

*Corvallis Area
Metropolitan Transportation Plan,
Destination 2030
Operations Analysis of Selected
Intersections*

October 2008

Final Report



*Prepared For:
Oregon Department
Of Transportation
Salem, Oregon*



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INTRODUCTION

Project Description and Purpose

The purpose of this project is to evaluate the performance of existing (2005) and future (2030) "Corvallis Area Metropolitan Transportation Plan (Destination 2030)" critical intersections on state highway and local intersections influencing state highway operations within Corvallis Area Metropolitan Planning Organization (CAMPO) area. The analysis considers the performance of eighteen study intersections using Oregon Highway Plan (OHP) and local mobility standards under five scenarios. The scenarios include the existing 2005 base condition and four future forecast conditions. Figure 1 depicts the study area and analyzed intersections.

The results of this analysis are intended to support the Metropolitan Transportation Plan (MTP) decision making process and help to determine if further corridor level study is warranted. There are other critical system intersections within the Metropolitan Planning Area that are not included in this analysis. Other on-going and/or upcoming planning efforts will be used in similar fashion to this analysis to determine if further study is appropriate.

Summary of Analysis Results

The analysis identifies operational performance deficiencies compared with mobility standards in all of the scenarios analyzed. In the existing conditions analysis, a handful of intersections operate at conditions worse than the mobility standard but better than intersection capacity. In the future, the number of intersections and the degree of failure will increase, even when projects in the MTP financially constrained and illustrative scenarios are considered. The number of intersections operating at levels worse than the mobility standard increase from five to twelve between the 2005 base year and future 2030 no-build analysis. In the future scenario analyses, many of the deficient intersections are forecast to operate both worse than the mobility standard and above capacity. The biggest project, adding additional capacity in the US20/OR34

corridor (an MTP illustrative project) greatly improves corridor operations, but does not by itself solve all of the corridor deficiencies.

The analysis results indicate that further corridor refinement planning work would be useful and should be considered. At the same time, it also indicates a policy need to consider the mobility standards used for MTP evaluation.

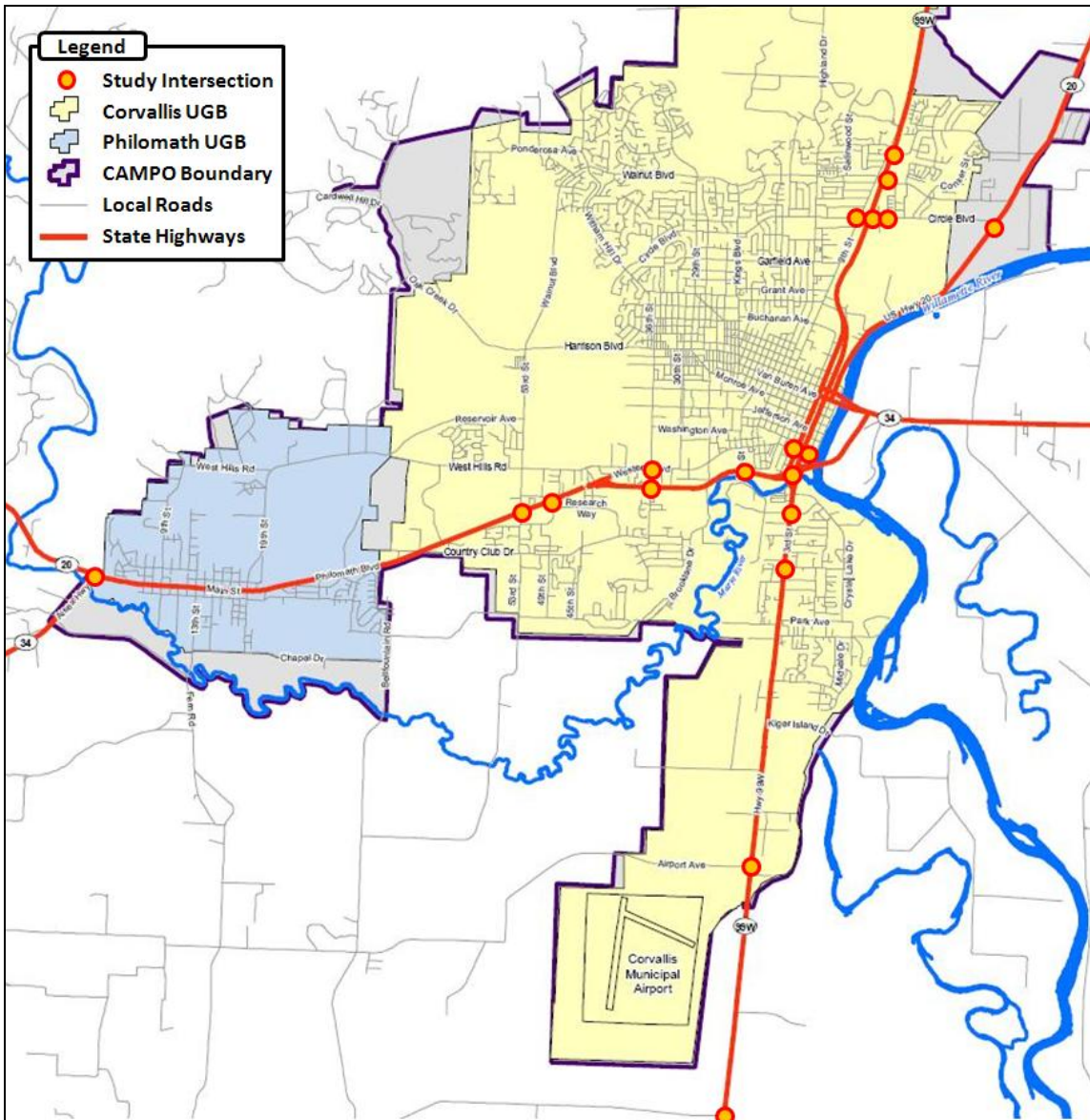


Figure 1. Study Intersections

VOLUME-TO-CAPACITY RATIO ANALYSIS

Volume-to-Capacity Analysis Methodology

Volume/Capacity (V/C) Ratio is defined as the ratio of traffic flow rate to capacity of the road to handle that traffic flow (ODOT Analysis Procedure Manual (APM), ODOT Transportation Planning Analysis Unit (TPAU)). The V/C may be the actual or projected rate of flow on a designated lane group during a specific time period. A V/C ratio over 1.0 indicates that traffic volume has exceeded the road or intersection's capacity.

The procedure for performing V/C analysis, sometimes referred to as "post-processing" in the context of future year analysis uses field collected traffic counts and traffic forecasts produced by the regional travel demand model together to estimate intersection performance as defined by the Highway Capacity manual (HCM).

Mobility Standard

For State highway intersections, the OHP establishes mobility standards for the highway and intersecting streets. The mobility standard is different depending on the functional designation of the roadway and special designation (e.g. freight route, Special Transportation Area (STA)) of each roadway segment. The City of Corvallis and Benton County have separate mobility standards for their facilities.

OHP mobility standards applicable to the study area are shown in Table 1. Local city and county mobility standards are presented in Table 2.

Table 1. Mobility Standards Applicable to the Project – State Highways

<i>No.</i>	<i>Highway Category</i>	<i>Land Use</i>	<i>Mobility Standard (V/C)</i>	<i>Level of Service (LOS)</i>
<i>Inside Urban Growth Boundary</i>				
1	Freight Route on a Statewide Highway	MPO	0.80	N/A
2	Regional Highways	STA	0.90	N/A
3	Regional Highways	MPO	0.85	N/A
<i>Outside Urban Growth Boundary</i>				
4	Regional Highways	Rural Lands	0.70	N/A

Table 2. Mobility Standards Applicable to the Project – Local Roadways

<i>No.</i>	<i>Category</i>	<i>Land Use</i>	<i>Mobility Standard (V/C)</i>	<i>Level of Service (LOS)</i>
<i>Benton County</i>				
1	Major Arterial	MPO	0.80	N/A
2	Minor Arterial	MPO	0.80	N/A
<i>City of Corvallis</i>				
3	Major Arterial	MPO	N/A	D
4	Minor Arterial	MPO	N/A	D

Highway designations for major highways in study area are shown below:

- Pacific Highway West (OR-99W) is classified as Regional Highway. In downtown Corvallis, the area from Polk Avenue to Western Boulevard is designated as an STA.
- Corvallis-Newport Highway (US-20/OR-34) is classified as Statewide Highway and a statewide freight route. It is part of the National Highway System (NHS).

- Albany-Corvallis Highway (US-20) is classified as Regional Highway. From OR OR-99W to the west end of the Van Buren Bridge along US-20 is designated as an STA.
- Alsea Highway (OR-34) is classified as a District Highway within the MPO planning area.
- Corvallis-Lebanon Highway (OR-34) is classified as a District Freight Route west of the Corvallis Bypass intersection and within the MPO area. The Van Buren Boulevard section between 4th Street and the Van Buren Bridge also is classified as an STA.

Table 3 lists each study area intersection analyzed and its associated mobility standard. The following section presents the results of the V/C analysis performed. Complete details on the analysis methodology are provided in Appendix A. Turning movement volumes used for both Existing (2005) and Future (2030) conditions analysis are provided in Appendix B.

Table 3. Study Intersection List

#	Primary Road Name	Secondary Road Name	Mobility Standard (V/C Ratio)
1	Pacific Highway West (99 W)	Conifer Boulevard	0.85
2	Pacific Highway West (99 W)	Circle Boulevard	0.85
3	Circle Boulevard	4 Acres Street	LOS D (0.80)
4	3rd Street (99 W)	Western Avenue	0.90
5	4th Street (99 W)	Western Avenue	0.90
6	Pacific Highway West (99 W)	Crystal Lake Drive	0.85
7	Pacific Highway West (99 W)	Alexander Avenue	0.85
8	Pacific Highway West (99 W)	Airport Road	0.85
9	Pacific Highway West (99 W)	Llewellyn Road	0.70
10	9th Street	Walnut Boulevard	LOS D (0.80)
11	9th Street	Circle Boulevard	LOS D (0.80)
12	Albany-Corvallis Highway (US-20)	Circle Boulevard	0.85

Table 3. Study Intersection List (Continued)

#	Primary Road Name	Secondary Road Name	Mobility Standard (V/C Ratio)
13	<i>Corvallis-Newport Highway (US-20/OR-34)</i>	<i>15th Street</i>	<i>0.80</i>
14	<i>Corvallis-Newport Highway (US-20/OR-34)</i>	<i>35th Street</i>	<i>0.80</i>
15	<i>Western Avenue</i>	<i>35th Street</i>	<i>LOS D (0.80)</i>
16	<i>Corvallis-Newport Highway (US-20/OR-34)</i>	<i>Technology Loop</i>	<i>0.80</i>
17	<i>Corvallis-Newport Highway (US-20/OR-34)</i>	<i>53rd Street</i>	<i>0.80</i>
18	<i>Corvallis-Newport Highway (US-20)</i>	<i>Alesea Highway (OR-34)</i>	<i>0.80</i>

Scenario Volume-to-Capacity Analysis Results

An intersection V/C analysis was conducted for the following five scenarios:

- 1) Base Year (2005): This scenario analyzes performance of traffic conditions for study intersections under MTP base year (2005) conditions.
- 2) Future (2030) No-Build: As a baseline of future performance, forecasted (2030) traffic volume is analyzed against the existing roadway network condition.
- 3) Future (2030) with Financially Constrained Projects: This analysis considers the financially constrained projects included in the CAMPO MTP.
- 4) Future (2030) with Illustrative Projects: The Illustrative Project Scenario considers intersection performance based on illustrative projects identified in the MTP at the studied intersections. The Illustrative Project Scenario also includes improvements from the Financially Constrained Scenario. The Illustrative Project Scenario is not financially funded.
- 5) Future (2030) with PTV America recommended Improvements: Improvements are listed in situations where future year deficiencies are not resolved by the financially constrained scenario (3) or by the illustrative scenario.

Project assumptions and analysis results for each scenario are presented in the following sections. A comparison table showing results for each scenario is provided in Appendix C.

Existing (2005) Condition

The existing conditions analysis is performed for year 2005 traffic conditions, consistent with the MTP existing conditions analysis. Some of the study area intersections were not included in the 2005 analysis. New traffic count data was collected for these intersections and adjusted to reflect 2005 conditions.

Traffic Operations Analysis

In the existing condition analysis, five intersections operate at conditions that are worse than the applicable mobility standard. All are State Highway intersections. Four of these are located on the Corvallis-Newport Highway (US-20/OR-34) Corridor, and one was on the Albany-Corvallis Highway (US-20) at the Circle Boulevard intersection. V/C analysis results for each intersection are presented in Table 4. A description of deficiencies identified for each of the five intersections is presented below:

- ***Albany-Corvallis Highway (US-20) and Circle Boulevard (#12)***: Overall intersection V/C ratio is 0.88. The high V/C ratio is due to the high volume of northbound through (0.88) and conflicting eastbound traffic (0.88). These are the largest volumes of traffic using this intersection.
- ***Corvallis-Newport Highway (US-20/OR-34) and 15th Street (#13)***: Overall intersection V/C ratio is 0.95. Three groups of traffic were showing a V/C ratio worse than standard (0.80): the through traffic on US-20/OR-34 (0.94 (eastbound) and 0.96 (westbound)), and the southbound traffic (0.96), coming from the Oregon State University (OSU) campus.
- ***Corvallis-Newport Highway (US-20/OR-34) and 35th Street (#14)***: Overall intersection V/C ratio is 0.86. Three movement groups exceeded the mobility standard (0.80): the eastbound left turn (0.86), westbound through (0.86) and

northbound left turn (0.86). The Corvallis School District Offices, Adams School and the housing south of the highway have their primary access via 35th Street, and the street is a primary route across the OSU Campus. As a result, there is a high eastbound left turn demand, heavy northbound traffic and high through volume on the highway.

- ***Corvallis-Newport Highway (US-20/OR-34) and Technology Loop (#16)***: Overall intersection V/C ratio is 0.99—very close to the at-capacity condition (1.00). All movements on US-20/OR-34 have V/C ratios higher than mobility standard (0.80). Especially, all eastbound traffic and westbound left turn movement showed overcapacity condition (1.12) while westbound through (0.87) and right turn (0.94) showed below capacity condition.
- ***Corvallis-Newport Highway (US-20/OR-34) and 53rd Street (#17)***: Overall intersection V/C ratio is 0.94. Most movements on US-20/OR-34 showed a high V/C ratio (all greater than 0.96). 53rd Street traffic also showed a relatively high V/C ratio for the southbound left turn (0.98) having the highest V/C ratio; the northbound through and northbound right turn movements have a lower V/C ratio (0.88), but this still exceeds the mobility standard (0.80).

Table 4. V/C Analysis Result – Existing (2005) Condition

	<i>Primary Road Name</i>	<i>Secondary Road Name</i>	<i>Mobility Standard</i>	<i>V/C Ratio</i>	<i>LOS</i>	<i>Deficiency Identified?</i>
1*	99 W	Conifer Boulevard	0.85 ⁽¹⁾	0.68	B	NO
2*	99 W	Circle Boulevard	0.85 ⁽¹⁾	0.72	C	NO
3*	Circle Boulevard	4 Acres Street	LOS D ⁽³⁾	0.48	A	NO
4*	3rd Street (99 W)	Western Avenue	0.90 ⁽²⁾	0.58	A	NO
5*	4th Street (99 W)	Western Avenue	0.90 ⁽²⁾	0.59	A	NO
6*	99 W	Crystal Lake Drive	0.85 ⁽¹⁾	0.80	D	NO
7*	99 W	Alexander Avenue	0.85 ⁽¹⁾	0.45	A	NO
8	99 W	Airport Road	0.85 ⁽¹⁾	0.26	A	NO
9	99 W	Llewellyn Road	0.70 ⁽¹⁾	0.07	A	NO
10*	9th Street	Walnut Boulevard	LOS D ⁽³⁾	0.64	B	NO
11*	9th Street	Circle Boulevard	LOS D ⁽³⁾	0.69	B	NO
12*	US-20	Circle Boulevard	0.85 ⁽¹⁾	0.88	D	YES
13*	US-20/OR-34	15th Street	0.80 ⁽¹⁾	0.95	E	YES
14*	US-20/OR-34	35th Street	0.80 ⁽¹⁾	0.86	D	YES
15*	Western Avenue	35th Street	LOS D ⁽³⁾	0.79	C	NO
16*	US-20/OR-34	Technology Loop	0.80 ⁽¹⁾	0.99	E	YES
17*	US-20/OR-34	53rd Street	0.80 ⁽¹⁾	0.94	E	YES
18	US-20	OR-34	0.80 ⁽¹⁾	0.33	A	NO

1) Mobility Standards based on ODOT, OHP, and City of Corvallis Standards: (1) ODOT OHP Mobility Standard, (2) ODOT OHP Mobility Standard – STA, and (3) City of Corvallis.

2) Intersections with an asterisk (*) were evaluated with the traffic signal in place.

3) Highlighted cells represent the location where mobility standard was not satisfied.

Future (2030) No-Build Condition

As a baseline of future (2030) conditions without any system improvements, the Future No-Build scenario was analyzed. This scenario is used to identify additional future deficiencies, considering how the system performs when future growth (demand) is accommodated by the current transportation system.

Traffic Operations Analysis

Twelve of the eighteen study intersections were not able to satisfy applicable mobility standards under the No-build analysis. Five of these are the intersections identified with deficiencies under existing (2005) traffic conditions. The remaining seven are intersections on or near Pacific Highway West (OR-99W). Nine of the twelve intersections are forecast to be over-capacity (a V/C ratio greater than 1.00), and three are forecasted expected to be close to capacity. V/C analysis results for each intersection are presented in Table 5. Details on deficiencies identified for each of the twelve intersections are described below:

- ***Pacific Highway West (OR-99W) and Circle Boulevard (#1)***: This intersection is over-capacity with V/C ratio of 1.17. All movements on OR-99W are unable to satisfy the OHP mobility V/C standard with relatively high V/C ratios (between 0.92 ~ 1.17). The westbound left turn movement on Circle Boulevard (toward OR-99W Southbound) is forecasted to be over-capacity (1.17), and the Eastbound through movement toward the HP Campus also had high V/C ratio (0.92).
- ***Third Street (OR-99W) and Western Boulevard (#4)***: This intersection is over-capacity with V/C ratio of 1.14. Northbound traffic on Third Street had a V/C ratio exceeding capacity (1.14). The eastbound left turn had the same V/C ratio due to permissive left-turn signal phase.
- ***Fourth Street (OR-99W) and Western Boulevard (#5)***: This intersection shows a similar pattern to the intersection on Third Street, with an over-capacity operating condition of 1.15. Traffic on Fourth Street had over-capacity V/C ratio (1.15), as did westbound left turn traffic due to permissive left-turn signal phase.

- ***Pacific Highway West (OR-99W) and Crystal Lake Drive (#6)***: Overall intersection V/C ratio is 1.04. All movements except for the westbound left-turn showed high V/C ratios (0.99 ~ 1.08) and more than half of these were in an over-capacity condition.
- ***Pacific Highway West (OR-99W) and Airport Road (unsignalized, #8)***: This is an unsignalized intersection, so only the minor approaches showed a high V/C ratio. The eastbound left-turn shows operation at a near capacity condition— (0.95).
- ***Ninth Street and Circle Boulevard (#11)***: This intersection operates at-capacity condition (0.99) with all intersection approaches having high V/C ratios (0.81 ~ 0.99). Since both roadway crossing volumes at this intersection are heavy, all movements are operating in a near- or at-capacity condition.
- ***Albany-Corvallis Highway (US-20) and Circle Boulevard (#12)***: This intersection is over-capacity with V/C ratio of 1.11. Eastbound movements and northbound through movements (majority of traffic going toward the city of Albany) had highest V/C ratio (1.11). Also, the southbound right-turn toward northern Corvallis is operating at over-capacity condition (1.06).
- ***Corvallis-Newport Highway (US-20/OR-34) and 15th Street (#13)***: This intersection is over-capacity with V/C ratio of 1.26. Through traffic on US-20/OR-34 and the eastbound left-turn heading towards the OSU campus show over-capacity conditions with a V/C ratio ranging from 1.20 to 1.27. Southbound traffic exceeds capacity (1.27) due to heavy left-turn volume and the permissive left-turn phase.
- ***Corvallis-Newport Highway (US-20/OR-34) and 35th Street (#14)***: This intersection operates in an at-capacity condition (0.99). All left-turns and through movements on US-20/OR-34 are functioning at an at-capacity level (0.92 ~0.97) due to heavy traffic volume. Northbound left-turn movements show a high V/C ratio (0.96) because of the heavy left-turn volume and opposing through movement volume.

