Intersection Control Study

Date:	Friday, October 05, 2018
Project:	ODOT | K19786 I-205: Stafford Rd to OR213 Corridor Widening and Abernethy Bridge Seismic Retrofit / Widening
To:	Tom Hamstra, ODOT – PM
From:	Steve Drahota, HDR – PM
Subject:	Intersection Control Study Conceptual Approval Request for Roundabout Oswego Highway No. 3 at I-205 Northbound Exit-Ramp (Hwy No. 3 at MP 11.29 & Hwy No. 64 at MP 1C 8.79) Clackamas County

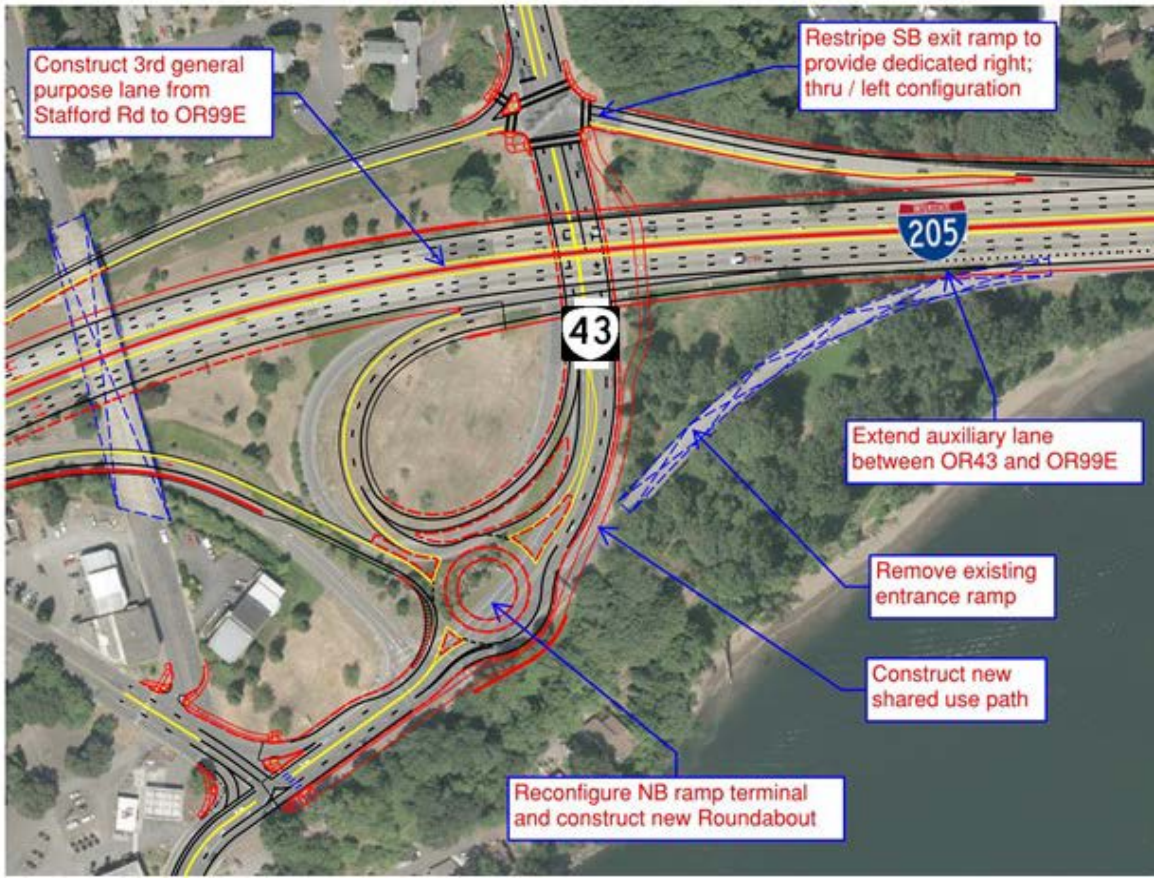
1 Introduction

1.1 Purpose and Background

The purpose of this Intersection Control Study (ICS) is to provide documentation required for the Conceptual Design Approval of a roundabout proposed at the intersection of Oswego Highway (Oregon Route (OR) 43) and Interstate (I) 205 northbound exit-ramp as part of the "I-205: Stafford Road to OR213 Project", key# 19786. An ICS is a formal comparison of intersection control alternatives, in this case, a traffic signal and a roundabout.

The project proposes to widen I-205 by adding a third travel lane in both directions between the Stafford Road and OR99E Interchanges, and adding a northbound auxiliary lane between the OR99E entrance ramp and OR213 exit-ramp. The project also includes widening and seismically retrofitting the Abernethy Bridge. At the OR43 Interchange, in order to conform to the widened Abernethy Bridge and improve the safety and operations of I-205, the existing northbound OR43 to northbound I-205 entrance ramp will be removed. This movement will be redirected to a reconstructed entrance loop, which currently only serves the southbound OR43 to northbound I-205 movement. A roundabout is proposed to be constructed at the northbound ramp terminal. Figure 1 shows the proposed improvements at the OR43 Interchange.

