd	EB	EBL		70
	WB	WBR		23
	SB	SBR		61
Airway Dr / Peace Ln & Vilas Rd	EB		Table Rock Rd	92
		EBL		73
		EBR		73
	WB		SB Ramps	33
	NB	NBL		24
Crater Lake Hwy & Vilas Rd	WB		Crater Lake Ave	23
		WBL		17
		WBR		15
	NB	NBL		27
	SB	SBR		15
Vilas Rd & Crater Lake Ave	NB	NBL		36
	WB	WBLTR		18
	SB	SBR		14
Table Rock Rd & Vilas Rd	EB		Pine St / Biddle Rd	57
		EBL		79
		EBR		79
	WB	WBL		36
	NB	NBR		89
	SB	SBL		91
		SBR		59
Biddle Rd & Table Rock Rd	SB	SBL		27
NB Ramps	EB		SB Ramps	9
		EBL		9
	WB		Lear Wy	13
		WBR		11
SB Ramps	WB		NB Ramps	13
		WBL		13
	EB	EBR		7
	SB	SBL		22
		SBR		7

Similar to the S5T1 Tight Diamond Scenario, S5T1R is unique with eastbound intersection blockage on Biddle Road from Table Rock Road to Hamrick Road 22% of the time. Additional significant intersection blockage occurs on eastbound Vilas Road beginning at the northbound ramps blocking the southbound ramps 25% of the time through the Airway Drive / Peace Lane intersection 89% of the time. Table 32 summarizes these results.

Table 32: S5T1R – Full Build Four-lane Vilas Road Roundabout Scenario Bay and Intersection Blockages

Intersection	Approach	Blocked Turn Bay	Blocked Intersection	Average % Time Blocked
Lear Wy & Vilas Rd	NB	NBL		8
	WB	WBL		5
Hamrick Rd & Biddle Rd	EB	EBL		12
	SB	SBR		56
Airway Dr / Peace Ln	SB	SBL		5
Crater Lake Hwy & Vilas Rd	WB	WBL		7
	SB	SBR		7
Vilas Rd & Crater Lake Ave	NB	NBL		19
Table Rock Rd & Vilas Rd	WB	WBL		48
	SB	SBL		13
Biddle Rd & Table Rock Rd	EB		Hamrick Rd	22
		EBL		88
	SB	SBL		46
NB Ramps	EB		SB Ramps	25
		EBL		55
	WB	WBR		6
	NB	NBL		7
SB Ramps	EB		Airway Dr / Peace Ln	89
		EBR		36
	SB	SBR		8

The addition of the Tier 2 projects reduces the blockage time of some elements as demonstrated in Table 33. For example, westbound on Vilas Road at Airway Drive / Peace Lane blocks the intersection with the southbound ramps 28% of the peak hour and the northbound ramps block the Lear Way intersection only 11% of the time. The only intersection blocked eastbound on Vilas Road extends from Airway Drive / Peace Lane to Table Rock Road 21% of the time. Table Rock Road and Vilas Road SBL turn bay is blocked 93% of the time while several turn bays at this intersection are significantly blocked without the Tier 2 projects.

Table 33: S1T2R – JTA Build Two-lane Vilas Road Tier 2 Roundabout Scenario Turn Bay and Intersection Blockages

Intersection	Approach	Blocked Turn Bay	Blocked Intersection	Average % Time Blocked
Lear Wy & Vilas Rd	NB	NBL		29
	WB	WBL		32
		WBR		32
	SB	SBR		7
Hamrick Rd & Biddle Rd	EB	EBL		10
	SB	SBR		49
Airway Dr / Peace Ln	EB		Table Rock Rd	21
	WB		SB Ramps	28
		WBL		36
	NB	NBL		54
		NBR		27
	SB	SBL		38
		SBR		14
Crater Lake Hwy & Vilas Rd	NB	NBL		12
Table Rock Rd & Vilas Rd	EB	EBL		15
	WB	WBL		38
	NB	NBR		48
	SB	SBL		93
		SBR		33
Biddle Rd & Table Rock Rd	EB	EBL		37
	WB	WBR		5
	SB	SBL		43
NB Ramps	WB		Lear Wy	11
		WBR		13
	EB	EBL		5
SB Ramps	EB	EBR		11
	SB	SBR		9