- ***Western Boulevard and 35th Street (#15)***: This intersection is over-capacity with a V/C ratio of 1.05. Almost all movements cannot satisfy the local mobility standard (LOS D/0.80) with varying degrees of magnitude. Western Boulevard movements operate at over-capacity levels ranging from 1.01~1.42 with majority vehicles moving west (outbound). Northbound traffic also exceeded capacity due to the single shared lane for all movements. The southbound through and right-turn movements barely exceeded local mobility standard.
- ***Corvallis-Newport Highway (US-20/OR-34) and Technology Loop (#16)***: This intersection is over-capacity with a V/C ratio of 1.06. Eastbound through traffic and westbound left-turn movement are both showing an over-capacity operating condition of 1.06. The right-turn movement on Technology Loop also showed a V/C ratio (0.91) that exceeds the mobility standard.
- ***Corvallis-Newport Highway (US-20/OR-34) and 53rd Street (#17)***: This intersection is over-capacity with V/C ratio of 1.19. All movements except for northbound left-turn showed over-capacity condition with tight V/C ratio range between 1.14~1.19. This intersection failed to serve all the vehicles using the intersection.

Table 5. V/C Analysis Result – Future (2030) No-Build Condition

	<i>Primary Road Name</i>	<i>Secondary Road Name</i>	<i>Mobility Standard</i>	<i>V/C Ratio</i>	<i>LOS</i>	<i>Deficiency Identified?</i>
1*	99 W	Conifer Boulevard	0.85 ⁽¹⁾	0.80	D	NO
2*	99 W	Circle Boulevard	0.85 ⁽¹⁾	1.17	F	YES
3*	Circle Boulevard	4 Acres Street	LOS D ⁽³⁾	0.64	B	NO
4*	3rd Street (99 W)	Western Avenue	0.90 ⁽²⁾	1.14	F	YES
5*	4th Street (99 W)	Western Avenue	0.90 ⁽²⁾	1.15	F	YES
6*	99 W	Crystal Lake Drive	0.85 ⁽¹⁾	1.04	F	YES
7*	99 W	Alexander Avenue	0.85 ⁽¹⁾	0.79	C	NO
8	99 W	Airport Road	0.85 ⁽¹⁾	0.95	E	YES
9	99 W	Llewellyn Road	0.70 ⁽¹⁾	0.17	A	NO
10*	9th Street	Walnut Boulevard	LOS D ⁽³⁾	0.71	C	NO
11*	9th Street	Circle Boulevard	LOS D ⁽³⁾	0.99	E	YES
12*	US-20	Circle Boulevard	0.85 ⁽¹⁾	1.11	F	YES
13*	US-20/OR-34	15th Street	0.80 ⁽¹⁾	1.26	F	YES
14*	US-20/OR-34	35th Street	0.80 ⁽¹⁾	0.96	E	YES
15*	Western Avenue	35th Street	LOS D ⁽³⁾	1.05	F	YES
16*	US-20/OR-34	Technology Loop	0.80 ⁽¹⁾	1.06	F	YES
17*	US-20/OR-34	53rd Street	0.80 ⁽¹⁾	1.19	F	YES
18	US-20	OR-34	0.80 ⁽¹⁾	0.42	A	NO

1) Mobility Standards based on ODOT, OHP, and City of Corvallis Standards: (1) ODOT OHP Mobility Standard, (2) ODOT OHP Mobility Standard – STA, and (3) City of Corvallis.

2) Intersections with an asterisk (*) were evaluated with the traffic signal in place.

3) Highlighted cells represent the location where mobility standard was not satisfied.

Future (2030) Condition with Financially Constrained Projects

All twelve intersections identified to have deficiencies in the No-Build scenario continue to show deficiencies under the Destination 2030 financially constrained project scenario. Nine intersections are over capacity. The financially constrained projects at three of the intersections resulted in slight improvement, but the intersections continue to be worse than the mobility standard and close to capacity. A list of the financially constrained projects applicable to study area intersections is shown in Table 6.

Table 6. Destination 2030 Financially Constrained Project List

	<i>Primary Road Name</i>	<i>Secondary Road Name</i>	<i>Details</i>
2	99 W	Circle Boulevard	<i>OR-99W:</i> Railroad over crossing to Circle Boulevard – Widen Circle Boulevard to four lanes with left turn refuges
8	99 W	Airport Road	<i>Airport Road:</i> Pacific Highway West (OR-99W) to Airport Place – Upgrade to urban standards (SDC).
11	9th Street	Circle Boulevard	<i>Circle Boulevard:</i> Add right-turn lane on Eastbound (2010)
12	US-20	Circle Boulevard	<i>Circle Boulevard:</i> HP campus to US-20 – Widen Circle Boulevard to 4 lanes (2030 Network)
14	US-20/OR-34	35th Street	<i>35th Street:</i> US-20/OR-34 to Orchard – Widen, realign and add bike lanes on 35 th St. (Completed by 2007 / Assumed to have no impact to capacity of study intersection)
15	Western Avenue	35th Street	
16	US-20/OR-34	Technology Loop	<i>US-20/OR-34:</i> Complete final design and acquire right-of-way (2020)
17	US-20/OR-34	53rd Street	<i>US-20/OR-34:</i> Add turning lanes (2010) / Complete final design and acquire right-of-way (2020)
18	US-20	OR-34	Install traffic signal when warranted.

Traffic Operations Analysis

Three intersections showed slight improvements after applying financially constrained projects to study intersections. However, as noted previously, none of the projects were able to improve operations enough to satisfy mobility standards. As a result, the

same twelve intersections identified to fail in the No-Build scenario are forecast to fail in the financially constrained scenario. V/C results for each intersection under the Financially Constrained Scenario are provided in Table 7. The three intersections with improved operations are discussed below; see the No-build analysis for a description of failing movements for the other nine intersections.

- ***9th Street and Circle Boulevard (#11)***: By adding a right-turn lane on the eastbound approach, the V/C ratio was reduced from 0.99 to 0.32. At the same time, this improvement also provided slight relief for all other movement V/C ratios. As a result, the intersection V/C ratio improved from 0.99 to 0.95.
- ***Albany-Corvallis Highway (US-20) and Circle Boulevard (#12)***: Adding an exclusive right-turn lane on Circle Boulevard allows the intersection to accommodate more vehicles than before. Eastbound traffic currently operates with a single, shared lane. With that improvement, the eastbound right-turn V/C ratio is reduced from 1.11 to 0.17, and the other movement V/C ratios are also slightly reduced. The overall intersection V/C ratio improves from 1.11 to 1.02.
- ***Corvallis-Newport Highway (US-20/OR-34) and 53rd Street (#17)***: Exclusive right-turn lanes are added to 53rd Street, improving the V/C ratio for right-turns on 53rd Street. However, intersection V/C performance as a whole is improved only from 1.19 to 1.07, remaining well over-capacity.

Table 7. V/C Analysis Result – Future Condition with Financially Constrained Projects

	<i>Primary Road Name</i>	<i>Secondary Road Name</i>	<i>Mobility Standard</i>	<i>V/C Ratio</i>	<i>LOS</i>	<i>Deficiency Identified?</i>
1*	99 W	Conifer Boulevard	0.85 ⁽¹⁾	0.80	D	NO
2*	99 W	Circle Boulevard	0.85 ⁽¹⁾	1.17	F	YES
3*	Circle Boulevard	4 Acres Street	LOS D ⁽³⁾	0.64	B	NO
4*	3rd Street (99 W)	Western Avenue	0.90 ⁽²⁾	1.14	F	YES
5*	4th Street (99 W)	Western Avenue	0.90 ⁽²⁾	1.15	F	YES
6*	99 W	Crystal Lake Drive	0.85 ⁽¹⁾	1.04	F	YES
7*	99 W	Alexander Avenue	0.85 ⁽¹⁾	0.79	C	NO
8	99 W	Airport Road	0.85 ⁽¹⁾	0.95	E	YES
9	99 W	Llewellyn Road	0.70 ⁽¹⁾	0.17	A	NO
10*	9th Street	Walnut Boulevard	LOS D ⁽³⁾	0.72	C	NO
11*	9th Street	Circle Boulevard	LOS D ⁽³⁾	0.95	E	YES
12*	US-20	Circle Boulevard	0.85 ⁽¹⁾	1.02	F	YES
13*	US-20/OR-34	15th Street	0.80 ⁽¹⁾	1.26	F	YES
14*	US-20/OR-34	35th Street	0.80 ⁽¹⁾	0.96	E	YES
15*	Western Avenue	35th Street	LOS D ⁽³⁾	1.05	F	YES
16*	US-20/OR-34	Technology Loop	0.80 ⁽¹⁾	1.06	F	YES
17*	US-20/OR-34	53rd Street	0.80 ⁽¹⁾	1.07	F	YES
18	US-20	OR-34	0.80 ⁽¹⁾	0.42	A	NO

1) Mobility Standards based on ODOT, OHP, and City of Corvallis Standards: (1) ODOT OHP Mobility Standard, (2) ODOT OHP Mobility Standard – STA, and (3) City of Corvallis.

2) Intersections with an asterisk (*) were evaluated with the traffic signal in place.

3) Highlighted cells represent the location where mobility standard was not satisfied.

Future (2030) Condition with Illustrative Projects

Projects identified in the Illustrative Scenario involve six of the eighteen study intersections. The largest and most significant project would widen US-20/OR-34 to four lanes. Illustrative project improvements also impact two intersections on OR-99W. The twelve intersections failing to meet applicable mobility standards in the Financially Constrained scenario is reduced to eight in the Illustrative scenario. Table 8 describes the Illustrative projects for each of the associated study intersections. Six intersections are over capacity; two are close to capacity.

Table 8. Destination 2030 Illustrative Project List

	<i>Primary Road Name</i>	<i>Secondary Road Name</i>	<i>Financially Constrained Project</i>
2	99 W	Circle Boulevard	<i>Circle Boulevard:</i> Construct Northbound right-turn lane
8	99 W	Airport Road	<i>OR-99W:</i> Rivergreen Avenue to Airport Road – Widen OR-99W from 2 lanes to 4 lanes with left turn lanes at major intersections to 500 ft. south of Airport Road
13	US-20/OR-34	15th Street	<i>US-20/OR34:</i> Western Boulevard to Pacific Highway West (OR-99W) – Reconstruct US-20/OR-34 to four lanes with left-turn refuges, bike lanes and sidewalks
14	US-20/OR-34	35th Street	
16	US-20/OR-34	Technology Loop	<i>US-20/OR-34:</i> 53 rd Street to Western Boulevard – Reconstruct US-20/OR-34 to four lanes with left-turn refuges, bike lanes and sidewalks
17	US-20/OR-34	53rd Street	

Traffic Operations Analysis

All six intersections where Illustrative project improvements were made lowered the associated intersection V/C ratio. Four of six intersections showed significant improvements, enough to satisfy the applicable mobility standard.

The most effective improvement is the widening of US-20/OR-34 to four- lanes. With this improvement, all intersections on US-20/OR-34 except for 15th Street are forecast to satisfy the mobility standard (0.80) and will be better than operation under the

existing conditions. The additional capacity on OR-99W at Airport Road also improves operations to satisfy mobility standards at that location. Performance at the six impacted intersections is described below; V/C results for all intersections under the Illustrative Scenario are presented in Table 9.

- ***Pacific Highway West (OR-99W) and Circle Boulevard (#2)***: The northbound right-turn V/C ratio is reduced from 1.17 (shared lane with through movement) to 0.40 with the capacity improvement. However, the V/C ratio for all other movements still exceeds capacity and overall operations still forecasts the intersection to fail with a V/C ratio of 1.1.
- ***Pacific Highway West (OR-99W) and Airport Road (8)***: Widening OR-99W created more opportunities for Airport Road traffic to find gaps in highway traffic to make left-turns. The V/C ratio for eastbound left-turns reduced from 0.95 to 0.84, barely satisfying the mobility standard (0.85).
- ***Corvallis-Newport Highway (US-20/OR-34) intersections (13-17)***: As discussed, adding additional lanes on US-20/OR-34 made traffic operations much more efficient. With the exception of 15th Street, all intersections perform better than the mobility standard. The remaining problem is that southbound traffic on 15th Street cannot be served with the current single shared lane and permissive left turn phasing.

- **Table 9. V/C Analysis Result – Future Condition with Illustrative Projects**

	<i>Primary Road Name</i>	<i>Secondary Road Name</i>	<i>Mobility Standard</i>	<i>V/C Ratio</i>	<i>LOS</i>	<i>Deficiency Identified?</i>
1*	99 W	Conifer Boulevard	0.85 ⁽¹⁾	0.80	D	NO
2*	99 W	Circle Boulevard	0.85 ⁽¹⁾	1.10	F	YES
3*	Circle Boulevard	4 Acres Street	LOS D ⁽³⁾	0.64	B	NO
4*	3rd Street (99 W)	Western Avenue	0.90 ⁽²⁾	1.14	F	YES
5*	4th Street (99 W)	Western Avenue	0.90 ⁽²⁾	1.15	F	YES
6*	99 W	Crystal Lake Drive	0.85 ⁽¹⁾	1.04	F	YES
7*	99 W	Alexander Avenue	0.85 ⁽¹⁾	0.79	C	NO
8	99 W	Airport Road	0.85 ⁽¹⁾	0.84	E	NO
9	99 W	Llewellyn Road	0.70 ⁽¹⁾	0.17	A	NO
10*	9th Street	Walnut Boulevard	LOS D ⁽³⁾	0.72	C	NO
11*	9th Street	Circle Boulevard	LOS D ⁽³⁾	0.95	E	YES
12*	US-20	Circle Boulevard	0.85 ⁽¹⁾	1.02	F	YES
13*	US-20/OR-34	15th Street	0.80 ⁽¹⁾	0.94	E	YES
14*	US-20/OR-34	35th Street	0.80 ⁽¹⁾	0.66	B	NO
15*	Western Avenue	35th Street	LOS D ⁽³⁾	1.05	F	YES
16*	US-20/OR-34	Technology Loop	0.80 ⁽¹⁾	0.71	C	NO
17*	US-20/OR-34	53rd Street	0.80 ⁽¹⁾	0.73	C	NO
18	US-20	OR-34	0.80 ⁽¹⁾	0.42	A	NO

1) Mobility Standards based on ODOT, OHP, and City of Corvallis Standards: (1) ODOT OHP Mobility Standard, (2) ODOT OHP Mobility Standard – STA, and (3) City of Corvallis.

2) Intersections with an asterisk (*) were evaluated with the traffic signal in place.

3) Highlighted cells represent the location where mobility standard was not satisfied.

Future (2030) Condition with PTV America Recommended Improvements

After considering the Financially Constrained and Illustrative project improvements, eight of eighteen study intersections still do not meet the applicable mobility standards. Six of these are forecast to operate with a V/C ratio > 1.0. As a result of this analysis, PTV America has recommended a number of complimentary improvements that are in addition to those specified in the financially constrained and illustrative project scenarios. Table 10 describes the recommended improvements for each intersection. In a few cases, the intersection may satisfy the mobility standard (for example, the OR-99W/Conifer Boulevard intersection) but the additional improvements would further improve the V/C performance.

Traffic Operations Analysis

The additional improvements identified help the performance of all of the intersections however, even these context sensitive improvements could not eliminate all of the mobility standard deficiencies. The recommendations did reduce the number of intersections not meeting mobility standards from eight to five. The improvements helped one intersection operate just under capacity and one intersection operates just over capacity. Individual intersection performance is discussed below; V/C results for all intersections are presented in Table 10.

- ***Pacific Highway West (OR-99W) and Conifer Boulevard (#1)***: While this intersection shows satisfactory performance versus the mobility standard, making the eastbound left-turn into a dual left-turn can further improve intersection operations. This improvement improves safety by reducing the queue spillback of the eastbound-left turns with the closely spaced upstream intersection.
- ***Pacific Highway West (OR-99W) and Circle Boulevard (#2)***: All approaches are experiencing over-saturated operating conditions despite of the improvements proposed to this intersection. However, further geometric capacity improvements are not practical given the physical location constraints (railroad and commercial buildings). The signal improvements for north-bound right-turns help reduce the V/C ratio slightly.

- ***Pacific Highway West (OR-99W) and Crystal Lake Drive (#6)***: Adding exclusive right-turn lanes on Crystal Lake Drive helps the intersection operate slightly below capacity. Larger scale capacity improvements (additional lanes) would need to be considered at this location to improve performance further.
- ***Pacific Highway West (OR-99W) and Airport Road (#8)***: Signalizing this intersection adds delay to vehicles on OR-99W. However, the overall intersection V/C ratio is reduced drastically because the eastbound left-turn volume does not have to wait for available gaps on OR-99W.
- ***9th Street and Circle Boulevard (#11)***: This intersection operates at-capacity condition (0.99) with all intersection approaches having high V/C ratios (0.81 ~ 0.99). Both roadway crossing volumes at this intersection are heavy and all movements are operating at near- or at-capacity.
- ***Albany-Corvallis Highway (US-20) and Circle Boulevard (#12)***: This intersection is over-capacity with V/C ratio of 1.11. Eastbound movements and northbound through movements (majority of traffic going toward the city of Albany) had the highest V/C ratio (1.11). Also, the southbound right-turn toward northern Corvallis is operating at over-capacity condition (1.06).
- ***Corvallis-Newport Highway (US-20/OR-34) and 15th Street (#13)***: Adding a left-turn lane to the southbound approach (15th Street from OSU campus) reduces the overall intersection V/C ratio from 0.94 to 0.77.

Table 10. Improvement List Recommended by PTV America

	<i>Primary Road Name</i>	<i>Secondary Road Name</i>	<i>Financially Constrained Project</i>
1	99 W	Conifer Boulevard	<i>Conifer Boulevard:</i> Make Eastbound left-turn dual Left-turn
2	99 W	Circle Boulevard	<i>Circle Boulevard:</i> Add Eastbound right-turn overlap phase <i>OR-99W:</i> Add Northbound right-turn overlap phase
6	99 W	Crystal Lake Drive	<i>Crystal Lake Drive:</i> - Add right-turn lane to East/Westbound approach - Add right-turn overlap phase to East/Westbound approach
8	99 W	Airport Road	Signalization (60 seconds cycle)
11	9th Street	Circle Boulevard	<i>9th Street:</i> Add Right-turn lane to Northbound approach
12	US-20	Circle Boulevard	<i>US-20:</i> - Widen US-20 NB to 2 lanes from the intersection to receive two left-turn lanes from Eastbound approach - Add right-turn overlap phase to all right-turns - Make Northbound left-turn protected left-turn <i>Circle Boulevard:</i> - Add right-turn lane to Eastbound approach - Add right-turn overlap phase to all right-turns
13	US-20/OR-34	15th Street	<i>15th Street:</i> Add Left-turn lane to Southbound approach

Table 11. V/C Analysis Result – Future Condition with PTV America Recommended Improvements

	<i>Primary Road Name</i>	<i>Secondary Road Name</i>	<i>Mobility Standard</i>	<i>V/C Ratio</i>	<i>LOS</i>	<i>Deficiency Identified?</i>
1*	99 W	Conifer Boulevard	0.85 ⁽¹⁾	0.74	D	NO
2*	99 W	Circle Boulevard	0.85 ⁽¹⁾	1.03	F	YES
3*	Circle Boulevard	4 Acres Street	LOS D ⁽³⁾	0.64	B	NO
4*	3rd Street (99 W)	Western Avenue	0.95 ⁽²⁾	1.14	F	YES
5*	4th Street (99 W)	Western Avenue	0.95 ⁽²⁾	1.15	F	YES
6*	99 W	Crystal Lake Drive	0.85 ⁽¹⁾	0.95	F	YES
7*	99 W	Alexander Avenue	0.85 ⁽¹⁾	0.79	C	NO
8	99 W	Airport Road	0.85 ⁽¹⁾	0.46	E	NO
9	99 W	Llewellyn Road	0.70 ⁽¹⁾	0.17	A	NO
10*	9th Street	Walnut Boulevard	LOS D ⁽³⁾	0.72	C	NO
11*	9th Street	Circle Boulevard	LOS D ⁽³⁾	0.89	D	NO
12*	US-20	Circle Boulevard	0.85 ⁽¹⁾	0.72	C	NO
13*	US-20/OR-34	15th Street	0.80 ⁽¹⁾	0.77	C	NO
14*	US-20/OR-34	35th Street	0.80 ⁽¹⁾	0.66	B	NO
15*	Western Avenue	35th Street	LOS D ⁽³⁾	1.05	F	YES
16*	US-20/OR-34	Technology Loop	0.80 ⁽¹⁾	0.71	C	NO
17*	US-20/OR-34	53rd Street	0.80 ⁽¹⁾	0.73	C	NO
18	US-20	OR-34	0.80 ⁽¹⁾	0.42	A	NO

1) Mobility Standards based on ODOT, OHP, and City of Corvallis Standards: (1) ODOT OHP Mobility Standard, (2) ODOT OHP Mobility Standard – STA, and (3) City of Corvallis.