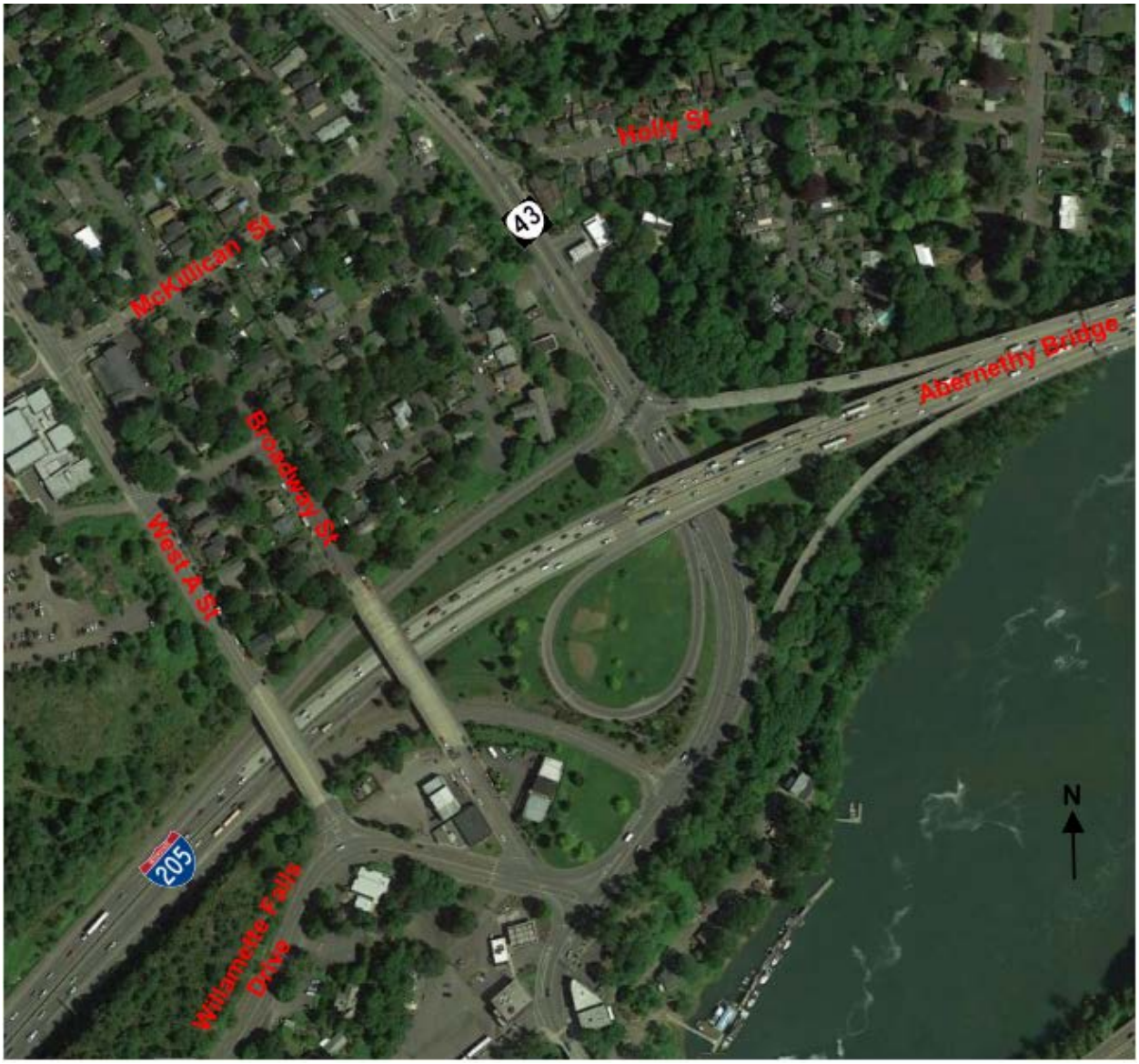
Figure 1. I-205 at OR43 Interchange – Proposed Improvements



1.2 Site Location and Study Area

The intersection of OR43 at I-205 northbound exit-ramp is located in the southern section of West Linn. It is currently signalized. The I-205 southbound ramp terminal is located approximately 850 feet to the north. Willamette Falls Drive, a City minor arterial, approaches from the west to create a T intersection with OR43 approximately 270 feet south of the proposed intersection. The Willamette Falls Drive approach is under stop control. The study area also includes the signalized intersection of OR43 and McKillican Street, which is approximately 950 feet north of the I-205 southbound ramp terminal. A map showing the study area is provided in Figure 2.

Figure 2. Study Area - OR43 between McKillican Street and Willamette Falls Drive



2 Traffic Data

2.1 AADT, Truck Percentage, and Posted Speed

I-205 serves as a major north-south regional transportation facility and the primary route to the East Portland metropolitan area. OR43 functions as the major north-south arterial through West Linn and includes turn lanes at the I-205 southbound and northbound ramp terminals as well as at Willamette Falls Drive and McKillican Street. Table 1 summarizes the roadway characteristics of I-205 and OR43 in the study area.