The S2T2 addition of four through lanes causes some intersections to be blocked a significant amount of the peak hour as depicted in Table 34. For example, Vilas Road eastbound is blocked from the northbound ramp through the southbound 59% and through Airway Drive / Peace Lane 90% of the time. Westbound Vilas Road is blocked from Table Rock to Airway Drive / Peace Lane 24%, through the southbound Ramps 46% of the time. At the Hamrick Road and Biddle Road intersection the EBL and SBR turn lanes are blocked 67% and 61% of the time, respectively.

Table 34: S2T2R – JTA Build Four-lane Vilas Road Tier 2 Roundabout Scenario Turn Bay and Intersection Blockages

Intersection	Approach	Blocked Turn Bay	Blocked Intersection	Average % Time Blocked
Hamrick Road & Biddle Road	EB	EBL		67
	SB	SBR		61
Airway Drive/Peace Lane	WB		SB Ramps	46
		WBTR		69
	NB	NBTR		9
	SB	SBTR		12
Table Rock Road & Vilas Road	WB		Airway Dr / Peace Ln	24
		WBL		36
		WBR		10
	SB	SBL		42
Biddle Rd & Table Rock Rd	EB	EBL		62
	SB	SBL		48
NB Ramps	EB		SB Ramps	59
		EBL		59
SB Ramps	EB		Airway Drive/Peace Lane	90
		EBR		30
	SB	SBL		22
		SBR		55

As seen in Table 35, S3T2R extensive blockages. Vilas Road eastbound is blocked from the Airway Drive / Peace Lane intersection through Table Rock Road 68% and all the way back to Pine Street / Biddle Road 35% of the time. Also eastbound on Vilas Road is blocked from the northbound ramp to the southbound 52% of the time. Vilas Road westbound is blocked from Airway Drive / Peace Lane through the southbound ramps 29% of the peak hour and then from the northbound ramps through Lear Way 5% of the time. The intersection of Vilas Road and Table Rock Road has significant blocked turn bays. The EBL and EBR bays are both blocked 71% of the time, NBR 75%, and SBL 87%.

Table 35: S3T2R – Full Build Two-lane Vilas Road Tier 2 Roundabout Scenario Turn Bay and Intersection Blockages

Intersection	Approach	Blocked Turn Bay	Blocked Intersection	Average % Time Blocked
Lear Wy & Vilas Rd	NB	NBL		16
Hamrick Rd & Biddle Rd	EB	EBL		75
	SB	SBR		63
		SBL		62
Airway Dr / Peace Ln	EB		Table Rock Rd	68
		EBL		64
		EBR		64
	WB		SB Ramps	29
		WBTR		36
	NB	NBL		45
		NBR		12
Table Rock Rd & Vilas Rd	EB		Biddle Rd	35
		EBL		71
		EBR		71
	WB	WBL		29
	NB	NBR		75
	SB	SBL		87
		SBTR		46
Biddle Rd & Table Rock Rd	SB	SBL		28
NB Ramps	EB		SB Ramps	52
		EBL		52
	WB		Lear Wy	5
		WBR		11
SB Ramps	EB	EBR		11
	WB	WBL		9
	SB	SBL		17
		SBR		6

With the inclusion of Tier 2 projects and four through lanes on Vilas Road, the blockages are improved as seen in Table 36. The only significant intersection blockage occurs eastbound on Vilas Road between the interchange ramps 47% of the peak hour and continuing through Airway Drive / Peace Lane 5% of the time.