2) Intersections with an asterisk (*) were evaluated with the traffic signal in place.

3) Highlighted cells represent the location where mobility standard was not satisfied.

QUEUE LENGTH ANALYSIS

Evaluating existing and forecast vehicle queue lengths at intersections is another way of describing how well intersections are performing, or will be performing. Vehicle queue lengths were analyzed for each of the five scenarios described earlier for the length of vehicle queues that can be expected to occur at the 95th percentile. The 95th percentile queue length is the length of queue that has a probability of being exceeded during the peak hour by 5 percent or less. The queue analysis was conducted with SimTraffic using five randomly seeded runs for each scenario. SimTraffic parameters were defined based on the ODOT Analysis Procedure Manual.

The results of the queue analysis reaffirm the deficiencies illustrated by the V/C ratio analysis. Intersections that could not meet mobility standards also have significant queues on one or more intersection approaches. For example, the 15th Street at US-20/OR-34 intersection (intersection #13 in the tables) has a V/C ratio of 0.95 under 2005 analysis conditions; under future No-Build scenario this intersection's V/C ratio is forecast to perform at 1.26. The queue analysis illustrates that this intersection has approaches with queue lengths near or in excess of a quarter of a mile (1,325 feet). Without capacity improvements, these queues lengths are forecast to increase to distances in excess of one half mile and greater and plague all critical movements. In the US-20/OR-34 corridor, the MTP's Illustrative project improvements are forecast to improve queue lengths dramatically over existing and forecast conditions. Queue analysis results for each scenario are rounded up to the nearest 25 foot increment and presented in Tables 12 through 21 along with storage length. Note that the longest queue length was reported when there are multiple lanes in the same lane group and the highlighted cell in each table represents the movement that the 95th percentile queue length exceeds storage length.

Table 12. 95th Percentile Queue Length and Storage Length (in parenthesis) (ft) – Existing (2005) Scenario – East/Westbound

	Primary Road Name	Secondary Road Name	Eastbound			Westbound		
			LT	TH	RT	LT	TH	RT
1*	99 W	Conifer Boulevard	275 (110)	300 (110)		175 (275)	325 (903)	
2*	99 W	Circle Boulevard	125 (190)	350 (315)	200 (130)	250 (160)	500 (635)	
3*	Circle Boulevard	4 Acres Street	50 (190)	250 (635)	150 (160)	125 (125)	250 (1,494)	
4*	3rd Street (99 W)	Western Avenue	200 (218)	50 (218)	N/A	N/A	150 (225)	75 (115)
5*	4th Street (99 W)	Western Avenue	N/A	175 (240)	125 (150)	125 (218)	150 (218)	N/A
6*	99 W	Crystal Lake Drive	125 (90)	250 (-*)		50 (170)	150 (-*)	
7*	99 W	Alexander Avenue	0 (120)			50 (450)		75 (125)
8	99 W	Airport Road	100 (-*)			N/A		
9	99 W	Llewellyn Road	75 (-*)			N/A		
10*	9th Street	Walnut Boulevard	200 (150)	250 (1,324)		100 (168)	150 (168)	
11*	9th Street	Circle Boulevard	225 (235)	475 (1,356)		250 (260)	325 (315)	
12*	US-20	Circle Boulevard	2,200 (-*)			N/A		
13*	US-20/OR-34	15th Street	150 (160)	1,225 (1,487)	325 (315)	75 (210)	1,025 (1,200)	50 (1200)
14*	US-20/OR-34	35th Street	150 (450)	475 (2,575)	150 (180)	425 (600)	1,150 (-*)	225 (200)
15*	Western Avenue	35th Street	175 (150)	200 (910)		200 (150)	800 (1,250)	
16*	US-20/OR-34	Technology Loop	0 (250)	300 (1,386)		225 (150)	850 (2,165)	
17*	US-20/OR-34	53rd Street	175 (240)	1,675 (-*)		200 (215)	750 (1,372)	100 (130)
18	US-20	OR-34	N/A	25 (-*)		125 (165)	N/A	

* If the adjacent intersection (not including private road) is located far enough to not to have an impact to upstream intersection, no specified storage length is provided in this table.

Table 13. 95th Percentile Queue Length and Storage Length (in parenthesis) (ft) – Existing (2005) Scenario – South/Northbound

	Primary Road Name	Secondary Road Name	Northbound			Southbound		
			LT	TH	RT	LT	TH	RT
1*	99 W	Conifer Boulevard	50 (300)	225 (1,155)		150 (300)	150 (1,222)	
2*	99 W	Circle Boulevard	100 (310)	225 (-*)		350 (400)	225 (1,810)	
3*	Circle Boulevard	4 Acres Street	500 (120)			50 (146)		
4*	3rd Street (99 W)	Western Avenue	250 (340)			N/A		
5*	4th Street (99 W)	Western Avenue	N/A			300 (330)		
6*	99 W	Crystal Lake Drive	175 (195)	300 (-*)		200 (175)	625 (-*)	
7*	99 W	Alexander Avenue	0 (220)	125 (-*)		100 (220)	100 (-*)	
8	99 W	Airport Road	25 (-*)		N/A	N/A	0 (-*)	
9	99 W	Llewellyn Road	25 (-*)		N/A	N/A	0 (-*)	
10*	9th Street	Walnut Boulevard	200 (150)	275 (1,882)		75 (175)	250 (1,015)	
11*	9th Street	Circle Boulevard	200 (150)	250 (2,167)		175 (140)	250 (1,882)	
12*	US-20	Circle Boulevard	125 (150)	250 (-*)	N/A	N/A	175 (-*)	100 (190)
13*	US-20/OR-34	15th Street	475 (-*)			1,525 (980)		
14*	US-20/OR-34	35th Street	275 (180)	1050 (698)		200 (140)	700 (788)	
15*	Western Avenue	35th Street	425 (788)			125 (150)	625 (1,843)	
16*	US-20/OR-34	Technology Loop	125 (407)		225 (407)	0 (200)		
17*	US-20/OR-34	53rd Street	100 (165)	600 (443)		150 (250)	250 (705)	
18	US-20	OR-34	50 (-*)	N/A	75 (175)	N/A		

* If the adjacent intersection (not including private road) is located far enough to not to have an impact to upstream intersection, no specified storage length is provided in this table.

Table 14. 95th Percentile Queue Length and Storage Length (in parenthesis) (ft) – Future (2030) No-Build Scenario – East/Westbound

	Primary Road Name	Secondary Road Name	Eastbound			Westbound		
			LT	TH	RT	LT	TH	RT
1*	99 W	Conifer Boulevard	275 (110)	250 (110)		300 (275)	425 (903)	
2*	99 W	Circle Boulevard	125 (190)	400 (315)	200 (130)	200 (160)	475 (635)	
3*	Circle Boulevard	4 Acres Street	50 (190)	275 (635)	175 (160)	175 (125)	2,025 (190)	
4*	3rd Street (99 W)	Western Avenue	325 (218)	25 (218)	N/A	N/A	750 (218)	200 (218)
5*	4th Street (99 W)	Western Avenue	N/A	425 (240)	225 (150)	350 (218)	N/A	250 (240)
6*	99 W	Crystal Lake Drive	175 (90)	975 (-*)		75 (170)	200 (-*)	
7*	99 W	Alexander Avenue	0 (120)			75 (450)		100 (125)
8	99 W	Airport Road	300 (-*)			N/A		
9	99 W	Llewellyn Road	75 (-*)			N/A		
10*	9th Street	Walnut Boulevard	225 (150)	425 (1,324)		200 (168)	325 (168)	
11*	9th Street	Circle Boulevard	300 (235)	2,825 (1,356)		325 (260)	325 (315)	
12*	US-20	Circle Boulevard	3,525 (-*)			N/A		
13*	US-20/OR-34	15th Street	225 (160)	1650 (1,487)	275 (315)	150 (210)	4,350 (160)	4,100 (1,487)
14*	US-20/OR-34	35th Street	550 (450)	2,500 (2,575)	175 (180)	825 (600)	3,800 (-*)	250 (200)
15*	Western Avenue	35th Street	200 (150)	3,800 (910)		225 (150)	3,300 (1,250)	
16*	US-20/OR-34	Technology Loop	0 (250)	600 (1,386)		225 (150)	1,775 (2,165)	
17*	US-20/OR-34	53rd Street	275 (240)	1,825 (-*)		225 (215)	875 (1,372)	100 (130)
18	US-20	OR-34	N/A	25 (-*)		75 (165)	N/A	

* If the adjacent intersection (not including private road) is located far enough to not to have an impact to upstream intersection, no specified storage length is provided in this table.

Table 15. 95th Percentile Queue Length and Storage Length (in parenthesis) (ft) – Future (2030) No-Build Scenario – South/Northbound

	Primary Road Name	Secondary Road Name	Northbound			Southbound		
			LT	TH	RT	LT	TH	RT
1*	99 W	Conifer Boulevard	100 (300)	450 (1,155)		150 (300)	300 (1,222)	
2*	99 W	Circle Boulevard	425 (310)	4075 (-*)		550 (400)	1,075 (1,810)	
3*	Circle Boulevard	4 Acres Street	3,350 (120)			75 (146)		
4*	3rd Street (99 W)	Western Avenue	1,400 (340)			N/A		
5*	4th Street (99 W)	Western Avenue	N/A			625 (330)		
6*	99 W	Crystal Lake Drive	250 (195)	1,100 (-*)		250 (175)	1,750 (-*)	
7*	99 W	Alexander Avenue	0 (220)	400 (-*)		125 (220)	300 (-*)	
8	99 W	Airport Road	25 (-*)		N/A	N/A	25 (-*)	
9	99 W	Llewellyn Road	0 (-*)		N/A	N/A	0 (-*)	
10*	9th Street	Walnut Boulevard	200 (150)	250 (1,882)		125 (175)	250 (1,015)	
11*	9th Street	Circle Boulevard	225 (150)	1,300 (2,167)		200 (140)	400 (1,882)	
12*	US-20	Circle Boulevard	225 (150)	6,175 (-*)	N/A	N/A	1,575 (-*)	300 (190)
13*	US-20/OR-34	15th Street	325 (-*)			2,650 (980)		
14*	US-20/OR-34	35th Street	250 (180)	575 (698)		200 (140)	575 (788)	
15*	Western Avenue	35th Street	875 (788)			200 (150)	1,400 (1,843)	
16*	US-20/OR-34	Technology Loop	200 (407)		375 (407)	0 (200)		
17*	US-20/OR-34	53rd Street	150 (165)	3,425 (443)		350 (250)	1,900 (705)	
18	US-20	OR-34	100 (-*)	N/A	25 (175)	N/A		

* If the adjacent intersection (not including private road) is located far enough to not to have an impact to upstream intersection, no specified storage length is provided in this table.

Table 16. 95th Percentile Queue Length and Storage Length (in parenthesis) (ft) – Future (2030) with Financially Constrained Projects Scenario – East/Westbound

	Primary Road Name	Secondary Road Name	Eastbound			Westbound		
			LT	TH	RT	LT	TH	RT
1*	99 W	Conifer Boulevard	275 (110)	250 (110)		250 (275)	375 (903)	
2*	99 W	Circle Boulevard	100 (190)	425 (315)	200 (130)	200 (160)	475 (635)	
3*	Circle Boulevard	4 Acres Street	50 (190)	275 (635)	175 (160)	200 (125)	2,175 (1,494)	
4*	3rd Street (99 W)	Western Avenue	275 (218)	25 (218)	N/A	N/A	700 (225)	175 (115)
5*	4th Street (99 W)	Western Avenue	N/A	300 (240)	225 (150)	325 (218)	275 (218)	N/A
6*	99 W	Crystal Lake Drive	150 (90)	750 (-*)		75 (170)	225 (-*)	
7*	99 W	Alexander Avenue	0 (120)			100 (450)		100 (125)
8	99 W	Airport Road	525 (-*)			N/A		
9	99 W	Llewellyn Road	100 (-*)			N/A		
10*	9th Street	Walnut Boulevard	225 (150)	475 (1,324)		200 (168)	300 (168)	
11*	9th Street	Circle Boulevard	300 (235)	3,275 (1,356)	225 (150)	325 (260)	325 (315)	
12*	US-20	Circle Boulevard	1,300 (-*)	N/A	1,225 (-*)	N/A		
13*	US-20/OR-34	15th Street	225 (160)	1,800 (1,487)	325 (315)	125 (210)	4,875 (1,200)	4,625 (1,200)
14*	US-20/OR-34	35th Street	475 (450)	1,750 (2,575)	200 (180)	825 (600)	4,100 (-*)	250 (200)
15*	Western Avenue	35th Street	200 (150)	4,125 (910)		225 (150)	4,100 (1,250)	
16*	US-20/OR-34	Technology Loop	0 (250)	750 (1,386)		225 (150)	1,775 (2,165)	
17*	US-20/OR-34	53rd Street	275 (240)	1,850 (-*)		225 (215)	875 (1,372)	125 (130)
18	US-20	OR-34	N/A	100 (-*)		75 (165)	150 (-*)	N/A

* If the adjacent intersection (not including private road) is located far enough to not to have an impact to upstream intersection, no specified storage length is provided in this table.

Table 17. 95th Percentile Queue Length and Storage Length (in parenthesis) (ft) – Future (2030) with Financially Constrained Projects Scenario – South/Northbound

	Primary Road Name	Secondary Road Name	Northbound			Southbound		
			LT	TH	RT	LT	TH	RT
1*	99 W	Conifer Boulevard	100 (300)	475 (1,155)		150 (300)	300 (1,222)	
2*	99 W	Circle Boulevard	425 (310)	3,950 (-*)		475 (400)	600 (1,810)	
3*	Circle Boulevard	4 Acres Street	4,425 (120)			50 (146)		
4*	3rd Street (99 W)	Western Avenue	1,325 (340)			N/A		
5*	4th Street (99 W)	Western Avenue	N/A			500 (330)		
6*	99 W	Crystal Lake Drive	250 (195)	1,125 (-*)		250 (175)	1,750 (-*)	
7*	99 W	Alexander Avenue	0 (220)	375 (-*)		100 (220)	250 (-*)	
8	99 W	Airport Road	25 (-*)		N/A	N/A	0 (-*)	
9	99 W	Llewellyn Road	0 (-*)		N/A	N/A	0 (-*)	
10*	9th Street	Walnut Boulevard	200 (150)	250 (1,882)		125 (175)	300 (1,015)	
11*	9th Street	Circle Boulevard	225 (150)	1,050 (2,167)		200 (140)	375 (1,882)	
12*	US-20	Circle Boulevard	200 (150)	4,350 (-*)	N/A	N/A	1,175 (-*)	275 (190)
13*	US-20/OR-34	15th Street	350 (-*)			3,125 (980)		
14*	US-20/OR-34	35th Street	250 (180)	725 (698)		200 (140)	475 (788)	
15*	Western Avenue	35th Street	850 (788)			175 (150)	725 (1,843)	
16*	US-20/OR-34	Technology Loop	175 (407)		300 (407)	0 (200)		
17*	US-20/OR-34	53rd Street	175 (165)	900 (443)	225 (150)	250 (250)	875 (705)	225 (150)
18	US-20	OR-34	75 (-*)	N/A	25 (175)	N/A		

* If the adjacent intersection (not including private road) is located far enough to not to have an impact to upstream intersection, no specified storage length is provided in this table.

Table 18. 95th Percentile Queue Length and Storage Length (in parenthesis) (ft) – Future (2030) with Illustrative Projects Scenario – East/Westbound

	Primary Road Name	Secondary Road Name	Eastbound			Westbound		
			LT	TH	RT	LT	TH	RT
1*	99 W	Conifer Boulevard	275 (110)	275 (110)		250 (275)	375 (903)	
2*	99 W	Circle Boulevard	100 (190)	400 (315)	200 (130)	200 (160)	475 (635)	
3*	Circle Boulevard	4 Acres Street	50 (190)	325 (635)	200 (160)	200 (125)	1,975 (1,494)	
4*	3rd Street (99 W)	Western Avenue	300 (218)	25 (218)	N/A	N/A	675 (225)	200 (115)
5*	4th Street (99 W)	Western Avenue	N/A	425 (240)	200 (150)	325 (218)	275 (218)	N/A
6*	99 W	Crystal Lake Drive	150 (90)	725 (-*)		75 (170)	200 (-*)	
7*	99 W	Alexander Avenue		0 (120)		75 (450)	75 (125)	
8	99 W	Airport Road		225 (-*)			N/A	
9	99 W	Llewellyn Road		100 (-*)			N/A	
10*	9th Street	Walnut Boulevard	200 (150)	400 (1,324)		175 (168)	325 (168)	
11*	9th Street	Circle Boulevard	300 (235)	2,775 (1,356)	225 (150)	325 (260)	350 (315)	
12*	US-20	Circle Boulevard	900 (-*)	N/A	675 (-*)		N/A	
13*	US-20/OR-34	15th Street	200 (160)	375 (1,487)	100 (315)	125 (210)	500 (1,200)	
14*	US-20/OR-34	35th Street	225 (450)	275 (2,575)	100 (180)	150 (600)	300 (-*)	200 (200)
15*	Western Avenue	35th Street	200 (150)	3,450 (910)		225 (150)	3,175 (1,250)	
16*	US-20/OR-34	Technology Loop	0 (250)	275 (1,386)		225 (150)	325 (2,165)	
17*	US-20/OR-34	53rd Street	250 (240)	375 (-*)		175 (215)	300 (1,372)	
18	US-20	OR-34	N/A	100 (-*)		100 (165)	175 (-*)	N/A

* If the adjacent intersection (not including private road) is located far enough to not to have an impact to upstream intersection, no specified storage length is provided in this table.

Table 19. 95th Percentile Queue Length and Storage Length (in parenthesis) (ft) – Future (2030) with Illustrative Projects Scenario – South/Northbound

	Primary Road Name	Secondary Road Name	Northbound			Southbound		
			LT	TH	RT	LT	TH	RT
1*	99 W	Conifer Boulevard	125 (300)	450 (1,155)		225 (300)	300 (1,222)	
2*	99 W	Circle Boulevard	450 (310)	3,225 (-*)	225 (150)	425 (400)	775 (1,810)	
3*	Circle Boulevard	4 Acres Street	4,575 (120)			50 (146)		
4*	3rd Street (99 W)	Western Avenue	1,325 (340)			N/A		
5*	4th Street (99 W)	Western Avenue	N/A			450 (330)		
6*	99 W	Crystal Lake Drive	275 (195)	1,175 (-*)		250 (175)	1,500 (-*)	
7*	99 W	Alexander Avenue	0 (220)	325 (-*)		125 (220)	225 (-*)	
8	99 W	Airport Road	25 (150)	0 (-*)	N/A	0 (-*)	0 (-*)	
9	99 W	Llewellyn Road	0 (-*)		N/A	N/A	0 (-*)	
10*	9th Street	Walnut Boulevard	225 (150)	300 (1,882)		125 (175)	300 (1,015)	
11*	9th Street	Circle Boulevard	225 (150)	750 (2,167)		200 (140)	300 (1,882)	
12*	US-20	Circle Boulevard	200 (150)	2,450 (-*)	N/A	N/A	825 (-*)	275 (190)
13*	US-20/OR-34	15th Street	200 (-*)			525 (980)		
14*	US-20/OR-34	35th Street	175 (180)	375 (698)		175 (140)	275 (788)	
15*	Western Avenue	35th Street	875 (788)			200 (150)	1,400 (1,843)	
16*	US-20/OR-34	Technology Loop	125 (407)	225 (407)		0 (200)		
17*	US-20/OR-34	53rd Street	125 (165)	400 (443)	200 (150)	150 (250)	275 (705)	150 (150)
18	US-20	OR-34	75 (-*)	N/A	25 (175)	N/A		

* If the adjacent intersection (not including private road) is located far enough to not to have an impact to upstream intersection, no specified storage length is provided in this table.