Table 1. Roadway Characteristics

Highway	Milepoint	Segment	Number of Lanes	2016 AADT	Truck Percent-age (%)	Posted Speed (mph)
I-205	7.00	0.60 mile east of 10th Street Interchange	4	92,600	6.3	55
I-205	9.12	On Willamette River Bridge (Abernethy Bridge), 0.30 mile northeast of Oswego Highway (OR43) Interchange	6	106,300	6.3	55
OR43	11.07	0.10 mile north of I-205	2-3	21,500	2.7	35
OR43	11.34	0.01 mile north of Willamette Falls Drive	4	14,000	2.7	35
OR43	11.43	On Willamette River Bridge (Aka Oregon City Arch Bridge)	2	15,600	2.7	25

2.2 Crash History

2.2.1 OR43 from McKillican Street to Willamette Falls Drive (MP 10.88 -11.36)

The reported crashes in the segment of OR43 between McKillican Street and Willamette Falls Drive were analyzed for the 5-year period from 2012 through 2016. The majority of crashes occurred north of the I-205 southbound ramp terminal (60 percent [46 crashes]). Crashes were concentrated at the signalized intersection of OR43 and McKillican Street (MP 10.92) and the minor street stop-controlled T intersection of OR43 at Holly Street (MP 10.99), which is approximately 350 feet south of McKillican Street.

The crash analysis results are summarized below and Table 2 represents crash trends by severity, year and time of day. A detailed listing of the crash data is provided in Appendix A.

- **Total Crashes** – 76
- **Fatal Crashes** – None
- **Serious Injury Crashes** – One serious injury crash occurred at the I-205 southbound ramp terminal intersection. A southbound through driver disregarded the signal and hit a westbound vehicle turning left from the exit-ramp.
- **Crash Type/ Cause** – The study segment of OR43 has a high percentage of turn movement crashes (43 percent [33 crashes]). The majority of the turning crashes occurred at intersections with McKillican Street (5 crashes), Holly Street (6 crashes), I-205 southbound exit-ramp (5 crashes), and Willamette Falls Drive (4 crashes). Many of them were caused by drivers who disregarded signal or failed to yield right-of-way.
- **Crash Rate** – The computed crash rate is 4.04 crashes per million vehicles miles (mvm), which is higher than the statewide average crash rate of 3.20 crashes per mvm. Potential factors attributed to the crashes include visibility of signals, congestion, and driveways at two gas stations just north of the I-205 southbound ramp terminal generating significant amount of traffic volumes.
- **Top 10 percent SPIS** – None

Table 2. Crash Data Summary

OR43 MP 10.88-11.36		Top 3 Most Frequent Collision Types		
	Total	Turning	Rear End	Sideswipe-opposite
Severity				
Number of Fatal Crash	0	0	0	0
Number of Serious Injury Crash	1	1	0	0
Number of Moderate Injury Crash	7	3	1	1
Number of Minor Injury Crash	32	10	16	2
Number of Property Damage Only Crash	36	19	11	3
Total	76	33	28	6
Type and Year				
2012	14	5	7	0
2013	11	4	3	1
2014	15	7	5	1
2015	20	9	7	3
2016	16	8	6	1
Total	76	33	28	6
Time of Day				
Early Morning (12-7)	5	2	1	0
Morning Peak (7-9)	6	4	1	1
Mid-day (9-4)	45	20	17	4
Afternoon Peak (4-6)	12	6	5	0
Evening (6-12)	8	1	4	1
Total	76	33	28	6

2.2.2 OR43 at I-205 Northbound Ramp Terminal

Since a roundabout is proposed to replace the existing signal control at the intersection of OR43 and I-205 northbound ramp terminal, an analysis of the crash history at this intersection was performed to determine current crash trends at the intersection.