Table 36: S5T2R – Full Build Four-lane Vilas Road Tier 2 Roundabout Scenario Turn Bay and Intersection Blockages

Intersection	Approach	Blocked Turn Bay	Blocked Intersection	Average % Time Blocked
Hamrick Rd & Biddle Rd	SB	SBR		42
Airway Dr / Peace Ln	EB	EBL		13
	NB	NBL		7
		NBR		5
Table Rock Rd & Vilas Rd	SB	SBL		24
Biddle Rd & Table Rock Rd	EB	EBL		54
	WB	WBR		5
	SB	SBL		49
NB Ramps	EB		SB Ramps	47
		EBL		47
SB Ramps	EB		Airway Dr / Peace Ln	5
		EBR		32

Crash Analysis Summary - Roundabout

By the CRF Appendix for ODOT's HSIP Countermeasures and Crash Reduction Factors (Appendix L), a Crash Reduction Factor (CRF) of 0.78 is applied to all injury crashes at the ramp terminals (p. 19) and the FHWA CRF of 0.48 for a signal to a roundabout modification is applied to the "Total Crash" value. The CRFs apply only to the predicted crash values at the crossroad ramp terminals produced by the ISATe spreadsheet tool. These crash frequencies are listed in Table 37. It should be noted that the crash frequencies could be understated to some degree because of the sheer amount of localized congestion at the ramp terminals that is not captured in the HSM methodology.

Table 37: Total Predicted Crash Frequency (crashes/year)

Tier 1 Scenario	Source	Total	FI[4]	PDO[3]
S1T1R	ISATe[2]	24.6	10.5	14.1
	HSM	69.3	22.1	47.3
	Total	93.9	32.6	61.3
S2T1R	ISATe	26.7	11.9	14.8
	HSM	81.0	25.5	55.5
	Total	107.7	37.4	70.3
S3T1R	ISATe	22.0	8.9	13.2
	HSM	71.8	22.8	49.0
	Total	93.8	31.7	62.1
S5T1R	ISATe	24.0	10.5	13.5
	HSM	77.9	24.5	53.4
	Total	101.9	35.0	66.9

Tier 2 Scenario	Source	Total	FI	PDO
S1T2R	ISATe	24.8	10.5	14.3
	HSM	70.9	22.5	48.4
	Total	95.8	33.1	62.7
S2T2R	ISATe	26.7	11.9	14.9
	HSM	80.7	25.5	55.2
	Total	107.4	37.4	70.1
S3T2R	ISATe	20.7	8.3	12.4
	HSM	63.4	20.1	43.4
	Total	84.1	28.3	55.8
S5T2R	ISATe	22.1	9.5	12.6
	HSM	74.6	23.4	51.1
	Total	96.7	32.9	63.8

[1]HSM is the Highway Safety Manual predictive spreadsheet tool for urban / suburban arterials and is used for intersections and segments outside of the interchange.
[2]ISATe is the Enhanced Interchange Safety Analysis Tool used for the OR 62 mainline segments, the ramps, and ramp terminals.
[3]PDO is Property Damage Only
[4]FI is Fatal and Injury in the HSM tool and the sum of fatal, incapacitating injury, non-incapacitating injury, and possibly injury fields in the ISATe tool.

Multimodal Level of Service Analysis

Roundabouts at the interchange ramp terminals do not differ from the Tight Diamond Scenario MMLOS results. See Appendix N.

Other Operational Performance Measures

The Overall Simulation Measures of Effectiveness (MOE) is a network level assessment of the functionality of each scenario. Lower values for Travel Time (TT), Delay, and Number of Stops indicate higher efficiency while a higher value for Speed indicates a more efficient scenario. As can be seen in Table 39, the most efficient roundabout scenario is S5T2R followed by S5T1R and S1T2R with similar results. However, because of the overall capacity and queuing issues with these scenarios at the interchange, these do not perform as well as similar Tight Diamond scenarios. Tier 1 scenarios do not operate as well as Tier 2 scenarios.