Table 20. 95th Percentile Queue Length and Storage Length (in parenthesis) (ft) – Future (2030) with PTV America’s Recommendation Scenario – East/Westbound

	Primary Road Name	Secondary Road Name	Eastbound			Westbound		
			LT	TH	RT	LT	TH	RT
1*	99 W	Conifer Boulevard	125 (110)	250 (110)		250 (275)	375 (903)	
2*	99 W	Circle Boulevard	125 (190)	425 (315)	200 (130)	200 (160)	525 (635)	
3*	Circle Boulevard	4 Acres Street	50 (190)	375 (635)	200 (160)	200 (125)	2,775 (1,494)	
4*	3rd Street (99 W)	Western Avenue	300 (218)	25 (218)	N/A	N/A	725 (225)	175 (115)
5*	4th Street (99 W)	Western Avenue	N/A	550 (240)	225 (150)	325 (218)	250 (218)	N/A
6*	99 W	Crystal Lake Drive	150 (90)	425 (-*)	150 (100)	50 (170)	100 (-*)	150 (100)
7*	99 W	Alexander Avenue	0 (120)			75 (450)		100 (125)
8	99 W	Airport Road	175 (-*)			N/A		
9	99 W	Llewellyn Road	100 (-*)			N/A		
10*	9th Street	Walnut Boulevard	225 (150)	375 (1,324)		200 (168)	325 (168)	
11*	9th Street	Circle Boulevard	325 (235)	2,975 (1,356)	225 (150)	350 (260)	425 (315)	
12*	US-20	Circle Boulevard	350 (-*)	N/A	150 (150)	N/A		
13*	US-20/OR-34	15th Street	150 (160)	275 (1,487)	75 (315)	100 (210)	400 (1,200)	
14*	US-20/OR-34	35th Street	450 (450)	825 (2,575)	100 (180)	150 (600)	300 (-*)	250 (200)
15*	Western Avenue	35th Street	200 (150)	3,650 (910)		225 (150)	3,725 (1,250)	
16*	US-20/OR-34	Technology Loop	0 (250)	275 (1,386)		225 (150)	350 (2,165)	
17*	US-20/OR-34	53rd Street	225 (240)	350 (-*)		150 (215)	325 (1,372)	
18	US-20	OR-34	N/A	100 (-*)		100 (165)	150 (-*)	N/A

* If the adjacent intersection (not including private road) is located far enough to not to have an impact to upstream intersection, no specified storage length is provided in this table.

Table 21. 95th Percentile Queue Length and Storage Length (in parenthesis) (ft) – Future (2030) with PTV America’s Recommendation Scenario – South/Northbound

	Primary Road Name	Secondary Road Name	Northbound			Southbound		
			LT	TH	RT	LT	TH	RT
1*	99 W	Conifer Boulevard	125 (300)	400 (1,155)		175 (300)	275 (1,222)	
2*	99 W	Circle Boulevard	425 (310)	4,300 (-*)	200 (150)	525 (400)	950 (1,810)	
3*	Circle Boulevard	4 Acres Street	2,425 (120)			50 (146)		
4*	3rd Street (99 W)	Western Avenue	1,175 (340)			N/A		
5*	4th Street (99 W)	Western Avenue	N/A			500 (330)		
6*	99 W	Crystal Lake Drive	250 (195)	675 (-*)		225 (175)	1,125 (-*)	
7*	99 W	Alexander Avenue	0 (220)	375 (-*)		125 (220)	225 (-*)	
8	99 W	Airport Road	25 (150)	75 (-*)	N/A	N/A	125 (-*)	
9	99 W	Llewellyn Road	0 (-*)		N/A	N/A	0 (-*)	
10*	9th Street	Walnut Boulevard	200 (150)	275 (1,882)		150 (175)	300 (1,015)	
11*	9th Street	Circle Boulevard	225 (150)	450 (2,167)	225 (150)	200 (140)	475 (1,882)	
12*	US-20	Circle Boulevard	200 (150)	2,200 (-*)	N/A	N/A	600 (-*)	275 (190)
13*	US-20/OR-34	15th Street	200 (-*)			175 (980)	175 (980)	
14*	US-20/OR-34	35th Street	225 (180)	750 (698)		175 (140)	325 (788)	
15*	Western Avenue	35th Street	950 (788)			175 (150)	1,300 (1,843)	
16*	US-20/OR-34	Technology Loop	125 (407)		200 (407)	0 (200)		
17*	US-20/OR-34	53rd Street	100 (165)	300 (443)	175 (150)	150 (250)	300 (705)	150 (150)
18	US-20	OR-34	75 (-*)	N/A	25 (175)	N/A		

* If the adjacent intersection (not including private road) is located far enough to not to have an impact to upstream intersection, no specified storage length is provided in this table.

MERGE/DIVERGE ANALYSIS (US-20/OR-34 @ OR-99W)

A weaving area analysis was conducted for the west end of the interchange. The segment is a single lane highway with a 45 mph speed limit and a signalized intersection is located downstream. The segment selected to be analyzed is shown in Figure 2.

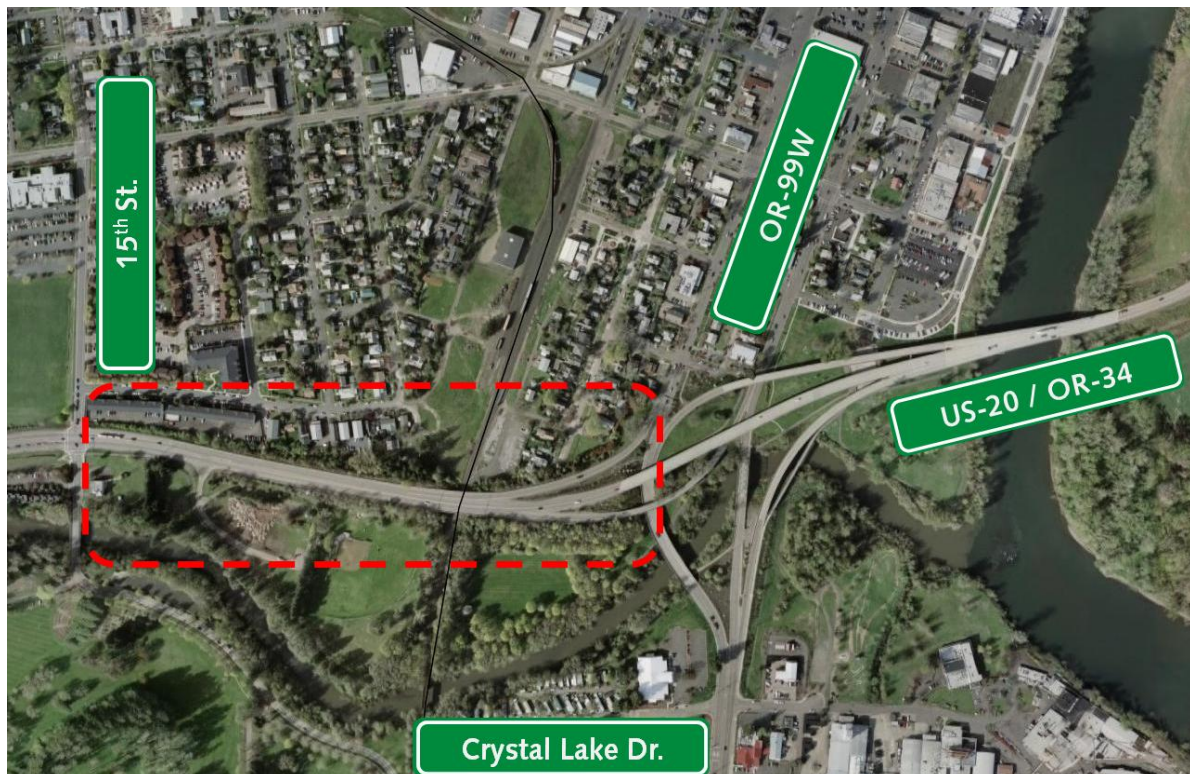


Figure 2. Merge/Diverge Analysis Study Area

Because of the unique geometry characteristics (i.e., single lane highway, low speed limit, etc.) described above, HCM 2000 analysis methodology is not applicable to this study area. TPAU staff were consulted for assumptions to approximate capacity for the purpose of estimating a comparable V/C ratio as part of this analysis. Capacity was approximated in two separate ways considering 1) the weaving behavior caused by the ramp merge and 2) the downstream signal control of the segment as the major factor which controls the capacity of the segment.

Free-Flow Highway Assumption Analysis

This analysis considers the highway segment as freeway weaving segment and ignores the capacity constraint caused by signal control located downstream (at 15th Street). HCM freeway analysis methodology uses density as a performance measure to determine level of service. Therefore, traffic density for both 2005 and 2030 conditions was calculated using HCM 2000 methodology and the capacity is approximated by increasing the weaving volume until it reaches a level of service F (density of 40pc/mi/ln). Then, the V/C ratio is calculated by dividing the original volume by approximated capacity. Table 22 shows the result of density analysis and V/C analysis with free-flow assumption.

Table 22. HCM Density and V/C Analysis – Merge/Diverge Area

	<i>Density (pc/mi/ln)</i>	<i>Level of Service</i>	<i>V/C Ratio</i>
<i>Existing (2005) Condition</i>	11.3	A	0.28
<i>Future (2030) Condition</i>	16.5	B	0.43

As shown in Table 22, performance of this weaving segment with the free-flow assumption operations are good in base (2005) and future year forecast (2030) condition with LOS being B or better and V/C ratio lower than 0.50.

Signalized Intersection Assumption Analysis

In this scenario, capacity was calculated using HCM 2000 methods for signalized intersection approach. Then, the V/C ratio is calculated by dividing the original volume by calculated capacity. As shown in Table 23, performance of the approach with signalized intersection assumption was also acceptable with the V/C ratio being lower than 0.80 in the existing base and 2030 future forecast.

Table 23. V/C Ratio Analysis Result – Signalized Intersection Approach Assumption

<i>Year</i>	<i>2005</i>	<i>2030</i>
<i>With Signalized Intersection Approach Assumption</i>	0.54	0.77

In order to analyze each merge/diverge area of the interchange considering both the weaving and signalized intersection operations simultaneously a microscopic simulation model was developed using VISSIM. Two analysis summary measures, the 95th percentile queue length and delay are reported for each simulation scenario in Tables 24 and 25.

Table 24. VISSIM Simulation Analysis – Merge/Diverge Area – US-20/OR-34

			<i>Eastbound</i>		<i>Westbound</i>	
			<i>Diverge</i>	<i>Merge</i>	<i>Diverge</i>	<i>Merge</i>
<i>Existing (2005) Condition</i>	<i>95% Q Length (ft)</i>	0.0	0.0	0.0	525.0	
	<i>Delay (sec)</i>	1.9	3.0	1.2	16.6	
<i>2030</i>	<i>No-Build</i>	<i>95% Q Length (ft)</i>	0.0	0.0	1,600.0	2,825.0
		<i>Delay (sec)</i>	10.4	11.9	22.4	103.0
	<i>Financially Constrained</i>	<i>95% Q Length (ft)</i>	0.0	0.0	1,600.0	2,825.0
		<i>Delay (sec)</i>	10.4	11.9	22.4	103.0
	<i>Illustrative</i>	<i>95% Q Length (ft)</i>	0.0	0.0	0.0	275.0
		<i>Delay (sec)</i>	6.7	10.6	6.7	17.3
	<i>PTV Recommend</i>	<i>95% Q Length (ft)</i>	0.0	0.0	0.0	275.0
		<i>Delay (sec)</i>	6.4	11.6	6.1	21.6

Table 25. VISSIM Simulation Analysis – Merge/Diverge Area – OR-99W

			<i>Southbound</i>		<i>Northbound</i>	
			<i>Diverge</i>	<i>Merge</i>	<i>Diverge</i>	<i>Merge</i>
<i>Existing (2005) Condition</i>		<i>95% Q Length (ft)</i>	0.0	375.0	0.0	125.0
		<i>Delay (sec)</i>	3.3	12.0	1.8	7.0
2030	<i>No-Build</i>	<i>95% Q Length (ft)</i>	825.0	2,550.0	0.0	225.0
		<i>Delay (sec)</i>	66.4	84.6	15.4	9.9
	<i>Financially Constrained</i>	<i>95% Q Length (ft)</i>	825.0	2,550.0	0.0	225.0
		<i>Delay (sec)</i>	66.4	84.6	15.4	9.9
	<i>Illustrative</i>	<i>95% Q Length (ft)</i>	825.0	1,675.0	0.0	275.0
		<i>Delay (sec)</i>	63.9	83.3	14.8	11.2
	<i>PTV Recommend</i>	<i>95% Q Length (ft)</i>	825.0	1,675.0	0.0	275.0
		<i>Delay (sec)</i>	51.5	83.7	15.8	12.5

Tables 24 and 25 illustrate that deficiencies were observed for the existing conditions (2005) for the west and southbound merge area movements that terminate at signalized intersections. Both the US-20/OR-34 westbound and the OR-99W southbound show acceptable queue lengths—shorter than storage area (1,500 feet).

In the 2030 No-Build Scenario, major deficiencies in queues and delay were observed on US-20/OR-34 westbound (heading towards 15th Street) and southbound on OR-99W (heading towards Crystal Lake Drive). These deficiencies are attributable to the heavy increase in forecasted traffic demand. In the Destination 2030 Illustrative Projects Scenario, a new lane in each direction on US-20/OR-34 is added to the system: this improvement eliminates the westbound queue length and the associated delay is reduced significantly. No significant deficiency would be expected under this scenario. However, as reported in the V/C ratio analysis, the US-20/OR-34 at 15th Street intersection operations will be worse than the OHP mobility standard even with the additional through lane capacity. As indicated by the PTV America

Recommendations Scenario (Tables 24 and 25), this appears to be due to conditions on the southbound approach to the intersection that can be resolved by adding a turn-lane on this approach. With the additional turn lane, overall intersection performance is expected to be better than the OHP mobility standard for the intersection.

The PTV America Recommendation Scenario also calls for adding turn lanes on Crystal Lake Drive and Avery Avenue at the OR-99W/Crystal Lake Drive intersection. The V/C ratio analysis indicates that this treatment will improve performance, but it will not allow the intersection to perform at the mobility standard level of operation. The simulation results further confirm that long vehicle queues and high delays will be an issue for southbound movements on OR-99W. Further analysis of possible solutions, such as adding additional lanes, or turn restrictions, will need to be evaluated for this intersection to meet the OHP mobility standard in the future.

APPENDIX A: Methodology Memorandum

Memo



To:

John deTar
Dorothy Upton, P.E.

For attention

Consultation

From:

Steve Perone
Jongsun Won
Thomas Bauer, PE, PTOE

Confidential

To do by:

Date:

11/09/2007

Subject: DRAFT Corvallis Area MPO (CAMPO) RTP Post Processing Analysis Methodology

This memorandum documents the proposed analysis methods, procedures and assumptions to support the intersection V/C analysis for the CAMPO MTP as specified in Task 2 – Intersection Volume / Capacity Analysis. The memorandum outlines the process using the imported EMME/2 turn volumes in VISUM, assumptions for determining 30th highest hour volume factors, peak hour determination and intersection V/C analysis by using VISUM's TRAFFIX™ kernel and NCHRP 255 procedures.

EMME/2 Import to VISUM

The base and future year EMME/2 networks were imported into VISUM in order to build the network for analysis. The reason for the import is to have the same node and link IDs in VISUM as in EMME/2. After importing the network, the EMME/2 base and future year assigned turn volumes were then copied over to the VISUM network based on the link IDs. Finally, HCM 2000 as implemented in TRAFFIX is used within VISUM with the EMME/2 assignment volumes and turn counts.

Intersection Volume / Capacity Analysis Methodology

20 intersections on the state highway system as well as closely spaced adjacent signalized intersections impacting highway operations were identified by ODOT for volume / capacity analysis and are listed in Table 1 below including control type, data collection date and duration.

Table 1. Study Intersections

Intersection		Control Type	Count Date	Duration
Primary Road	Secondary Road			
Pacific Hwy W (OR 99W)	Circle Blvd.	Signalized	May 24, 2005	16-Hour
	Walnut Blvd.	Signalized	August 24~27, 2004	69-Hour
	Conifer Blvd.	Signalized	May 25, 2005	16-Hour
	Llewellyn Rd.	Unsignalized	October 21, 2004	
	Airport Ave.	Unsignalized	May 25, 2005	
	Crystal Lake Dr.	Signalized	March 6/7, 2007	
	Alexander Ave.	Signalized	March 5/6, 2007	
9 th St.	Circle Blvd.	Signalized	October, 2004	16-Hour
	Walnut Blvd.	Signalized	October, 2004	
Corvallis-Newport Hwy. (US 20 / OR 34)	Pacific Hwy. W (OR 99W)	Interchange	May 24, 2005	16-Hour
	15 th St.	Signalized	May 24, 2005	
	35 th St.	Signalized	March 7/8, 2007	
	53 rd St.	Signalized	March 12/13, 2007	
	Technology Lp.	Signalized	October 21, 2004	
Corvallis-Newport Hwy. (US 20)	Alsea Hwy. (OR 34)	Unsignalized	October 21, 2004	6-Hour (3 in AM and 3 in PM)
Albany-Corvallis Hwy. (US 20)	Circle Blvd.	Signalized	May 25, 2005	
3 rd St. (OR 99W)	Western Blvd.	Signalized	May 22, 2007	
4 th St. (OR 99W)	Western Blvd.	Signalized	May 22, 2007	
Western Blvd.	35 th St.	Signalized	May 22, 2007	
Circle Blvd.	Four Acres St. / Shopping Ctr.	Signalized	May 22, 2007	

As a result of the count data review provided by ODOT, the PM peak hour for each study intersection was determined. Count data for each movement at every study intersection during the peak hour are shown in Tables 2 and 3.