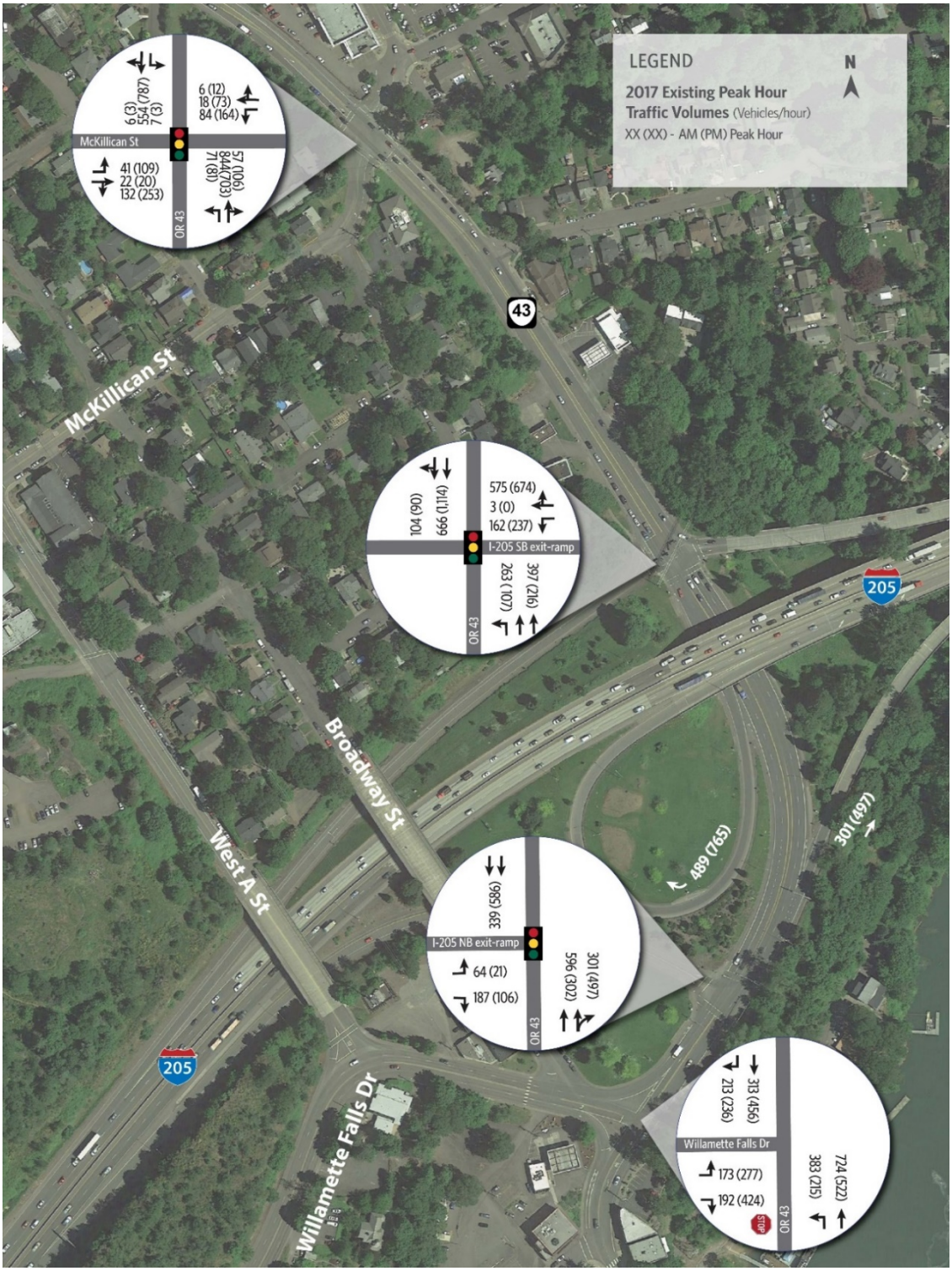
There were a total of eleven crashes at the I-205 northbound ramp terminal intersection. The most severe injury type was moderate injury, which resulted from a fixed-object collision involving an intoxicated driver who exceeded the speed limit, ran off the I-205 northbound exit-ramp, and hit a tree. Rear-end (36 percent [4 crashes]) and turning movement (36 percent [4 crashes]) crashes are the top two most frequent collision types at this intersection. Of the four turning crashes, three were caused by a southbound through vehicle on OR43 that disregarded the traffic signal and hit an I-205 northbound exit-ramp vehicle turning left. No pedestrian or bicycle crashes occurred at this intersection. A detailed listing of the crash data is provided in Appendix B.

2.3 2017 Existing Traffic Volumes

Existing weekday AM and PM turning movement counts were collected on OR43 at its intersections with McKillican Street, I-205 southbound ramps, I-205 northbound ramps, and Willamette Falls Drive by ODOT Region 1 Traffic staff in May 2017. The AM and PM peak hours

were determined to occur between 7:30 AM and 8:30 AM and between 4:30 PM and 5:30 PM, respectively. The existing year 2017 AM and PM traffic volumes and lane configurations at the intersections on OR43 are provided in Figure 3.

Figure 3. Existing Year 2017 Traffic Volumes



Traffic analysis of the 2017 existing conditions was performed using Synchro (version 9.2), which is a traffic analysis and signal optimization software that emulates the methodology from the Highway Capacity Manual with SimTraffic serving as its accompanying micro-simulation application. SimTraffic was used to simulate alternatives and provide queue length statistics.

Table 3 provides volume-to-capacity (v/c) ratio, average control delay, and resulting LOS for the four study intersections. The OR43/McKillican Street intersection operates at LOS C. The two interchange ramp terminal intersections operate with moderately low delay while the stop-controlled movement at the Willamette Falls Drive intersection is operating at LOS F and experiences delay exceeding two minutes for the side street approach. The delay for this intersection is primarily influenced by insufficient gaps in southbound OR43 traffic resulting in substantial delay for both right- and left-turning vehicles from Willamette Falls Drive during peak periods, despite having a two-stage median turn lane. Synchro/SimTraffic analysis worksheets are provided in Appendix C.