Table 39: Year 2040 Roundabout Scenario Overall Simulation Measures of Effectiveness[1]

Scenario	Travel Time (vehicle-hours)	Speed (mph)	Delay (vehicle-hours)	Number of Stops
JTA Build				
+2 Ln Vilas Rd				
T1	2,000	16	1,200	26,400
T2	1,600	20	800	28,300
+4 Ln Vilas Rd				
T1	2,000	18	1,100	27,500
T2	2,100	16	1,300	32,400
Full Build				
+2 Ln Vilas Rd				
T1	2,400	12	1,700	23,700
T2	2,000	15	1,300	23,500
+4 Ln Vilas Rd				
T1	1,700	21	850	28,600
T2	1,400	24	550	22,400

[1]A stop is recorded every time a vehicle drops below 7 mph (crawl speed). A vehicle might have multiple stops on a single intersection approach.

SCENARIO SUMMARY & COMPARISON

The performance of the No-build / No-mitigation (NBNM) scenario is improved with appropriate mitigations (S0T1) as well as the addition of the Tier 2 projects (S0T2), as can be seen in Table 40. S0T1 and S0T2 both have zero blocked intersections and only five or six blocked turn storage bays which is about a 50% improvement from the NBNM. The overall delay is also cut almost in half from 1,000 vehicle-hours to 600 in S0T1 and 500 in S0T2. The overall network travel time is slightly better with the inclusion of the Tier 2 projects at 1,100 hours followed by 1,200 hours for S0T1, both of which are an improvement from the 1,600 hours for NBNM. S0T1 and S0T2 have the two lowest overall network travel time of any scenario. The overall network speeds improve from 14 mph in NBNM to 19 and 21 mph for S0T1 and S0T2 respectively. The number of locations over standards is decreased from eight to four in S0T1 and three in S0T2 and the number of locations over capacity is reduced from eight to only one in S0T1 and two in S0T2. The number of predicted crashes is reduced and the number of locations with an MMLOS worse than D is decreased by almost 75%. The only measure that deteriorates is the overall number of stops which increases by 1,200 and 2,300 which would be expected because the interchange adds intersections where none previously existed.

The two mitigated no-build scenarios S0T1 and S0T2 performed better than the build scenarios in almost every measure. They both have zero intersections blocked by queues which is not the case for ANY of the build scenarios. The overall network speeds are faster than most of the build scenarios and the overall network travel times are better than all of the build scenarios. The overall delay of 600 and 500 vehicle-hours is significantly lower than most of the scenarios except for S5T2 and S5T2R which are very similar with both having an overall delay of 550 vehicle hours (Tables 41 and 42).

The two through lanes on Vilas Road scenarios are only viable with the inclusion of the Tier 2 projects. Without the Tier 2 projects, there is extensive queuing on Vilas Road throughout the entire study area causing frequent occurrences of intersection and turn bay blockages. The increased travel routes provided by the Tier 2 projects distribute the volume throughout the network thereby reducing the queuing. These projects also cause more locations to meet standards. The overall average network speed increases from 18 to 20 mph and the network travel time decreases from 1,800 to 1,600 hours. Overall delay decreases as does the number of stops. Table 41 summarizes these deficiencies.

The Roundabout scenarios are also not a potential solution. The roundabout ramp terminals are above capacity at the southbound ramp in every scenario and at the northbound ramp in every scenario except for S3T1R andS3T2R (Table 27). They also have queuing issues causing extensive intersection blockages. This results in very low overall average speeds with S3T1R being the slowest at 12 mph, and high overall network travel times. Table 42 depicts these issues.

The worst functioning alternative is S3T1R which creates conditions worse than the NBNM. With only two through lanes on Vilas Road and without the additional network created by the inclusion of the Tier 2 projects, coupled with the roundabout interchange, extremely long queues and significant intersection and turning bay blockages exist. S2T1 also performs poorly. Generally the Tier 2 scenarios perform better than Tier 1.