Table 2. Raw Traffic Volumes (1 of 2)

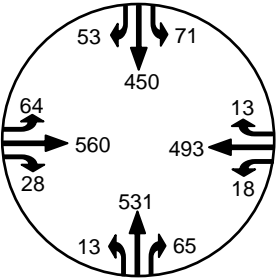
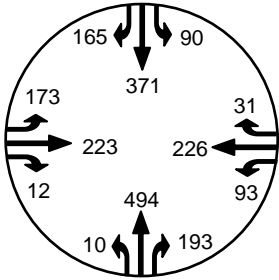
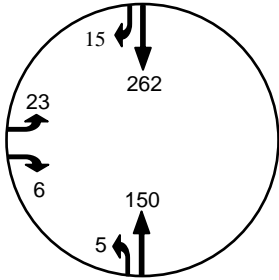
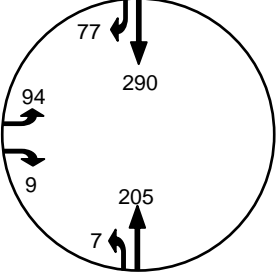
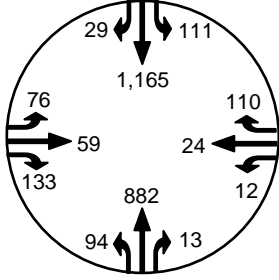
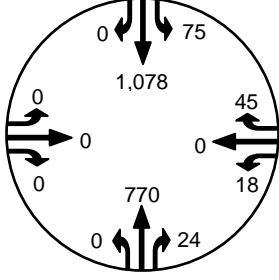
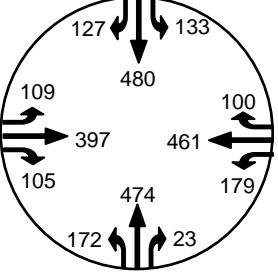
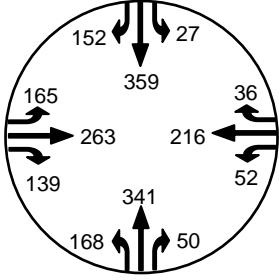
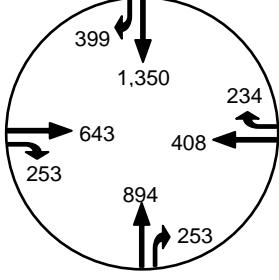
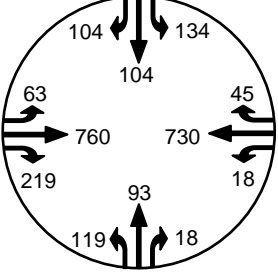
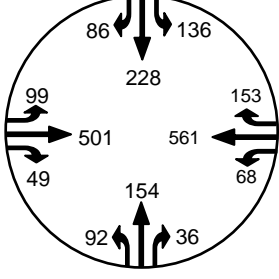
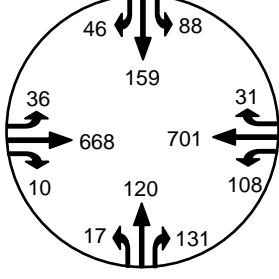
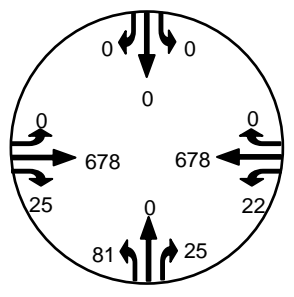
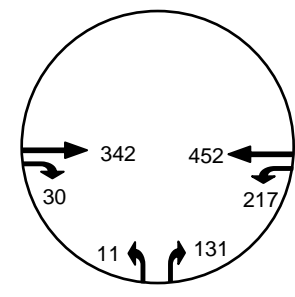
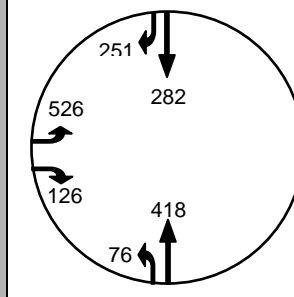
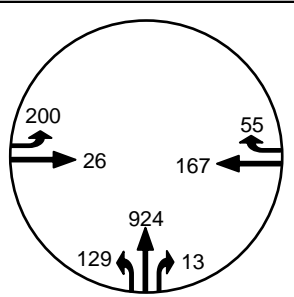
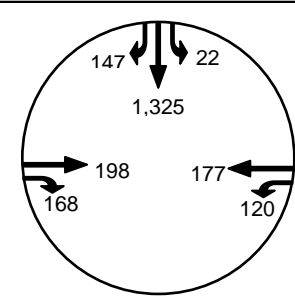
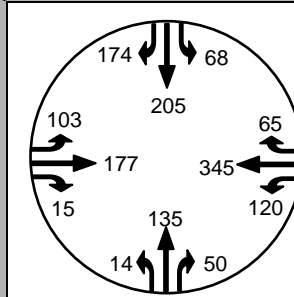
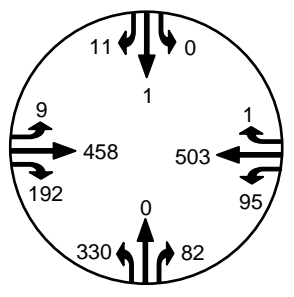
Volume	Circle Blvd.	Pacific Hwy. W (OR 99W)		Conifer Blvd.	Pacific Hwy. W (OR 99W)		Llewellyn Rd.	Pacific Hwy. W (OR 99W)	
									
Date		5/24/2005	4:30~5:30		5/25/2005	5:00~6:00		10/21/2004	4:45~5:45
Volume	Airport Ave.	Pacific Hwy. W (OR 99W)		Crystal Lake Dr.	Pacific Hwy. W (OR 99W)		Alexander Ave. / Driveway	Pacific Hwy. W (OR 99W)	
									
Date		5/25/2005	4:15~5:15		3/6/2007	4:45~5:45		3/5/2007	4:45~5:45
Volume	Circle Blvd.	9th St.		Walnut Blvd.	9th St.		Corvallis-Newport Hwy.	Pacific Hwy. W (OR 99W)	
									
Date		10/00/2004	4:00~5:00		10/00/2004	5:00~6:00		5/24/2005	4:45~5:45
Volume	Corvallis-Newport Hwy.	15 th St.		Corvallis-Newport Hwy.	35 th St.		Corvallis-Newport Hwy.	53 rd St.	
									
Date		5/24/2005	4:45~5:45		3/7/2007	4:30~5:30		3/7/2007	4:30~5:30

Table 3 Raw Traffic Volumes (2 of 2)

Volume	Corvallis-Newport Hwy.	Driveway / Technology Lp.		Corvallis-Newport Hwy.	Alsea Hwy. (OR 34)		Circle Blvd.	Corvallis-Albany Hwy.	
									
Date		10/21/2004	4:30~5:30		10/21/2004	4:30~5:30		5/25/2005	4:30~5:30
Volume	Western Blvd.	3 rd St.		Western Blvd.	4 th St.		Western Blvd.	35 th St.	
									
Date		5/22/2007	4:45~5:45		5/22/2007	4:45~5:45		5/22/2007	4:45~5:45
Volume	Circle Blvd.	Four Acres St.							
									
Date		5/22/2007	4:30~5:30						

In order to process the field collected count data, as directed by ODOT’s Analysis Procedure Manual, the following four steps were taken in sequence.

- Volume Year Adjustment
- System Peak Hour Determination
- 30th Highest Hour Development
- Volume Balancing for closely spaced intersections

Volume Year Adjustment

Per the study's scope of work, the year 2005 is the designated analysis base year. Therefore, all count data was adjusted to that year using TPAU future volume tables. Table 4 shows the list of intersections where volume year adjustments were necessary as well as the respective factors applied.

Table 4 Volume Year Adjustment Using Future Volumes Table (Base Year 2005)

Intersection		Data Year	Future Volumes Table						Annual Growth Rate (%)	
Primary Road	Secondary Road		Hwy #	MP	2003	2004	2005	2025		RSQ
Pacific Hwy W (OR 99W)	Circle Blvd.	2005	91	81.78		20,200		24,900	Model	1.11
	Walnut Blvd.	2004	91	81.43		15,200		19,700	Model	1.41
	Conifer Blvd.	2005	91	81.20		14,400		18,300	Model	1.29
	Llewellyn Rd. ¹⁾	2004	91	87.54		5,700		7,800	Model	1.66
			91	94.90		5,100		6,600	0.8290	
	Airport Ave.	2005	91	87.54		5,700		7,800	Model	1.75
	Crystal Lake Dr. ¹⁾	2007	91	84.48		25,600		42,900	Model	3.21
			91	84.50		24,500		41,000	Model	
Alexander Ave. ¹⁾	2007	91	84.92		19,700		35,600	Model	3.93	
		91	84.94		19,900		36,700	Model		
9 th St.	Circle Blvd. ²⁾	2004	91	81.43		15,200		19,700	Model	1.41
	Walnut Blvd. ²⁾	2004	91	81.20		14,400		18,300	Model	1.29
Corvallis-Newport Hwy. (US 20 / OR 34)	Pacific Hwy. W (OR 99W) ¹⁾	2005	33	55.65	15,700			20,600	Model	2.15
			33	56.70	16,900			25,800	Model	
	15 th St.	2005	33	55.44	17,500			21,500	Model	1.04
	35 th St.	2007	33	54.64	16,600			20,600	Model	1.10
	53 rd St.	2007	33	53.50	15,100			17,500	Model	0.72
Technology Lp	2004	33	53.50	15,100			17,500	Model	0.72	
Corvallis-Newport Hwy. (US 20)	Alesea Hwy. (OR 34)	2004	33	49.66			8,100	13,800	Model	3.52
Albany-Corvallis Hwy. (US 20)	Circle Blvd.	2005	31	2.20			7,200	9,400	Model	1.53
3 rd St. (OR 99W)	Western Blvd. ¹⁾	2007	91	84.94		14,400		22,800	Model	2.81
			91	84.92		14,600		23,300	Model	
4 th St. (OR 99W)	Western Blvd. ¹⁾	2007	91	84.92		13,500		17,600	Model	1.77
			91	84.94		14,100		20,300	Model	
Western Blvd.	35 th St. ²⁾	2007	33	54.64	16,600			20,600	Model	1.10
Circle Blvd.	Four Acres St. / Shopping Ctr. ²⁾	2007	91	81.78		20,200		24,900	Model	1.11

- 1) Two adjacent growth rates were weighted based on the distance to the intersection. See below for more detailed information.
- 2) Growth rate for this intersection has been copied from adjacent state highway intersection.

Study intersections with two adjacent future volumes table mileposts were weighted based on the relative distance from the intersection to those mileposts using the following equation.

Memo



$$\left\{ \left[\frac{(V_{F(a)} - V_{E(a)}) - 1}{\text{Year Difference}} \times \text{Dist}_{(b)} \right] + \left[\frac{(V_{F(b)} - V_{E(b)}) - 1}{\text{Year Difference}} \times \text{Dist}_{(a)} \right] \right\} \div (\text{Dist}_{(a)} + \text{Dist}_{(b)})$$

where, $V_{F(i)}$: Predicted volume in 2025 at milepost i

$V_{E(i)}$: Existing volume at milepost i

$\text{Dist}_{(i)}$: Distance to the intersection from milepost i

Table 5 depicts the intersection count data adjusted to the base year.

Table 5. Base Year 2005 Traffic Volumes after Volume Year Adjustment (1 of 2)

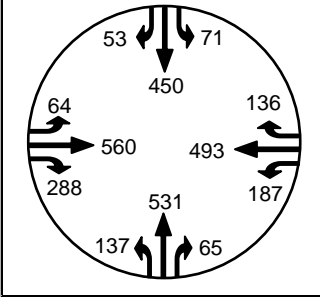
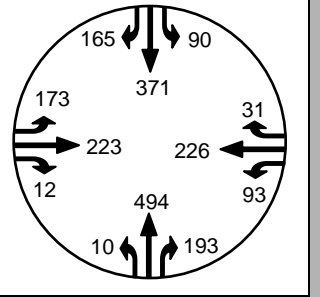
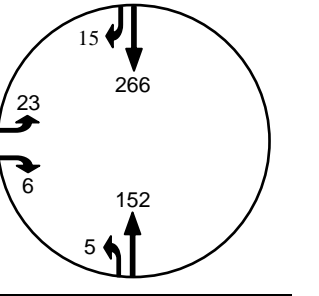
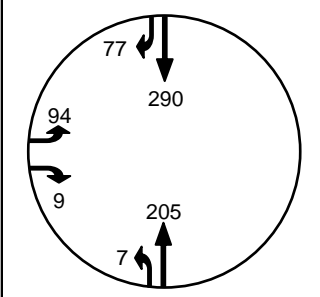
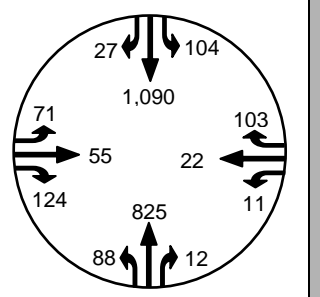
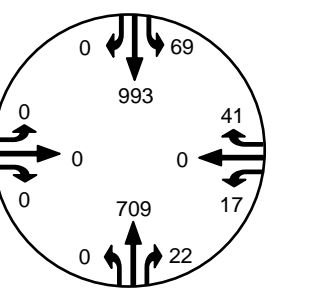
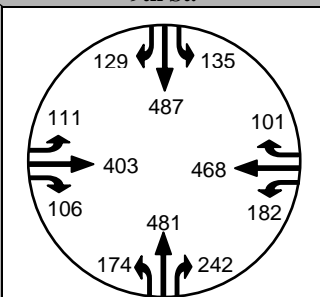
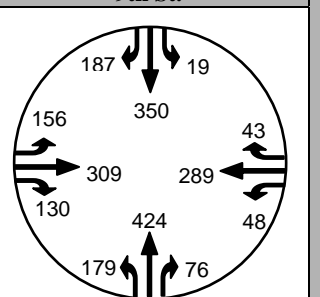
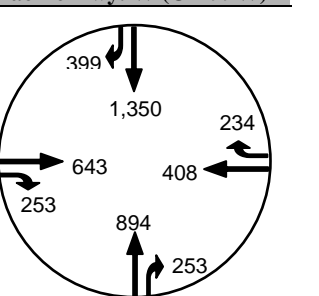
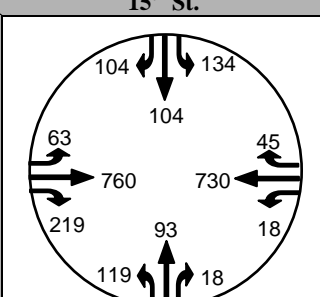
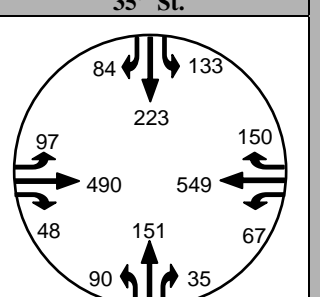
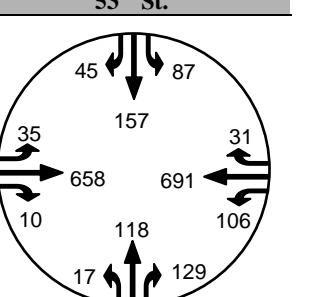
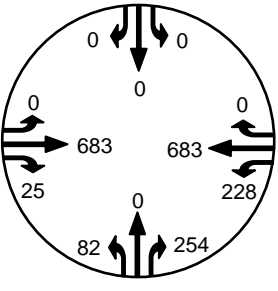
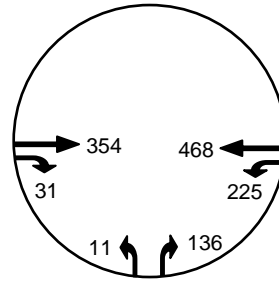
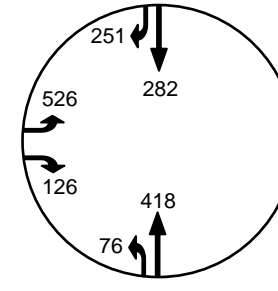
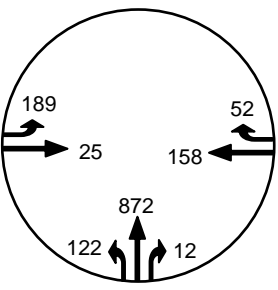
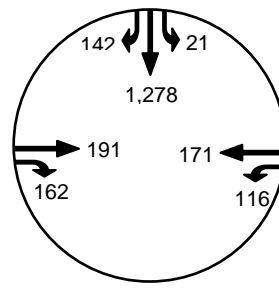
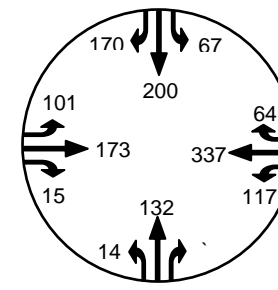
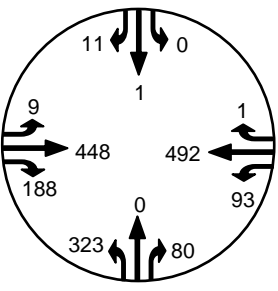
Volume	Pacific Hwy. W (OR 99W)	Pacific Hwy. W (OR 99W)	Pacific Hwy. W (OR 99W)
			
Time	4:30~5:30	5:00~6:00	4:45~5:45
Volume	Pacific Hwy. W (OR 99W)	Pacific Hwy. W (OR 99W)	Pacific Hwy. W (OR 99W)
			
Time	4:15~5:15	4:45~5:45	4:45~5:45
Volume	9th St.	9th St.	Pacific Hwy. W (OR 99W)
			
Time	4:00~5:00	5:00~6:00	4:45~5:45
Volume	15 th St.	35 th St.	53 rd St.
			
Time	4:45~5:45	4:30~5:30	4:30~5:30

Table 6. Base Year 2005 Traffic Volumes after Volume Year Adjustment (2 of 2)W

Volume	Corvallis-Newport Hwy.	Driveway / Technology Lp.	Corvallis-Newport Hwy.	Alesea Hwy. (OR 34)	Circle Blvd.	Corvallis-Albany Hwy.
						
Time		4:30~5:30		4:30~5:30		4:30~5:30
Volume	Western Blvd.	3 rd St.	Western Blvd.	4 th St.	Western Blvd.	35 th St.
						
Time		4:45~5:45		4:45~5:45		4:45~5:45
Volume	Circle Blvd.	Four Acres St.				
						
Time		4:30~5:30				

System Peak Hour Determination

The system PM peak hour was determined based on collected traffic count data for 17 study intersections (Note: Three intersections were excluded from the determination process due to unavailable data and no breakdown into 15 minute intervals). As shown in Table 7, the hourly volume from 4:00 PM to 6:00 PM was analyzed in 15 minutes intervals and the peak hour for each

intersection determined. The peak hour for 8 out of 17 (47.1%) intersections was found to be from 4:45 PM to 5:45 PM, which is thus determined to be the system peak hour.

Table 6. Peak Hour Selection Spreadsheet

#	Primary Rd	Secondary Rd	4:00~5:00	4:15~5:15	4:30~5:30	4:45~5:45	5:00~6:00
1	OR 99W	Circle Blvd.	2,899	2,940	3,035	2,985	2,902
2	OR 99W	Conifer Blvd.	1,660	1,845	1,956	2,033	2,081
3	OR 99W	Llewellyn Rd.	432	436	446	469	454
4	US 20 / OR 34	15th St.	2,141	2,175	2,263	2,407	2,387
5	US 20 / OR 34	35th St.	2,005	2,027	2,115	2,088	2,061
6	US 20 / OR 34	53rd St.	1,852	1,967	2,085	2,082	2,021
7	US 20 / OR 34	Technology Lp.	1,837	1,906	1,954	1,942	1,869
8	US 20	OR 34(Alsea Hwy.)	1,211	1,192	1,221	1,167	1,106
9	US 20	Circle Blvd.	1,554	1,608	1,721	1,719	1,683
10	OR 99W	Airport Ave.	655	682	663	641	600
11	OR 99W	Crystal Lake Dr.	2,315	2,424	2,477	2,534	2,449
12	OR 99W	Alexander Ave.	1,679	1,740	1,835	1,852	1,779
13	US 20 / OR 34	OR 99W Int	5,735	5,939	6,331	6,505	6,447
14	OR 99W / 3rd St.	Western Blvd.	1,340	1,389	1,421	1,429	1,382
15	OR 99W / 4th St.	Western Blvd.	1,818	1,930	2,056	2,081	2,038
16	Western Blvd.	35th St.	1,209	1,325	1,399	1,439	1,387
17	Circle Blvd.	Four Acres St	1,564	1,632	1,645	1,609	1,549
18	OR 99W	Walnut Blvd.					
19	9th St.	Circle Blvd.	3,039				2,971
20	9th St.	Walnut Blvd.	2,016				2,235
Number of Peaks			0	1	7	8	1

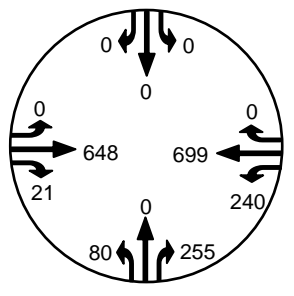
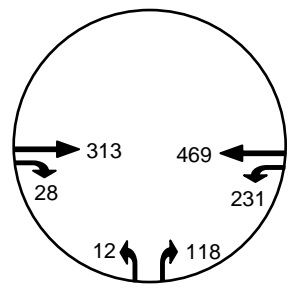
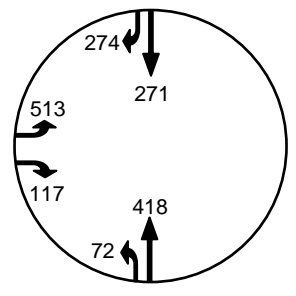
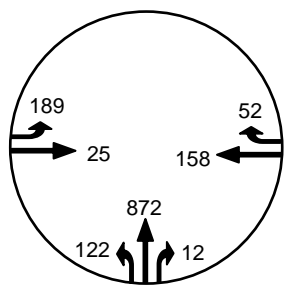
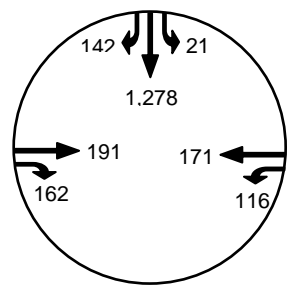
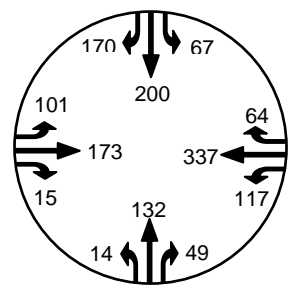
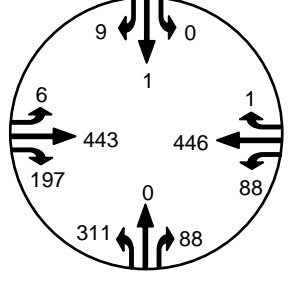
* Intersection # 18~20 (gray-colored rows) were excluded from peak hour selection process due to unavailable data or no breakdown into 15 min intervals.