Table 3. OR43 Interchange Traffic Operations Analysis Results (2017 Existing)

Intersection	Peak Hour	Delay (sec/veh)	LOS	V/C
OR43 at McKillican St	AM	29.0	C	0.83
	PM	32.9	C	0.79
OR43 at I-205 SB Ramp Terminal	AM	17.9	B	0.87
	PM	16.9	B	0.69
OR43 at I-205 NB Ramp Terminal	AM	6.0	A	0.40
	PM	4.7	A	0.33
OR43 at Willamette Falls Drive	AM	>120	F	**
	PM	>120	F	**

**For unsignalized intersections, the delay is reported for the minor street left turn movement under stop control. Intersection v/c ratio is not reported for unsignalized intersections.

2.4 Design Year 2045 Traffic Volumes

The Metro Regional Travel Demand Models were used to forecast project future year demands. ODOT provided the Metro travel demand Visum models for existing year 2010 and future year 2040 AM and PM peak period conditions. These models encompass freeways, arterials, local streets, and intersections within the Portland region. The future year regional models integrate planned transportation projects outside of the project study area to generate reliable and realistic future volume forecasts. The future year Metro models were reviewed and adjusted with appropriate capacity and lane configurations for the no-build baseline scenario. Future build scenario models were developed by updating the no-build model with the widened I-205 freeway segment between OR99E and Stafford Road. Lane capacity and number of lanes were updated

per the proposed roadway design. Examination of the updated regional models identified that no local streets were missing in either the no-build or build scenarios.

The Difference (Incremental) Method was used to forecast future volumes as recommended by ODOT. This method is best suited to the study area because the other future demand forecasting method, the Growth Method, tends to severely overestimate growth on lower volume roadways. In the Difference Method, future year demand volumes are determined by adding the existing traffic counts and the differences between existing and future model volumes. Design year 2045 traffic volumes were developed through extrapolation using the differences between the 2010 and 2040 travel demand models. After developing the future year volumes, volumes were balanced to obtain a set of cohesive network volumes.

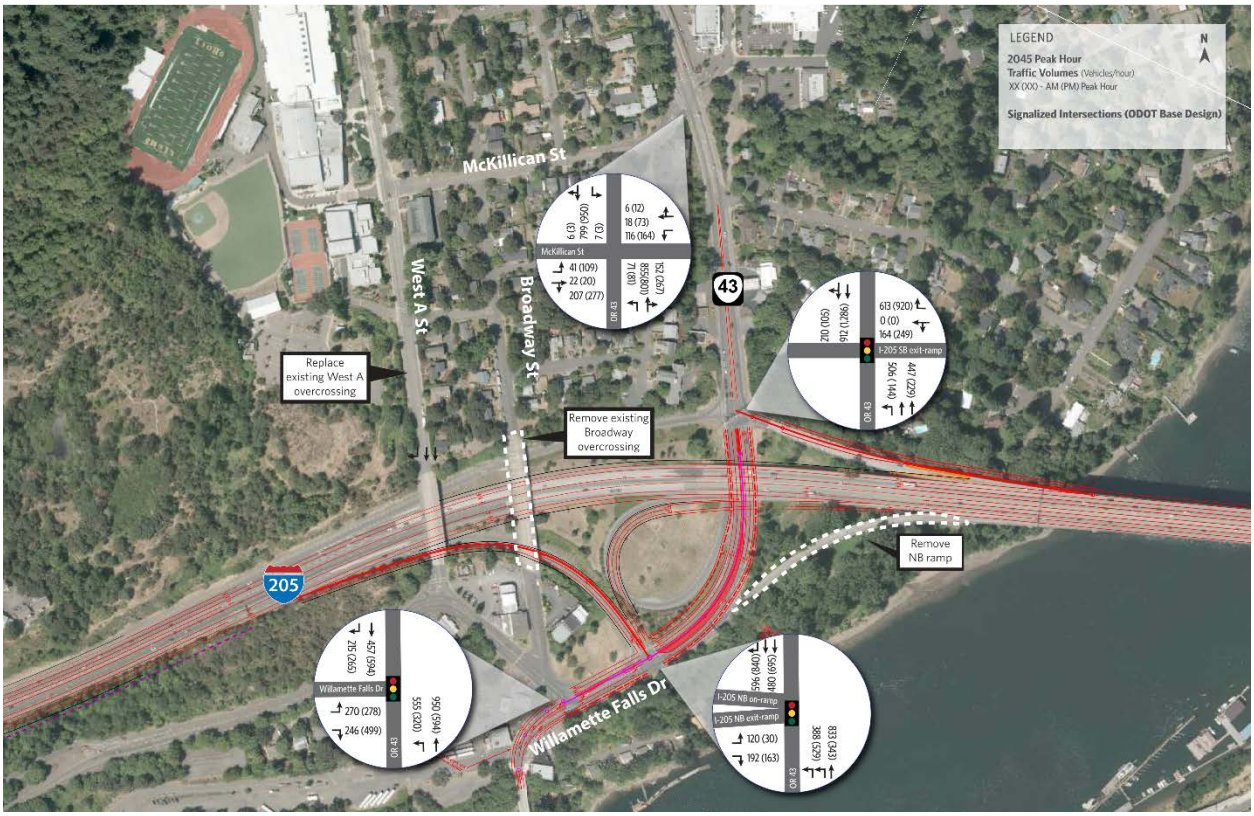
3 Development of Intersection Control Alternatives