Table 40: No-build Alternative Comparison for 2040 Results[1]

Measure	NBNM	S0T1	S0T2
Number of locations over standards[2]	**8**	4	3
Number of locations over capacity[3]	**8**	1	2
Number of turn storage bays blocked more than 50% of the peak hour	12	5	6
Number of intersections blocked by queues	2	0	0
Overall average network speed (mph)	14	19	21
Overall network travel time (hr)	1,600	1,200	1,100
Overall delay (vehicle-hours)	1,000	600	500
Overall number of stops	20,200	21,400	22,500
Number of predicted crashes[4]	**83.7**	70.3	68.5
Number of segments with MMLOS worse than D	**54**	14	14

[1]The black to gray shading depicts the two best and the two worst performing scenarios. The black shaded cell is the worst up the gradient to the best performing scenario is the lightest shade of gray.
[2]Determined by OHP, HDM, City, or County Standards and Targets
[3]Defined as v/c > 1.0 or LOS E or F
[4]The No-build Scenarios do not include the OR62 mainline output from ISATe so here are shaded just relative to each other.

Table 41: Tight Diamond Interchange Alternative Comparison for 2040 Results[1]

Measure	S1T1	S2T1	S3T1	S5T1	S1T2	S2T2	S3T2	S5T2
Number of locations over standards[2]	6	**8**	5	3	4	4	3	2
Number of locations over capacity[3]	2	3	2	1	1	3	2	1
Number of turn storage bays blocked more than 50% of the peak hour	9	8	5	3	5	2	6	1
Number of intersections blocked by queues	6	5	7	2	4	4	4	1
Overall average network speed (mph)	18	15	18	21	20	15	20	25
Overall network travel time (hr)	1,800	2,200	1,800	1,700	1,600	2,100	1,600	1,400
Overall delay (vehicle-hours)	1,000	1,400	1,000	**1,700**	800	1,300	850	550
Overall number of stops	28,100	28,000	28,400	28,100	31,300	24,500	23,700	22,600
Number of predicted crashes	103.9	119.6	101.7	112.0	106.2	**119.7**	91.1	105.3
Number of segments with MMLOS worse than D	**20**	18	18	16	16	16	16	16

[1]The black to gray shading depicts the two best and the two worst performing scenarios. The black shaded cell is the worst up the gradient to the best performing scenario is the lightest shade of gray.
[2]Determined by OHP, HDM, City, or County Standards and Targets
[3]Defined as v/c > 1.0 or LOS E or F

Table 42: Roundabout Interchange Alternative Comparison for 2040 Results[1]

Measure	S1T1R	S2T1R	S3T1R	S5T1R	S1T2R	S2T2R	S3T2R	S5T2R
Number of locations over standards[2]	7	**8**	7	3	6	6	5	5
Number of locations over capacity[3]	3	5	5	1	3	6	4	3
Number of turn storage bays blocked more than 50% of the peak hour	12	4	**13**	4	2	8	12	1
Number of intersections blocked by queues	7	3	**8**	3	3	4	5	2
Overall average network speed (mph)	16	18	**12**	21	20	16	15	24
Overall network travel time (hr)	2,000	2,000	**2,400**	1,700	1,600	2,100	2,000	1,400
Overall delay (vehicle-hours)	1,200	1,100	**1,700**	850	800	1,300	1,300	550
Overall number of stops	26,400	27,500	23,700	28,600	28,300	**32,400**	23,500	22,400
Number of predicted crashes	93.9	107.7	93.8	101.9	95.8	107.4	84.1	96.7
Number of segments with MMLOS worse than D	**20**	18	18	16	16	16	16	16

[1]The black to gray shading depicts the two best and the two worst performing scenarios. The black shaded cell is the worst up the gradient to the best performing scenario is the lightest shade of gray.
[2]Determined by OHP, HDM, City, or County Standards and Targets
[3]Defined as v/c > 1.0 or LOS E or F

S0T2 has the overall best results and S5T2 has the best results of the build scenarios.in all measures except for three (Table 43). First, with 22,600 overall number of stops, it is a close second best behind S5T2R with 22,400. It would be expected that a roundabout would have less stops than a signalized intersection. Second, the number of predicted crashes is 105.3 which is 15% more than S3T2 which has the lowest number of crashes of the build scenarios. The third measure that S5T2 does not have the best scenario is MMLOS. It has the second best overall, but is tied with several other build scenarios as the best. S5T2R, the roundabout interchange version of the same scenario, has the second best results.