The study intersection volumes for the determined system peak hour of 4:45 PM to 5:45 PM are shown in Tables 8 and 9.

Table 7. System Peak Hour Volumes (1 of 2)

Volume	Pacific Hwy. W (OR 99W)	Pacific Hwy. W (OR 99W)	Pacific Hwy. W (OR 99W)
	Circle Blvd.	Conifer Blvd.	Llewellyn Rd.
Volume	Pacific Hwy. W (OR 99W)	Pacific Hwy. W (OR 99W)	Pacific Hwy. W (OR 99W)
	Airport Ave.	Crystal Lake Dr.	Alexander Ave. / Driveway
Volume	9th St.	9th St.	Pacific Hwy. W (OR 99W)
	Circle Blvd.	Walnut Blvd.	Corvallis-Newport Hwy.
Volume	15 th St.	35 th St.	53 rd St.
	Corvallis-Newport Hwy.	Corvallis-Newport Hwy.	Corvallis-Newport Hwy.

Table 8. System Peak Hour Volumes (2 of 2)

Volume	<p>Driveway / Technology Lp.</p> 	<p>Alsea Hwy. (OR 34)</p> 	<p>Corvallis-Albany Hwy.</p> 
	<p>3rd St.</p> 	<p>4th St.</p> 	<p>35th St.</p> 
	<p>Four Acres St.</p> 		

30th Highest Hour and Average Daily Traffic Volume Methodology

As there is no automated traffic recorder (ATR) site within the study area, seven ATR sites with similar characteristics were chosen using the 2007 ATR Characteristics Table. Details on each selected ATR are shown in Table 10 below.

Table 9. ATR Stations Used for Seasonal Adjustment

ATR Station Number	Station Name	Route #	Highway Name	Seasonal Traffic Trend	Area Type	# of Lanes	AADT	OHP Classification
02-007	Monroe	OR-99W	Pacific Highway West	Commuter	Rural	2	5,000	Regional Highway
06-004	Bandon	US 101	Oregon Coast Highway	Coastal Destination	Populated Rural	2	6,500	Statewide Highway
18-018	Klamath Falls	OR-39	Klamath Fall-Malin Highway	Commuter	Small Urban	5	23,200	Regional Highway
24-001	Woodburn	OR-99E	Pacific highway East	Commuter	Small Urban	2	10,700	Regional Highway
24-016	Hubbard	OR-551	Wilsonville-Hubbard Highway	Commuter	Rural	2	8,200	Regional Highway
30-008	South Pendleton	US 395	Pendleton-John Day Highway, No. 28	Commuter	Small Urban	5	22,300	Statewide Highway
31-003	Island City	OR-82	Wallowa Lake Highway, No. 10	Commuter	Small Urban Fringe	5	12,200	Statewide Highway

The procedure used to estimate the 30th highest hour volume is referenced from ODOT’s Analysis Procedure Manual (April 2006). As directed by the manual, the ADT to AADT ratios were taken from the ATR summaries for the past five years and presented in Table 11. Per the manual’s instruction, the high and low percentage values were excluded from the seasonal adjustment factor calculation.

Table 10. Seasonal Adjustments (%)

ATR Station Number	Month	2003	2002	2001	2000	1999	Seasonal Adjustment Factor	
02-007	Peak Month	115 (Aug)	117 (Jul)	113 (Aug)	111 (Aug)	112 (Aug)		
	Count Month	May	98	107	102	100	104	1.11
		Jun	106	111	107	103	106	1.07
		Oct	100	84	102	103	99	1.13
		Nov	96	94	98	99	96	1.17
06-004	Peak Month	126 (Jul)	127 (Jul)	132 (Aug)	131 (Jul)	129 (Aug)		
	Count Month	Oct	105	106	105	104	105	1.23
		Nov	96	95	95	95	95	1.36
18-018	Peak Month	119 (Jun)	119 (Jun)	119 (Jun)	117 (Jun)	117 (May)		
	Count Month	May	117	112	115	115	117	1.04
		Jun	119	119	119	117	116	1.00
		Aug	113	115	116	110	113	1.04
		Sep	110	114	115	109	110	1.06
		Oct	115	117	118	117	117	1.01
24-001	Peak Month	108 (Aug)	111 (Jul)	122 (Jul)	112 (Jul)	113 (Aug)		
	Count Month	May	97	105	104	106	104	1.07
		Jun	101	110	111	109	110	1.02
24-016	Peak Month	116 (Jun)	118 (Jun)	117 (Jun)	116 (Aug)	119 (Aug)		
	Count Month	May	111	114	111	110	110	1.06
		Jun	116	118	117	113	115	1.01
30-008	Peak Month (Jun)	115	113	114	114	114		
	Count Month	Feb	106	103	102	107	104	1.09
		Mar	107	109	104	106	107	1.07
		May	112	109	111	113	113	1.02
		Jun	115	113	114	114	114	1.00
		Oct	108	107	110	103	107	1.06
		Nov	104	102	103	99	103	1.11
31-003	Peak Month	119 (Jun)	118 (Jul)	120 (Jul)	117 (Jul)	120 (Aug)		
	Count Month	Feb	106	96	99	98	99	1.21
		Mar	105	106	106	102	104	1.13

Note: Gray cells indicate high and low value excluded from the calculations.

The percentage applied to calculate seasonal adjustment factors in Table 11 above represent the 15th day of the month; therefore, counts that were not collected on the 15th of each month need to be adjusted based on its data collection date. Table 12 shows the seasonal adjustment factor after consideration of the actual data collection date.

Table 11. Seasonal Adjustment Factors

Intersection		Applied ATR Station Number	Count Date	Seasonal Factor
Primary Road	Secondary Road			
Pacific Hwy. W (OR 99W)	Circle Blvd.	18-018	May 24, 2005	1.03
	Walnut Blvd.	18-018	August 24~27, 2004	1.05
	Conifer Blvd.	18-018	May 25, 2005	1.03
	Llewellyn Rd.	02-007	October 21, 2004	1.14
	Airport Ave.	02-007	May 25, 2005	1.10
	Crystal Lake Dr.	31-003	March 6/7, 2007	1.16
	Alexander Ave.	31-003	March 5/6, 2007	1.16
9 th St.	Circle Blvd.	18-018	October, 2004	1.01
	Walnut Blvd.	18-018	October, 2004	1.01
Corvallis-Newport Hwy. (US 20 / OR 34)	Pacific Hwy. W (OR 99W)	30-008	May 24, 2005	1.01
	15th St.	30-008	May 24, 2005	1.01
	35th St.	30-008	March 7/8, 2007	1.08
	53rd St.	30-008	March 12/13, 2007	1.07
	Technology Lp.	30-008	October 21, 2004	1.07
Corvallis-Newport Hwy. (US 20)	Alsea Hwy. (OR 34)	06-004	October 21, 2004	1.25
Albany-Corvallis Hwy. (US 20)	Circle Blvd.	24-016	May 25, 2005	1.04
3 rd St. (OR 99W)	Western Blvd.	18-018	May 22, 2007	1.03
4 th St. (OR 99W)	Western Blvd.	18-018	May 22, 2007	1.03
Western Blvd.	35th St.	24-001	May 22, 2007	1.06
Circle Blvd.	Four Acres St. / Shopping Ctr.	18-018	May 22, 2007	1.03

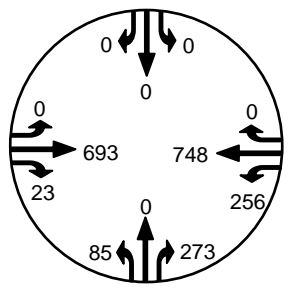
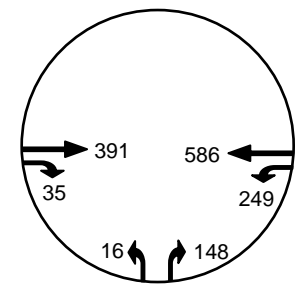
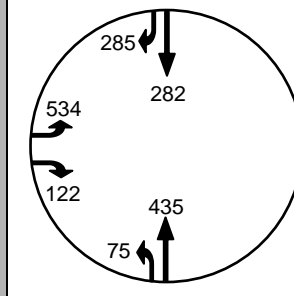
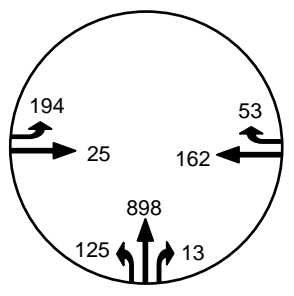
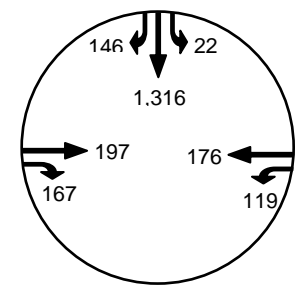
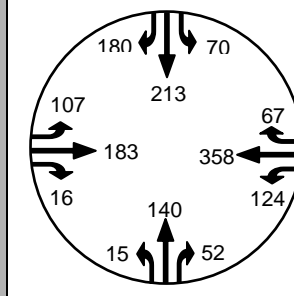
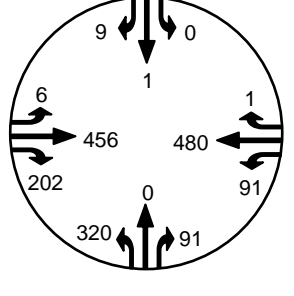
The following equation is used to compute the 30th highest peak hour volume for each study intersection. The resulting volume sets are depicted in Tables 13 and 14.

$$30 \text{ HV (30}^{\text{th}} \text{ Hour Volumes)} = \text{System Peak Hour Volume from traffic count} * \text{Seasonal Factor}$$

Table 12. 30th Highest Hour Volumes (1 of 2)

Volume	Pacific Hwy. W (OR 99W)	Pacific Hwy. W (OR 99W)	Pacific Hwy. W (OR 99W)
	Circle Blvd.	Conifer Blvd.	Llewellyn Rd.
Volume	Pacific Hwy. W (OR 99W)	Pacific Hwy. W (OR 99W)	Pacific Hwy. W (OR 99W)
	Airport Ave.	Crystal Lake Dr.	Alexander Ave. / Driveway
Volume	9th St.	9th St.	Pacific Hwy. W (OR 99W)
	Circle Blvd.	Walnut Blvd.	Corvallis-Newport Hwy.
Volume	15 th St.	35 th St.	53 rd St.
	Corvallis-Newport Hwy.	Corvallis-Newport Hwy.	Corvallis-Newport Hwy.

Table 13. 30th Highest Hour Volumes (2 of 2)

Volume	<p>Driveway / Technology Lp.</p> 	<p>Alsea Hwy. (OR 34)</p> 	<p>Corvallis-Albany Hwy.</p> 
	<p>3rd St.</p> 	<p>4th St.</p> 	<p>35th St.</p> 
Volume	<p>Four Acres St.</p> 		

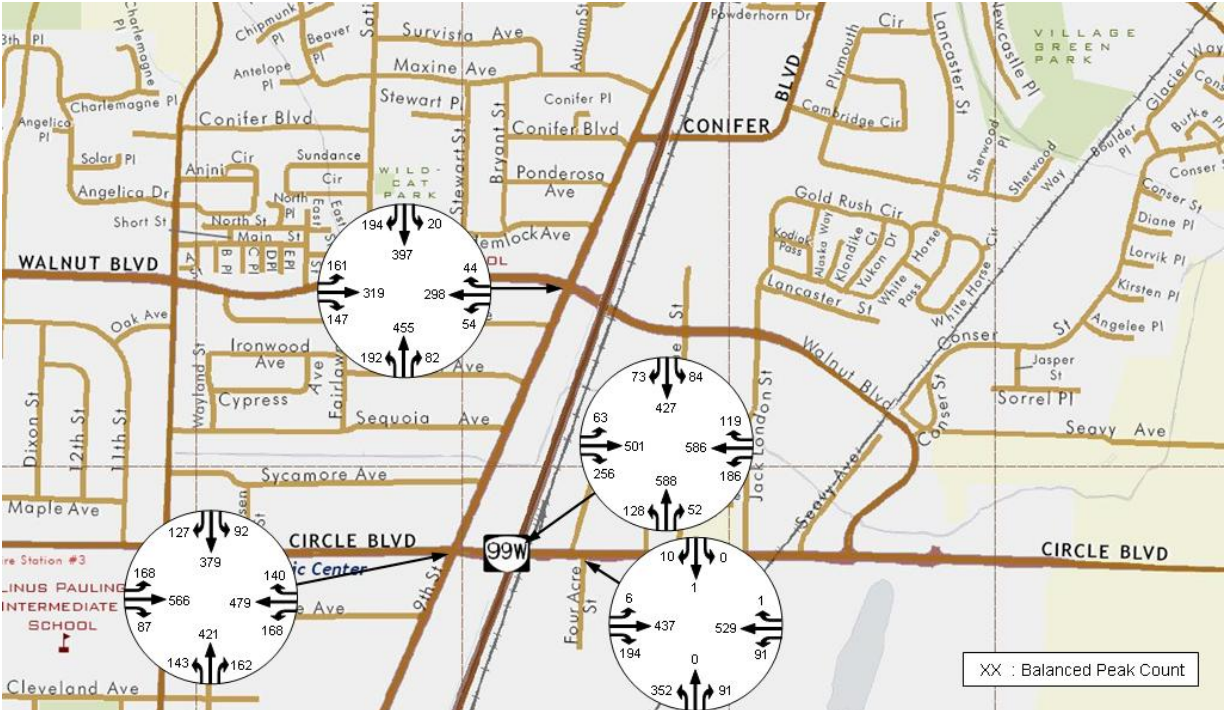
Volume Balancing for Closely Located Intersections

As all traffic counts were collected under different conditions, times of year, etc., counts are not matching smoothly when comparing the exiting volume at upstream intersections to the entering volume at downstream intersections. In other words, as it was stated in the Analysis Procedure Manual, what goes into an intersection or segment needs to come out from upstream intersection. Therefore, the original turning movement counts were balanced by interpolation adjustment step. The list of intersections balanced is shown in Table 15. Movements which contribute to the difference were only modified while the other movements were not.

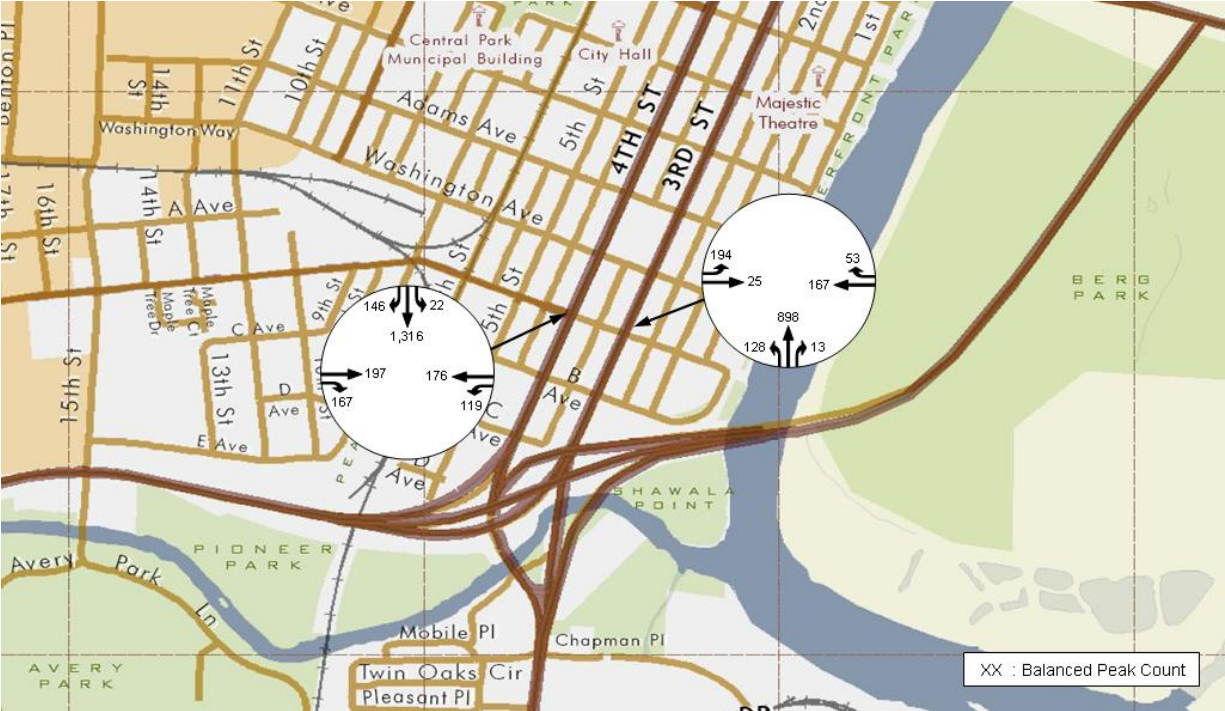
Table 14. List of Balanced Intersections

Area Name	Intersection List			
	Primary Road	Secondary Road	Primary Road	Secondary Road
OR 99W & 9 th St. Area	9 th St.	Circle Blvd.	9 th St.	Walnut Blvd.
	OR 99W	Circle Blvd.	Circle Blvd.	4 Acres St.
Downtown	3 rd St.	Western Ave.	4 th St.	Western Ave.
US 20 @ OR 99W	US 20	OR 99W	US 20	15 th St.
35 th St. Corridor	US 20	35 th St.	Western Ave.	35 th St.

Balanced counts are shown by each area in Figure 1 and 2 below.