Currently, there are two closely spaced I-205 northbound entrance ramps serving OR43, one from OR43 southbound and the other from OR43 northbound. In order to improve freeway safety and operations and accommodate the widened Abernethy Bridge, the I-205 northbound entrance ramp serving OR43 northbound will be removed, and the entrance loop ramp from OR43 southbound will be reconstructed to allow for the left turn movements from OR43 northbound. Two intersection control alternatives were evaluated to accommodate the left turn movements from OR43 northbound to I-205 northbound at the reconstructed northbound ramp terminal. These two alternatives are described below.

3.1 Signal Control

The initial intersection control alternative developed during the early conceptual design phase of the project was a traffic signal. Due to the heavy turning movements, dual left turn lanes were considered on OR43 northbound at its intersection with the I-205 northbound ramp terminal. The existing signal would be replaced to allow for the dual northbound left turn lanes on OR43. Due to the proximity of the adjacent intersections, the intersection of OR43 and Willamette Falls Drive was also assumed to be under signal control. The signal alternative also included a revised lane configuration of the I-205 southbound exit-ramp, through restriping, to accommodate the heavy right turn movement onto OR43 northbound in the existing and future traffic conditions. Figure 4 shows a conceptual design layout of this alternative along with the Design Year 2045 AM and PM peak hour volumes.

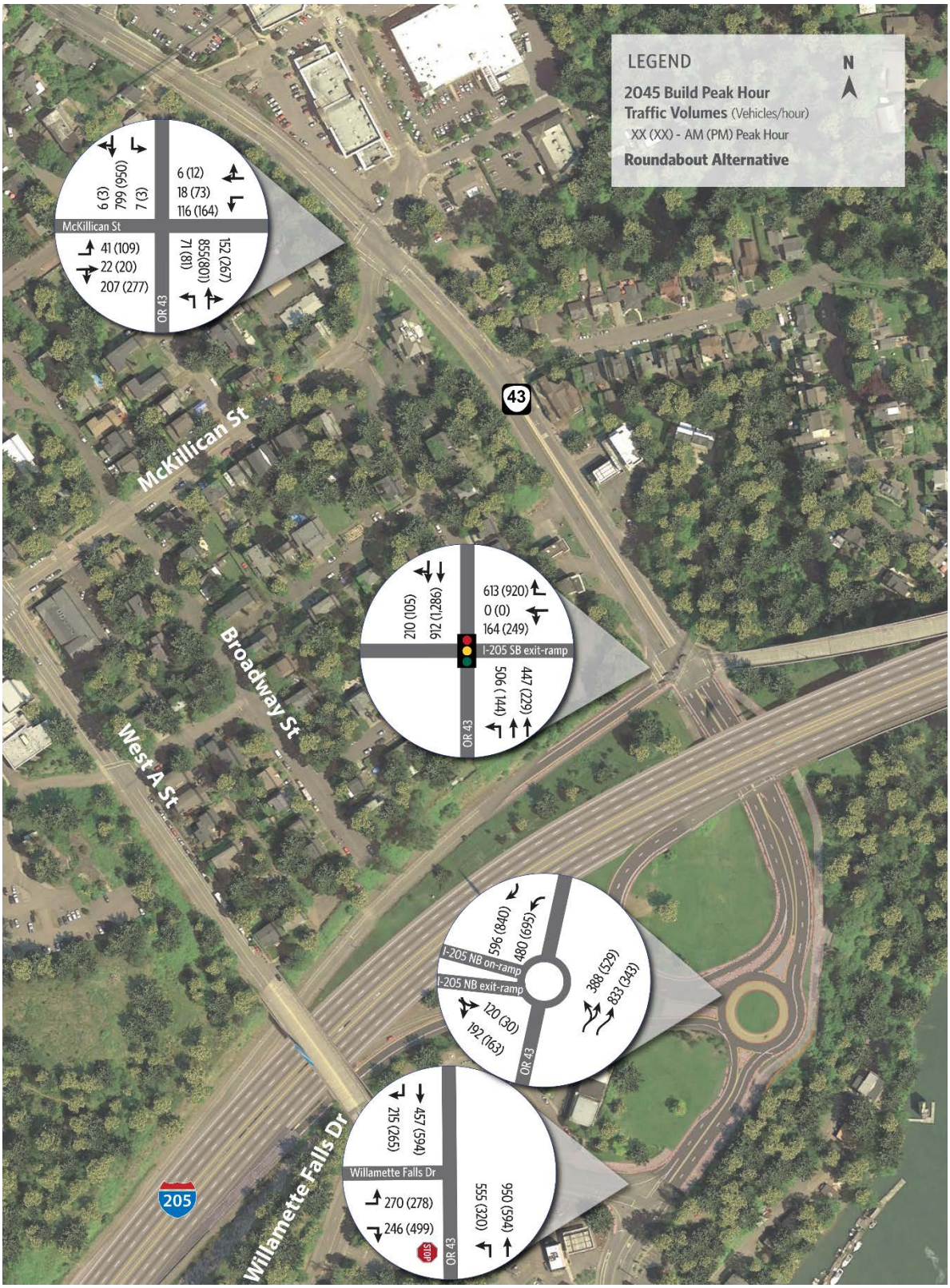
Figure 4. Signal Control Alternative - Design Year 2045 Traffic Volumes