The No-build / No-mitigation (NBNM) scenario is improved in a number of ways by the inclusion of the Tier 2 projects (S0T2). The number of locations over capacity is reduced 75% due to the mitigations as well as the increased network distributing the overall volume. The number of locations over standards has a similar reduction. The number of turn storage bays blocked more than 50% of the peak hour is reduced 50% and the number of intersections blocked by queues is completely eradicated from two to zero. The overall average network speed is increased by 7 mph, the overall network travel time is decreased by 500 hours, and the overall network delay is decreased by 50%. The overall number of stops is increased, which would be expected with the inclusion of additional intersections. The number of predicted crashes is reduced by about 20%.

The No-build / No-mitigation (NBNM) scenario is improved in a number of ways by S5T2. The number of locations over capacity is reduced 50% due to the increased capacity provided by four through lanes on Vilas Road and also the increase in route options created by the Tier 2 projects distributing the traffic volume. The number of locations over standards is reduced about 33%. The number of turn storage bays blocked more than 50% of the peak hour is reduced 92% and the number of intersections blocked by queues is reduced 50% which reflects the reduction in locations over capacity reducing congestion and allowing traffic to flow more consistently. The overall average network speed is increased by 11 mph, the overall network travel time is decreased by 200 hours, and the overall network delay is decreased by 450 vehicle-hours. The overall number of stops is increased, but this would be unavoidable with the construction of the interchange. The crash frequency also increases with the inclusion of OR62 mainline and ramps.

Table 43: Viable Alternative Comparison for 2040 Results[1]

Measure	S0T1	S0T2	S2T1	S5T1	S1T2	S2T2	S3T2	S5T2
Number of locations over standards[2]	**4**	3	**8**	3	**4**	**4**	3	2
Number of locations over capacity[3]	1	2	**3**	1	1	**3**	2	1
Number of turn storage bays blocked more than 50% of the peak hour	5	**6**	**8**	3	5	2	**6**	1
Number of intersections blocked by queues	0	0	**5**	2	**4**	**4**	**4**	1
Overall average network speed (mph)	**19**	21	**15**	21	20	**15**	20	25
Overall network travel time (hr)	1,200	1,100	**2,200**	1,700	1,600	**2,100**	1,600	1,400
Overall delay (vehicle-hours)	600	500	**1,400**	**1,700**	800	1,300	850	550
Overall number of stops	21,400	22,500	28,000	**28,100**	**31,300**	24,500	23,700	22,600
Number of predicted crashes	70.3	68.5	**119.6**	112.0	106.2	**119.7**	91.1	105.3
Number of segments with MMLOS worse than D	14	14	**18**	**16**	**16**	**16**	**16**	**16**

Measure	S0T1	S0T2	S2T1	S5T1	S1T2	S2T2	S3T2	S5T2
Total number of Worst	0	0	**8**	1	1	**3**	0	0
Total number of 2nd Worst	2	1	**2**	2	3	**4**	3	1
Total number of 2nd Best	2	4	0	2	0	1	2	2
Total number of Best	4	5	0	1	1	0	0	5

[1]The black to gray shading depicts the two best and the two worst performing scenarios. The black shaded cell is the worst up the gradient to the best performing scenario is the lightest shade of gray.
[2]Determined by OHP, HDM, City, or County Standards and Targets
[3]Defined as v/c > 1.0 or LOS E or F

Crash frequency is another important parameter to consider. Overall, the No-build scenarios have the lowest predicted crash frequencies. Table 44 lists all of the scenarios' predicted crash frequencies from least crashes per year to the most. The roundabout interchange and the inclusion of the Tier 2 projects reduce crash frequencies. Two-lanes on Vilas Road have lower crash frequencies than four-lanes.

Generally the roundabout scenarios have a lower crash frequency because of the direct application of a crash reduction factor. However, the extreme localized congestion at the ramp terminals is not necessarily captured in the crash analysis so the values could be understated. Also, the larger capacity produced by the four-lane Vilas Road scenarios results in higher crash frequencies due to the higher volumes. The addition of the Tier 2 projects may have been expected to increase the crash frequencies due to the added roadways; however, the projects actually caused traffic to be distributed across the increased route options thereby lowering the effective volume present at each segment. Because the crash analysis output is largely driven by traffic volume, the inclusion of the Tier 2 projects reduces the crash frequency in most scenarios.