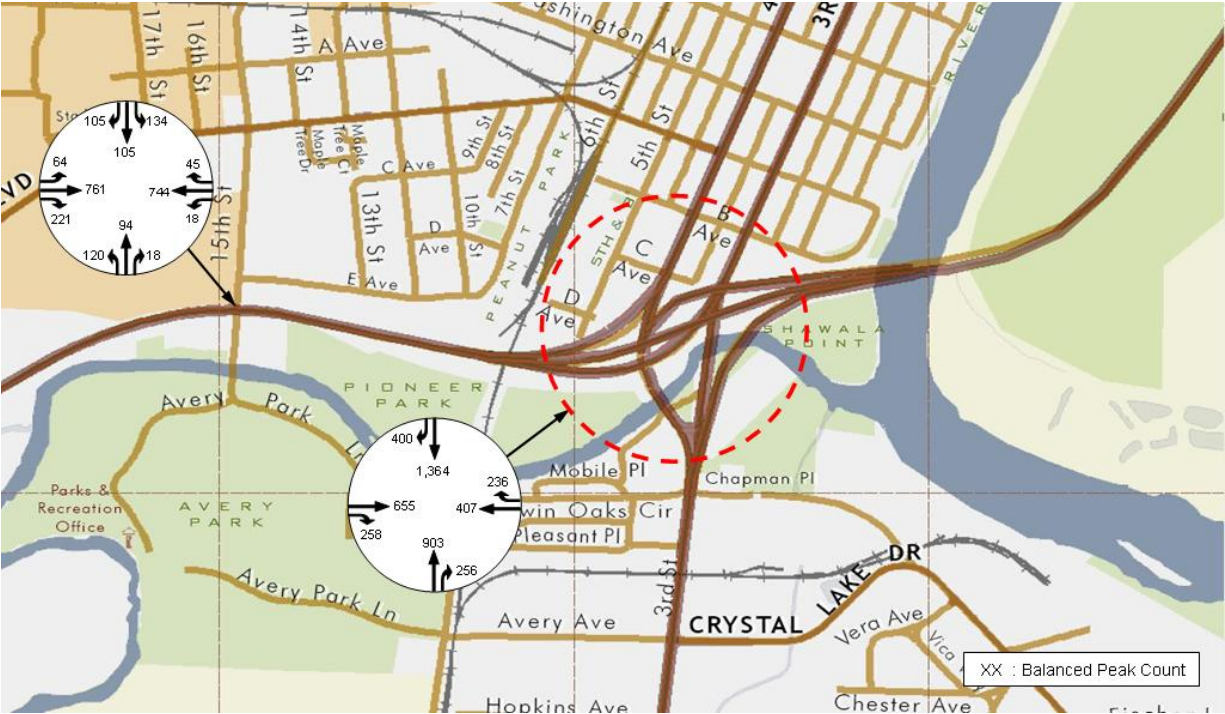


(a) OR 99W & 9th St. Area

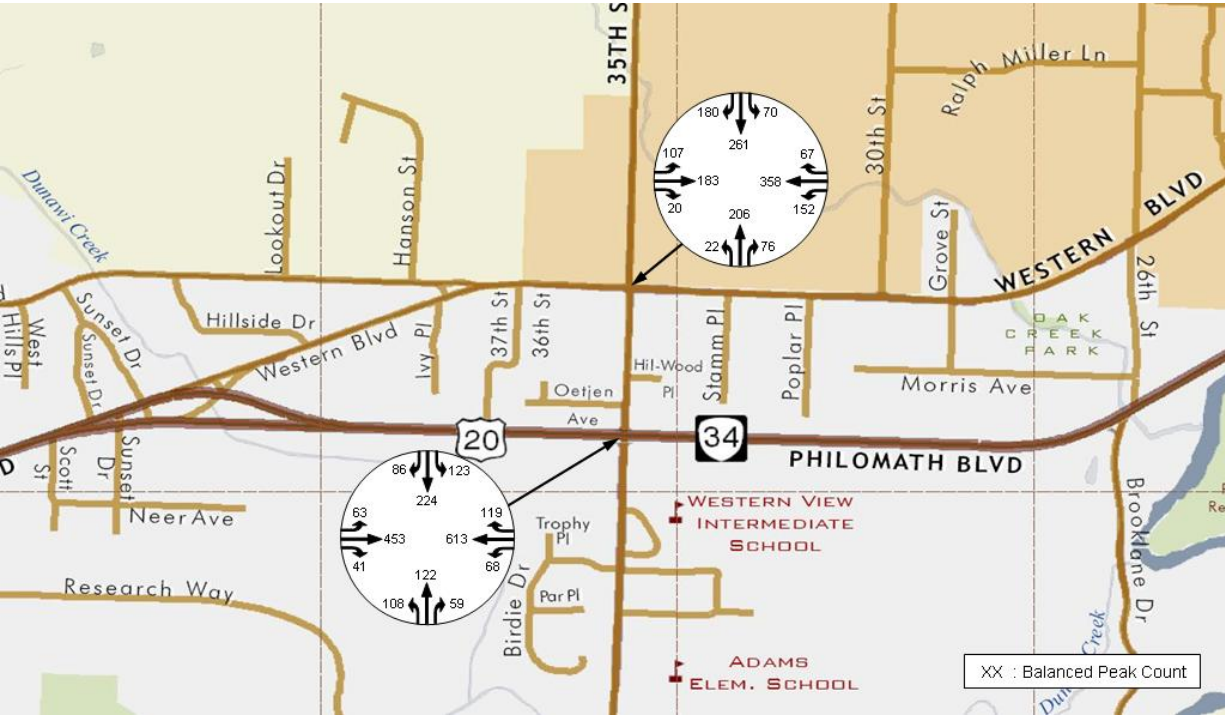


(b) Downtown Area

Figure 1. Balanced Peak Hour Volumes (1 of 2)



(a) US 20 @ OR 99W



(b) 35th St. Corridor

Figure 2. Balanced Peak Hour Volumes (2 of 2)

Intersection Capacity Analysis

The level of service analysis of the designated study intersections will be performed using the 2000 Highway Capacity Manual (HCM 2000) methodology as implemented in TRAFFIX™. The future year intersection demand will be calculated in accordance with NCHRP 255 Chapter 8. The CAMPO demand model is a PM peak hour model. Thus, the NCHRP 255 process was done for the PM future analysis. The volumes for the AM future analysis were estimated by multiplying the AM counts by the NCHRP 255 calculated turn growth rates for the PM peak period.

HCM 2000 Methodology

The HCM 2000 capacity analysis methodology incorporates numerous input parameters. The list of parameters includes: ideal saturation flow rate, analysis period, peak hour volume, peak hour factor, truck percentage, geometry (lane width, lane configuration, etc.), signal phasing and timing, etc.

Table 16 below shows all adjustment parameters proposed for this capacity analysis.

Table 15. Proposed HCM Analysis Parameters

Traffix™ Parameters	Default	Proposed
Sneakers (Vehicles)	0.00	Traffix™ default will be used due to unavailable relevant local data.
Peak Hour Factor	1.00	From traffic counts or <ul style="list-style-type: none"> • 0.85 for Minor Street inflows and outflows, • 0.90 for Minor Arterials, • 0.95 for Major Streets, Whichever higher.
Analysis Period	1 hour	15 minutes
CBD	Other	CBD: Along 3 rd and 4 th St. in downtown. Other: All other intersections.
Arrival Type	3	Based on coordination patterns.
Ideal Saturation Flow Rate (PC/hr/G/Lane)	1,900	1,800
Lane Width (feet)	12	From field visit or ODOT online inventory, otherwise 12.
Percent Heavy Vehicles (%)	0	From traffic counts, otherwise 5.
Percent Grade (%)	0	From ODOT online inventory, otherwise 0.
Intersection signal phasing and coordination	User input	Current timing plans provided by City of Corvallis Public Works Dept. / ODOT
Other Signal Timing Data	User input	Current timing plans provided by City of Corvallis Public Works Dept. / ODOT
Right Turn on Red	Not allowed, unless user set to allow.	Allowed, except where signed.

Future Year Analysis Methodology

NCHRP 255 Chapter 8 calculates the difference between base year and future year assignment results at the intersection approach level. This difference (either absolute or relative) is then added to the base year count volumes. The result is adjusted future year turn movement volumes that are based on both, the reality of base counts and the built-in intelligence of the travel demand forecast model. The “difference” method was used for this analysis as it is expected to better reflect the anticipated traffic growth resulting from planned development patterns.

Once the future volume data are generated, the same intersection capacity analysis is performed.

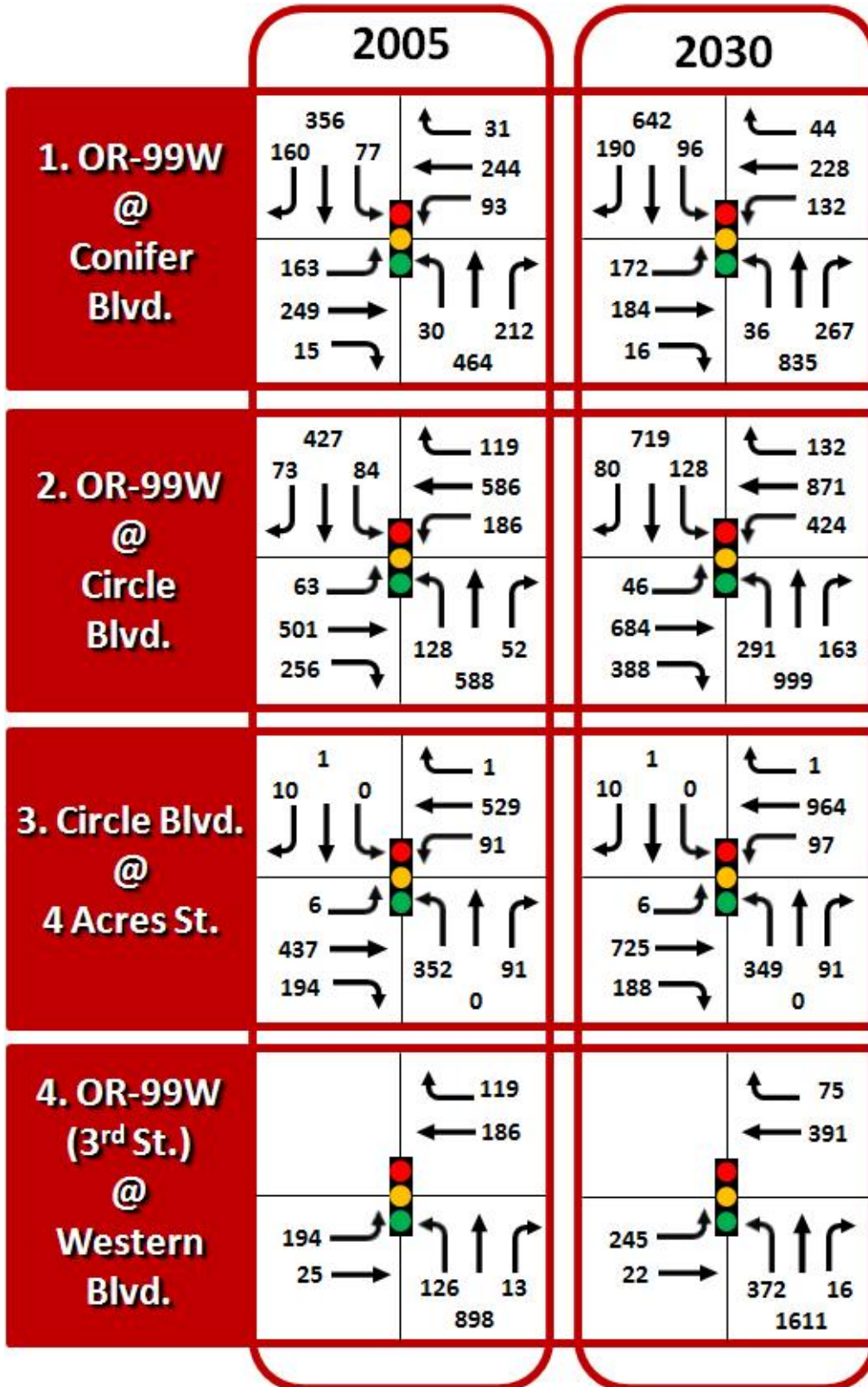
Merge / Diverge Analysis

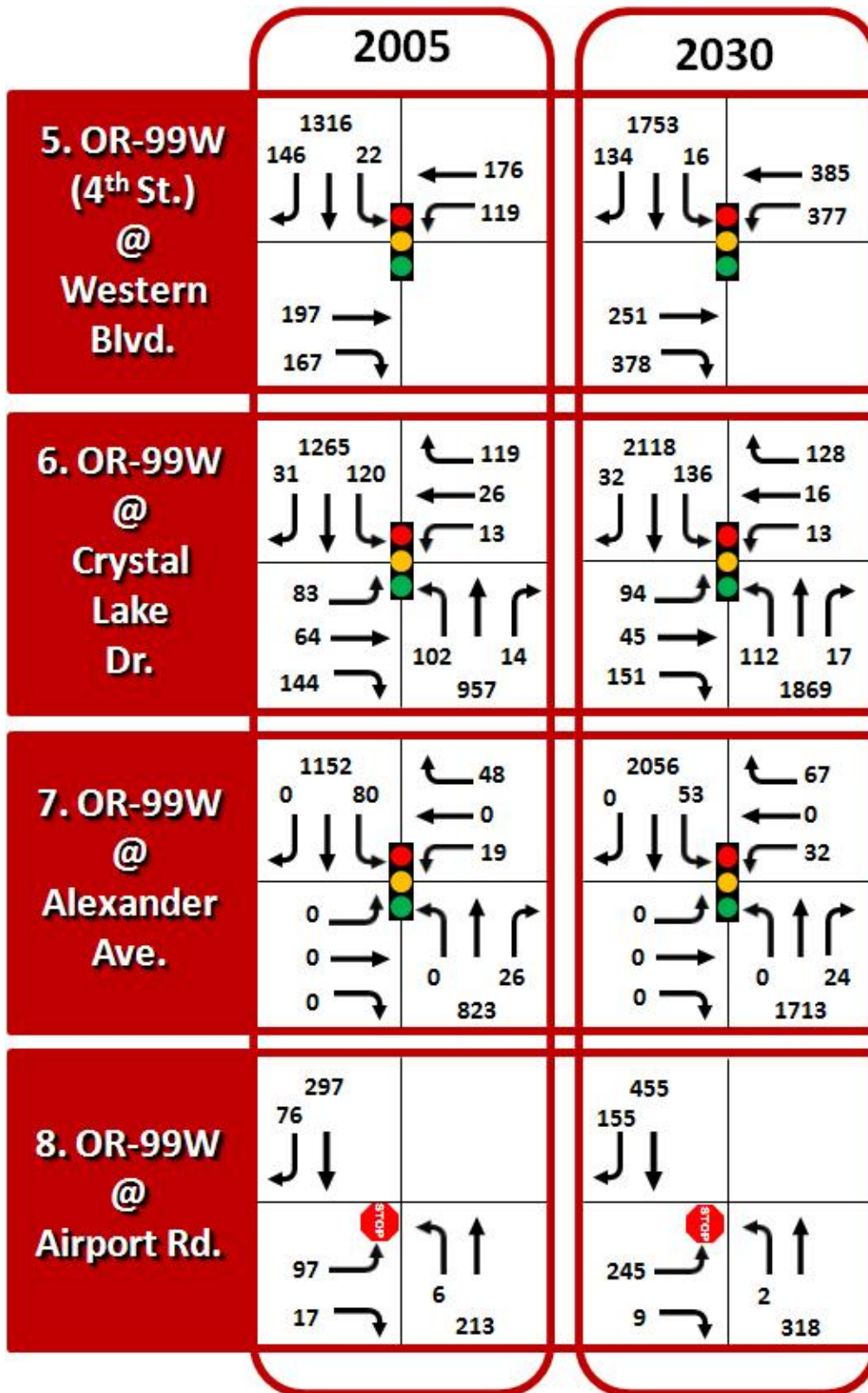
As the interchange of US 20/OR 34 at OR 99W requires merge and diverge analysis, the most appropriate analysis methodology has to be determined. ODOT recommended using the methodology described in chapter 25 of HCM from Analysis Procedure Manual. However, that methodology is only applicable to freeways with more than two lanes per direction and a mainline free flow speed greater than 55 mph; clearly not conditions matching our study interchange. Therefore, we propose the use of the microscopic simulation model, VISSIM, to analyze each merge/diverge area of the interchange. We also propose to use delay as the critical measure of effectiveness to better reflect the urban characteristics of the study location.