3.2 Roundabout

As the project design was advanced, a roundabout alternative at the I-205 northbound ramp terminal was identified for consideration as a potential alternative to address safety and operational concerns related to the signalized intersection concept. The roundabout lane configurations and geometry were developed and refined through collaboration with ODOT Region and Salem Traffic-Roadway staff during the Design Verification Package (DVP) and Draft Design Acceptance Package (DAP) phases. For this alternative, no modification to the lane configuration or traffic control at the intersection of OR43 and Willamette Falls Drive was assumed. Similar to the signal alternative, the roundabout design option also included a revised lane configuration of the I-205 southbound exit-ramp, through restriping, to accommodate the heavy right turn movement onto OR43 northbound in the existing and future traffic conditions. Figure 5 shows the current conceptual design layout of the roundabout along with the Design Year 2045 AM and PM peak hour volumes.

Figure 5. Roundabout Alternative - Design Year 2045 Build Traffic Volumes



4 Intersection Control Evaluation

A traffic capacity analysis was performed to evaluate how each alternative would perform under Design Year 2045 AM and PM peak hour conditions. It should be noted that the existing ramp meter that regulates traffic entering from OR43 southbound will be removed and a new ramp meter will not be installed for the consolidated I-205 northbound entrance ramp under either alternative. This is due to the insufficient ramp meter storage on the realigned entrance ramp to accommodate the high combined traffic demand from OR43 southbound and northbound. Under current conditions the existing ramp meter has been observed to create queuing that extends beyond the entrance loop ramp and onto OR43 southbound. In either design alternative, the queuing related to a ramp metered condition would result in significant queuing into the new intersection, causing safety and operational issues on OR43. In addition to constructing the new third general purpose lane, the project will be extending the northbound auxiliary lane to the combined entrance loop, which will eliminate the existing short merge condition between I-205 and the entrance loop. For these reasons, a ramp meter will not be constructed with this project.

4.1 Capacity Analysis

4.1.1 Signal Control Alternative

Traffic analysis was performed using Synchro (version 9.2) with SimTraffic serving as its accompanying micro-simulation application used to provide queue length statistics. Table 4 provides the average control delay, resulting Level of Service (LOS), and volume-to-capacity (v/c) ratios for the four study intersections under the Design Year 2045 conditions. At the OR43 and I-205 northbound ramp terminal, the v/c ratio of 0.79 in the 2045 PM peak hour would exceed the Highway Design Manual (HDM) mobility standard (v/c ratio) of 0.75, which would require a design exception. Although the intersection will operate at an acceptable level of service from a traffic capacity perspective, the vehicle queue in the northbound inside left turn lane would well exceed the available storage as shown in Table 5. This implies that the queue of left-turning vehicles would extend through the upstream signalized intersection and impact the operations of OR43 and Willamette Falls Drive. Additionally, the short length of the second receiving lane on the I-205 entrance loop ramp would result in a low lane utilization rate for the dual turn lane, further affecting the capacity of the signal option.

Due to its proximity to the I-205 northbound ramp terminal, the OR43/Willamette Falls Drive intersection would have to operate on closely coordinated signal timing. This intersection also experiences heavy northbound left turn demands from OR43, which would result in significant queue lengths, particularly in the AM peak hour. During these peak operating conditions, the combined queue effect of northbound through and northbound left turns would result in a condition that creates extensive queuing beyond the intersections and continue over the Oregon City Arch Bridge and into downtown Oregon City. The long northbound queue would create conflicts with the driveways along OR43 between Willamette Falls Drive and the west end of the Oregon City Arch Bridge. One of the project goals was to maintain or improve existing operations on impacted connections while accommodating the third lane on I-205. Based on these traffic analysis findings, the signalized intersection alternative fails to meet one of the key project objectives of not degrading existing operations of an impacted facility.