As expected, the Tier 1 and Tier 2 No-build Scenarios (S0T1 and S0T2) produce the lowest crash frequency at 70.3 and 68.5 crashes per year respectively; however, OR62 mainline, ramps, and ramp terminals are not included in these values. There are 40% less crashes in the S0T2 than the Tier 2 JTA build +4 lane Vilas Rd (S2T2 the scenario with the highest predicted crash rate). Excluding the No-build scenarios, S3T2R has the lowest predicted crash rate. S0T2 has 20% less predicted crashes than this lowest value.

Because Tier 2 scenarios have more roadways than Tier 1, it may be expected that there would be more crashes in Tier 2; however, the Tier 1 scenarios have less crashes. By taking a closer look at a specific segment it can be seen that the predicted crashes for Scenario 3 on the Vilas Road segment between Lear Way and CLH is almost double in Tier 1 than in Tier 2 (1.885 vs 1.026) and also CLH between Vilas Road and the North

Project Limit is higher in Tier 1 than Tier 2 (2.336 vs 1.690). The Vilas Road AADT drops from 20,200 in Tier 1 to 12,500 in Tier 2 and the CLH drops from 28,700 to 21,200. There is a similar volume drop from Tier 1 to 2 in Scenario 5. Vilas Road decreases from 23,500 to 17,600 and CLH from 29,000 to 20,200. The crash analysis output is largely driven by the traffic volume so the lower predicted crashes in Tier 2 would be expected due to the lower volumes even though more roadways are added. The additional roadways cause traffic to be spread out over the increased route options.

Table 44: Total Predicted Crash Frequency (crashes/year) for all Tight Diamond and Roundabout interchange scenarios listed from least to greatest predicted crashes.

Scenario	Total	FI
S0T2	68.53	21.54
S0T1	70.3	22.2
S3T2R	84.10	28.33
S3T2	91.14	29.35
S3T1R	93.85	31.72
S1T1R	93.95	32.62
S1T2R	95.77	33.07
S5T2R	96.66	32.90
S3T1	101.69	32.86
S5T1R	101.94	35.02
S1T1	103.92	34.15
S5T2	105.26	34.25
S1T2	106.18	34.62
S2T2R	107.42	37.36
S2T1R	107.70	37.40
S5T1	111.97	36.61
S2T1	119.55	39.27
S2T2	119.67	39.25

The intersections of Hamrick Road and Table Rock Road with Biddle Road are over capacity in almost every scenario, the worst being the No-build/No-mitigation. This intersection is a standalone issue with or without any Vilas Road interchange improvements. The build scenarios do lower the v/c and LOS, but generally not enough to meet standards. One issue is that widening Hamrick Rd north of Biddle Rd was not a possible mitigation in order to remain consistent with Central Point's desire to maintain this as a two-lane roadway. Maintaining a context-sensitive capacity on this section to be most compatible with the surrounding residential land uses in the area is a priority.

CONCLUSIONS

With no-mitigation, the entire study area will have extensive queuing and congestion. Even with mitigation improvements, none of the roundabout or the two-lane Tier 1 scenarios are viable because of capacity or queuing issues, respectively.

All scenarios function better with the inclusion of the Tier 2 projects. Vilas Road should be widened to four through lanes as this significantly improves functionality. Therefore, if the interchange is constructed, the system functions best in S5T2, Full Build with four-lanes on Vilas Road and the inclusion of the Tier 2 projects. The No-build scenarios are also viable options with the lowest crash rates, shortest overall network travel times, low intersection and turning bay blocking and only a couple of locations exceeding capacity. Therefore, in the absence of the interchange S0T2 has the best performance with the JTA Build, two-lanes on Vilas Road and the inclusion of Tier 2 projects.