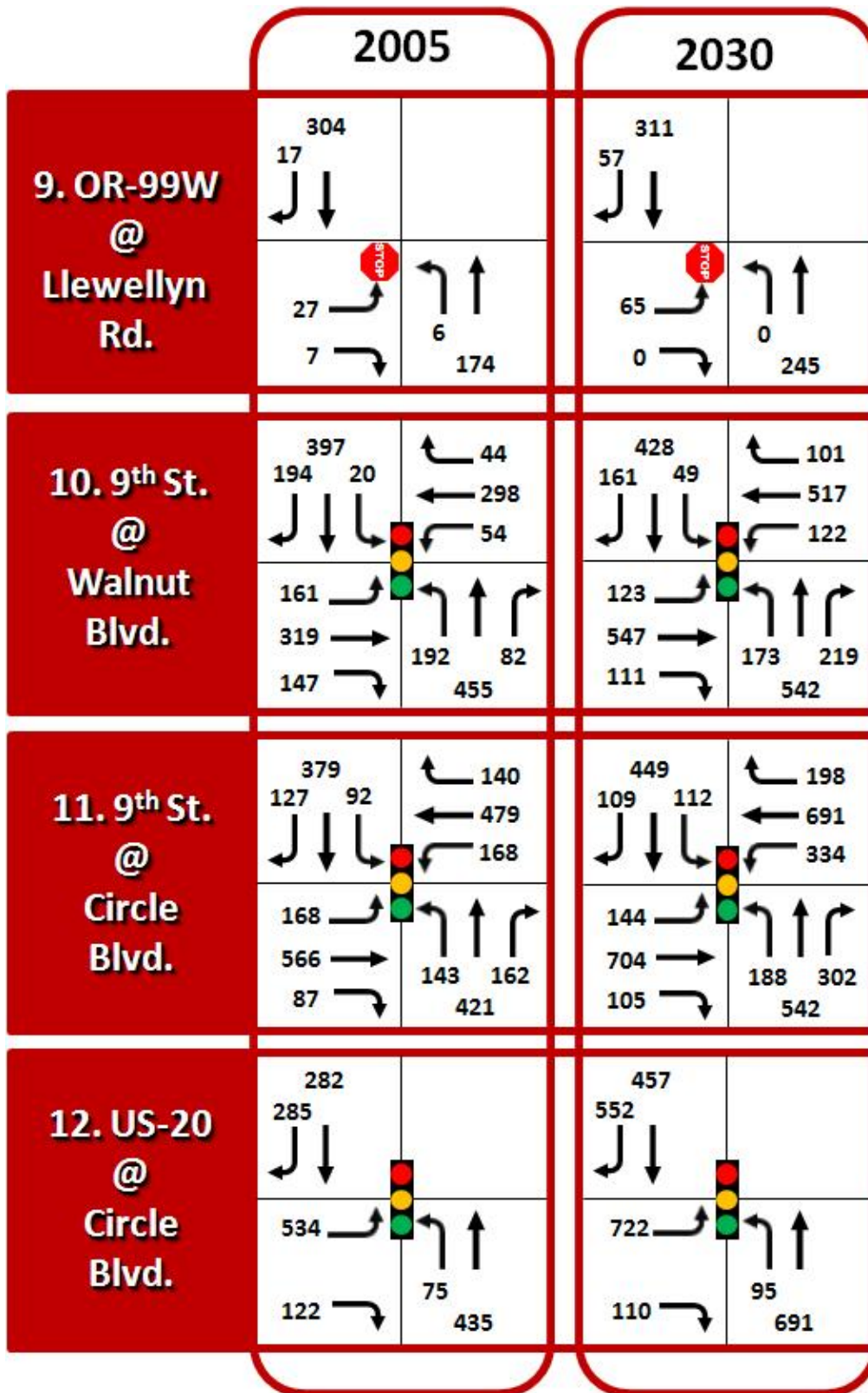
Queuing Analysis

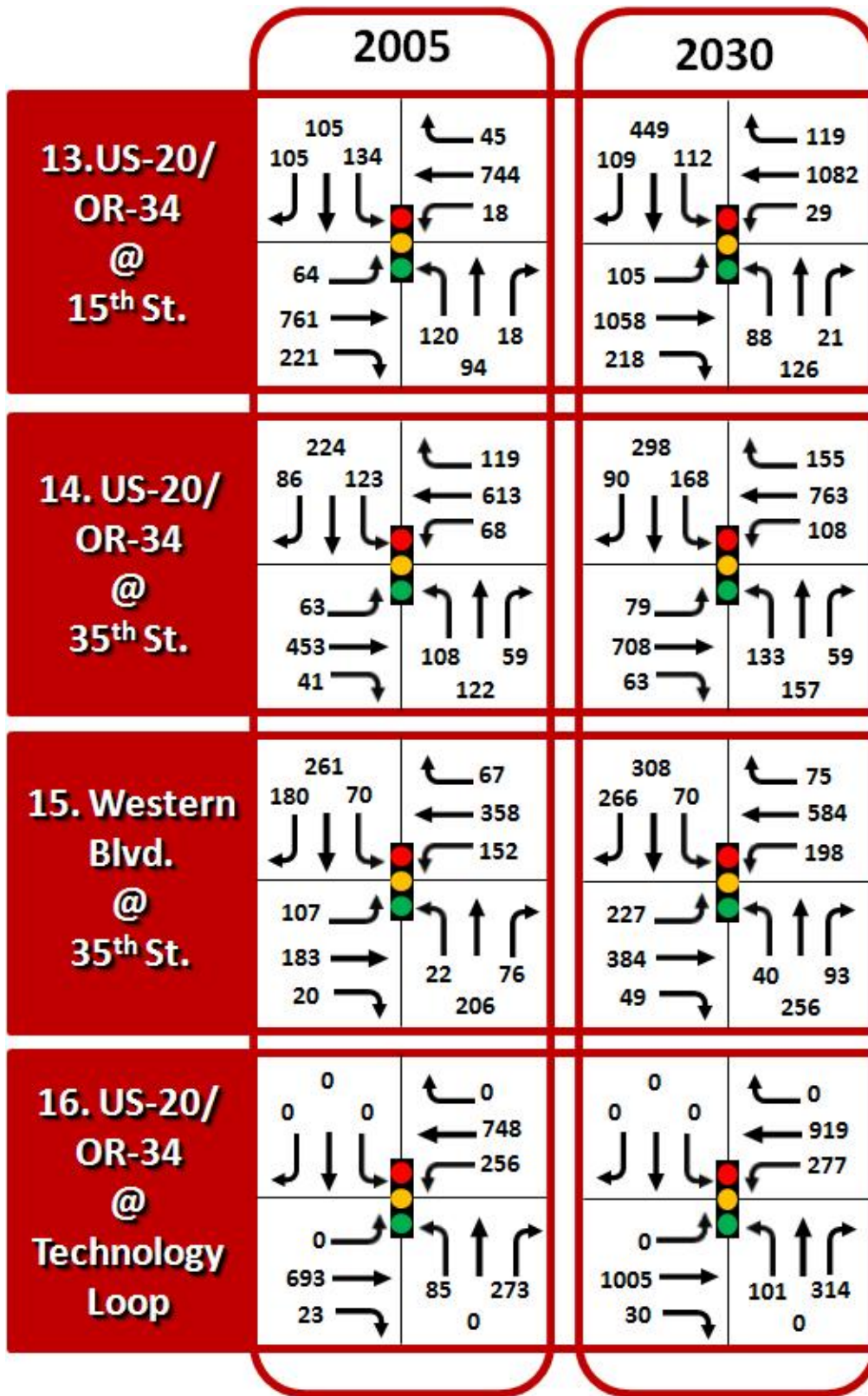
Several study intersections are located in close proximity of each other. As a result a more detailed queuing analysis is required for an accurate traffic operations analysis. We propose to use the microscopic simulation model VISSIM for this analysis. VISSIM’s input parameters will be set to match ODOT’s default parameters for SimTraffic. At a minimum, microsimulation output will include control delay and 95th percentile queuing for each movement. Additional output will be provided based on ODOT’s request.

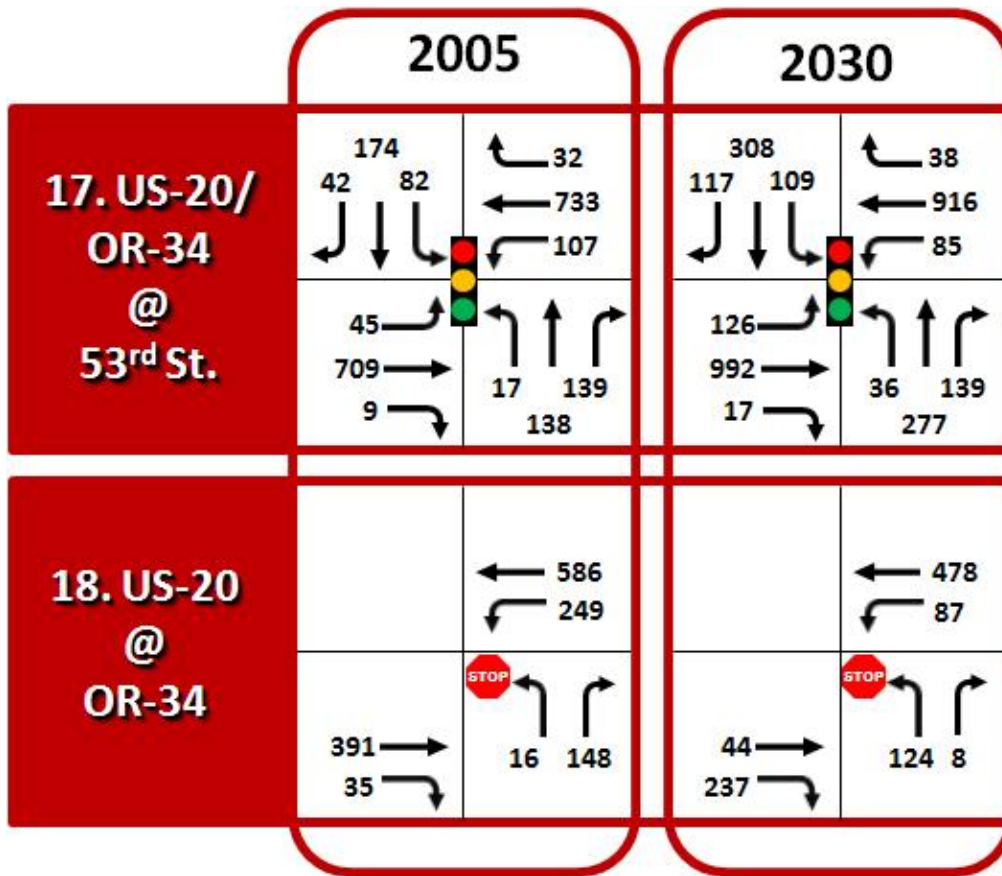
APPENDIX B: Turning Movement Volumes (2005 / 2030)











APPENDIX C: V/C Analysis Result Comparison Table

Volume / Capacity Analysis Result

	Primary Road Name	Secondary Road Name	Mobility Standard ⁽¹⁾	2005 ⁽²⁾		2030									
				V/C	LOS	No-Build ⁽⁴⁾		Financially Constrained Projects ⁽⁴⁾		Illustrative Projects ⁽⁴⁾		PTV America's Alternative			
						V/C	LOS	V/C	LOS	V/C	LOS	V/C	LOS	V/C	LOS
1	OR-99W	Conifer Boulevard	0.85 ⁽¹⁾	0.68	B	0.80	D	0.80	D	0.80	D	0.80	D	0.74	C
2	OR-99W	Circle Boulevard	0.85 ⁽¹⁾	0.72	C	1.17	F	1.17	F	1.10	F	1.10	F	1.03	F
3*	Circle Boulevard	4 Acres Street	LOS D ⁽³⁾	0.48	A	0.64	B	0.64	B	0.64	B	0.64	B	0.64	B
4*	3rd Street	Western Avenue	0.90 ⁽²⁾	0.58	A	1.14	F	1.14	F	1.14	F	1.14	F	1.14	F
5*	4th Street	Western Avenue	0.90 ⁽²⁾	0.59	A	1.15	F	1.15	F	1.15	F	1.15	F	1.15	F
6*	OR-99W	Crystal Lake Drive	0.85 ⁽¹⁾	0.80	D	1.04	F	1.04	F	1.04	F	1.04	F	0.95	E
7*	OR-99W	Alexander Avenue	0.85 ⁽¹⁾	0.45	A	0.79	C	0.79	B	0.79	C	0.79	C	0.79	C
8	OR-99W	Airport Road	0.85 ⁽¹⁾	0.26	A	0.95	E	0.95	E	0.84	D	0.84	D	0.46	A
9*	OR-99W	Llewellyn Road	0.70 ⁽¹⁾	0.07	A	0.17	A	0.17	A	0.17	A	0.17	A	0.17	A
10*	9th Street	Walnut Boulevard	LOS D ⁽³⁾	0.64	B	0.71	C	0.72	C	0.72	C	0.72	C	0.72	C
11*	9th Street	Circle Boulevard	LOS D ⁽³⁾	0.69	B	0.99	E	0.95	E	0.95	E	0.95	E	0.89	D
12	US-20	Circle Boulevard	0.85 ⁽¹⁾	0.88	D	1.09	F	1.02	F	1.02	F	1.02	F	0.72	C
13	US-20/OR-34	15th Street	0.80 ⁽¹⁾	0.95	E	1.26	F	1.26	F	0.94	E	0.94	E	0.77	C
14*	US-20/OR-34	35th Street	0.80 ⁽¹⁾	0.86	D	0.96	E	0.96	E	0.66	B	0.66	B	0.66	B
15*	Western Avenue	35th Street	LOS D ⁽³⁾	0.79	C	1.05	F	1.05	F	1.05	F	1.05	F	1.05	F
16	US-20/OR-34	Technology Loop	0.80 ⁽¹⁾	0.99	E	1.06	F	1.06	F	0.71	C	0.71	C	0.71	C
17*	US-20/OR-34	53rd Street	0.80 ⁽¹⁾	0.94	E	1.19	F	1.07	F	0.73	C	0.73	C	0.73	C
18	US-20	OR-34	0.80 ⁽¹⁾	0.33	A	0.42	A	0.42	A	0.42	A	0.42	A	0.42	A

1) Mobility Standards based on ODOT, OHP, and City of Corvallis Standards (1) ODOT OHP Mobility Standard, (2) ODOT OHP Mobility Standard – STA, and (3) City of Corvallis.

2) Intersections with an asterisk (*) were not included as part of 2005 MTP existing conditions analysis.

3) Highlighted cells represent the location where mobility standard was not satisfied.

4) When V/C ratio values are same between future (2030) scenarios, same improvements were assumed.

APPENDIX D: Google Earth V/C Analysis Results Output

To: **John deTar** From: **Steve Perone** Date: **08/19/2008**
Jongsun Won

- For attention
- Confidential
- Consultation
- To do by:

Subject: KMZ (Google Earth) V/C Analysis Results Output Files

The V/C analysis results for each scenario have been compiled into a KMZ output file. KMZ files can be used (opened) in applications, most notably Google Earth. As such, the results can be made accessible for access via the internet. The figure below illustrates viewing the data inside Google Earth.

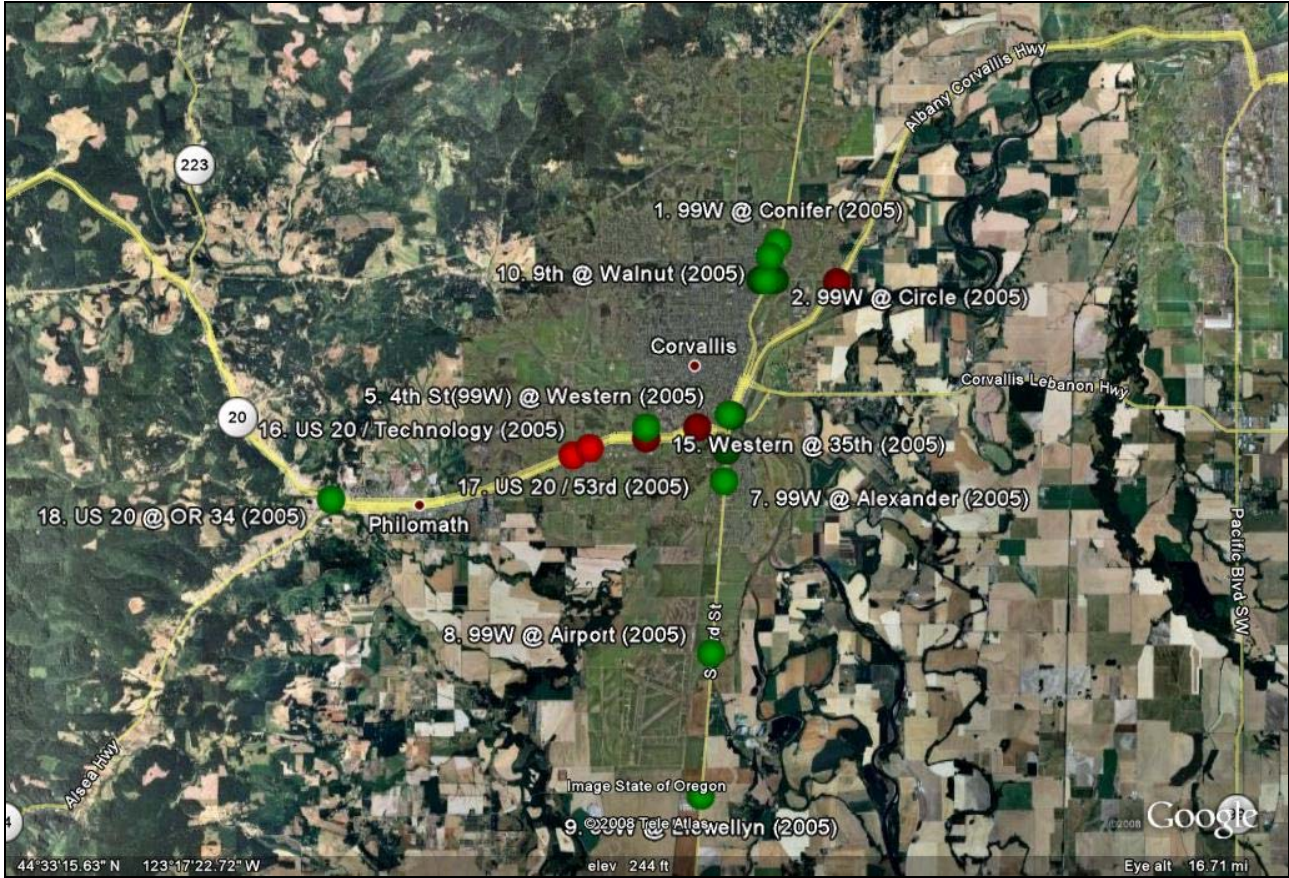


Figure 1: Intersection Locations in Google Earth

Memo

Users may select any location by scenario to see the applicable V/C analysis results. The figure below illustrates the results of selecting an intersection from with Google Earth.

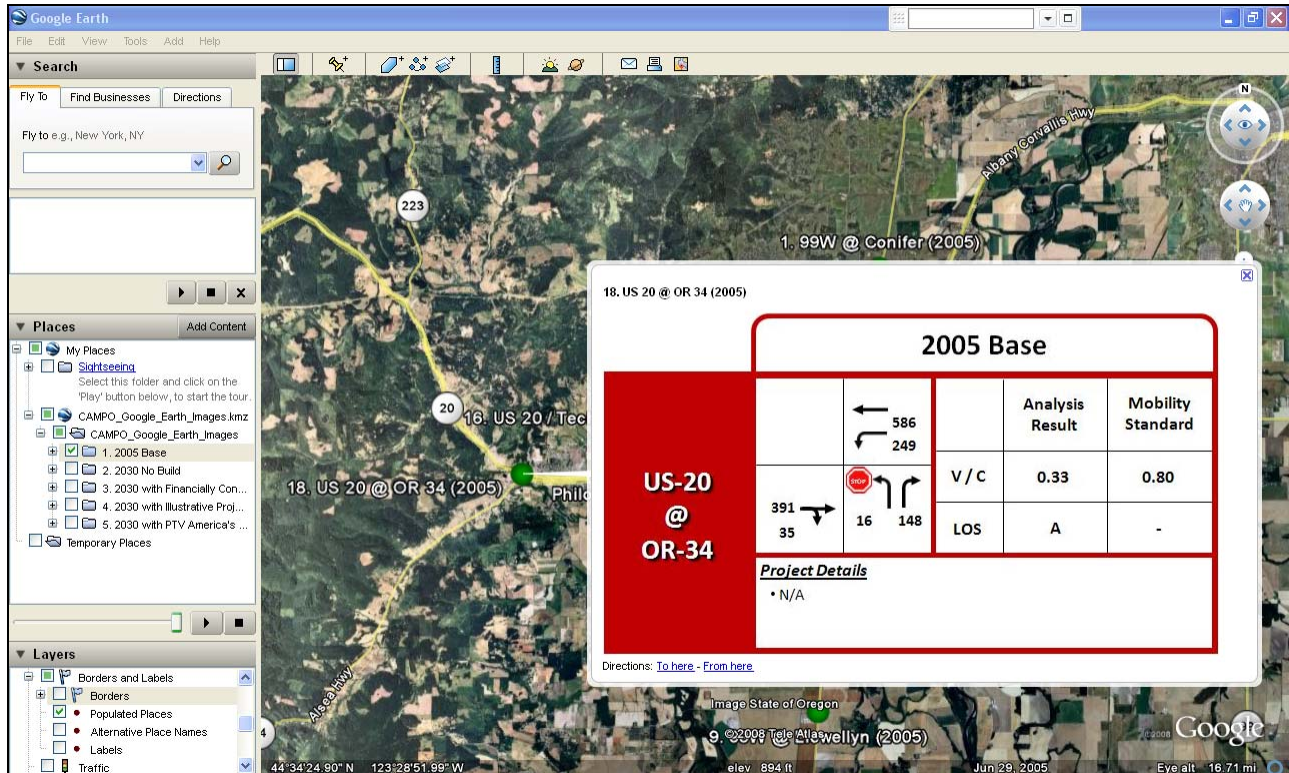


Figure 2: Display of Intersection V/C Analysis Result

Installation Instructions:

The steps below describe the actions necessary to access the KML files via Google Earth from a personal computer. The instructions assume that the user has already installed Google Earth on their computer.

- (1) Copy the folder "CAMPO_Google_Images" to the root "C:" directory. After copying the you should have a folder with image files like: "c:\CAMPO_Google_Images\"

Note: This is can be modified to provide access from and Internet location.

- (2) Copy the file CAMPO_Google_Earth_Images.kmz to any location anywhere on the computer. Afterwards, the file can be opened by double clicking on the file or using the File -> Open option from within Google Earth.

Memo

(3) The numbering scheme for image files stored in the CAMPO_Google_Images folder is as follows:

"AABB.jpg" => "AA": Intersection Number, "BB": Scenario Number

* Intersection Numbers *

01. Pacific Highway West (99W) @ Conifer Boulevard
02. Pacific Highway West (99W) @ Circle Boulevard
03. Circle Boulevard @ 4 Acres Street
04. 3rd Street (99W) @ Western Avenue
05. 4th Street (99W) @ Western Avenue
06. Pacific Highway West (99W) @ Crystal Lake Drive
07. Pacific Highway West (99W) @ Alexander Avenue
08. Pacific Highway West (99W) @ Airport Road
09. Pacific Highway West (99W) @ Llewellyn Road
10. 9th Street @ Walnut Boulevard
11. 9th Street @ Circle Boulevard
12. Albany-Corvallis Highway (US 20) @ Circle Boulevard
13. Corvallis-Newport Highway (US 20/OR 34) @ 15th Street
14. Corvallis-Newport Highway (US 20/OR 34) @ 35th Street
15. Western Avenue @ 35th Street
16. Corvallis-Newport Highway (US 20/OR 34) @ Technology Loop
17. Corvallis-Newport Highway (US 20/OR 34) @ 53rd Street
18. Corvallis-Newport Highway (US 20) @ Alsea Highway (OR 34)

Memo

* Scenario Numbers *

01. Existing (2005) Condition Scenario
02. Future (2030) Condition No-Build Scenario
03. Future (2030) Condition with Financially Constrained Projects Scenario
04. Future (2030) Condition with Illustrative Projects Scenario
05. Future (2030) Condition with PTV America's Recommendation Scenario