Table 4. OR43 Interchange Traffic Operations Analysis Results (2045 Signal Alternative)

Intersection	Peak Hour	Delay (sec/veh)	LOS	V/C
OR43 at McKillican St	AM	34.1	C	0.86
	PM	65.0	E	0.99
OR43 at I-205 SB Ramp Terminal	AM	31.0	C	0.86
	PM	18.1	B	0.78
OR43 at I-205 NB Ramp Terminal	AM	16.7	B	0.66
	PM	21.7	C	0.79
OR43 at Willamette Falls Drive	AM	27.6	C	0.79
	PM	20.4	C	0.71

Table 5. Design Year 2045 Intersection Operations – Signal Control

OR43 at I-205 NB Ramp Terminal	Delay (sec/veh)	LOS	V/C	95th Percentile Queue (ft)		Available Storage (ft)	
				NB inside Left Turn Lane	NB Outside Left Turn Lane	NB inside Left Turn Lane	NB Outside Left Turn Lane
2045 AM Peak Hour	16.7	B	0.66	*422*	*352*	*75	*220
2045 PM Peak Hour	21.7	C	0.79	*252*	*287*	*75	*220
OR43 at Willamette Falls Drive	**Delay (sec/veh)**	**LOS**	**V/C**	**95th Percentile Queue (ft)**		**Available Storage (ft)**	
				NB Left Turn Lane	**NB Thru Lane**	**NB Left Turn Lane**	**NB Thru Lane**
2045 AM Peak Hour	27.6	C	0.79	*380*	*779*	*200*	---
2045 PM Peak Hour	20.4	C	0.71	*314*	*550*	*200*	---

*Physical storage limit before the lane spilled into the adjacent signal at Willamette Falls Drive; total queue extend much further.
Red = Queue length longer than available storage length

4.1.2 Roundabout Alternative

Sidra (version 7), which is primarily used to analyze roundabouts, was used to evaluate the OR43/I-205 northbound ramp terminal intersection under the Design Year 2045 Roundabout alternative. The Sidra results are based on Highway Capacity Manual 6th Edition output, which incorporates the latest NCHRP research and methodology for analyzing roundabouts in the U.S.

As part of the concept development for a Roundabout alternative, a single lane entrance ramp with no southbound right turn bypass lane concept was evaluated first. As shown in Table 6, this concept would result in an intersection v/c ratio of 0.95 in the 2045 PM peak hour due to the heavy southbound right turn to I-205 northbound movement. This v/c ratio well exceeds the HDM

mobility standard of 0.75 for Build alternatives. A single northbound lane approaching the roundabout with a southbound right turn bypass lane concept was evaluated next. This concept would also result in a high intersection v/c ratio (0.99) in the 2045 AM peak hour due to the heavy northbound through movement, indicating the intersection would operate at capacity. The Sidra lane configuration layout and traffic capacity analysis results for these two concepts are provided in the Appendix D.

Based on evaluation of the two initial concepts, it was concluded that a southbound right turn bypass lane and a 2-lane northbound approach would be needed in order to achieve an acceptable v/c ratio. Consequently, the conceptual design layout shown in Figure 5 emerged and was selected as the preferred roundabout alternative. Table 6 provides the average control delay, resulting Level of Service (LOS), and volume-to-capacity (v/c) ratios for the intersection of OR43 and I-205 northbound ramp terminal under the Design Year 2045 conditions. As shown, the roundabout would operate at LOS A with very low vehicle delay due to the yield control entry. It also has a low v/c ratio in 2045 AM peak hour while the v/c ratio in the 2045 PM peak hour is slightly higher than the Highway Design Manual mobility standard of 0.75. As shown in Table 7, the 95th percentile vehicle queues in all the approach lanes are relatively short, ranging from two to nine vehicles (5 feet to 225 feet), indicating the roundabout operations would not impact the corridor immediately upstream from the roundabout intersection.

Table 6. Design Year 2045 Intersection Operations – Roundabout Alternative Lane Configurations

Alternative	OR43 at I-205 NB Ramp Terminal	Delay (sec/veh)	LOS	V/C
Single lane entrance ramp with no southbound right turn bypass lane and with 2 northbound approach lanes	2045 PM Peak Hour	12.6	B	0.95
2 lane entrance ramp with a southbound right turn bypass lane and a single northbound approach lane	2045 AM Peak Hour	12.4	B	0.99
Build Alternative – 2 lane entrance ramp with a southbound bypass lane and with 2 northbound approach lanes	2045 AM Peak Hour	5.4	A	0.49
Build Alternative – 2 lane entrance ramp with a southbound bypass lane and with 2 northbound approach lanes	2045 PM Peak Hour	6.7	A	0.78

Red = v/c ratio for roundabout intersection exceeds Highway Design Manual Mobility Standard of 0.75 for Build Alternative.

Table 7. Design Year 2045 Build 95th Percentile Queues at the OR43/I-205 NB Ramp Terminal – Roundabout Alternative

	95th percentile Queue Length (# of vehicles – feet)				
OR43 at I-205 NB Ramp Terminal	OR43 SB Right Turn Bypass Lane	OR43 SB Through Lane	Shared right/left Turn Lane on I-205 NB exit-ramp	OR43 NB inside Through Lane	OR43 NB outside Through Lane
2045 AM Peak Hour	0 vehicle	3 veh. – 75’	2 veh. – 50’	3 veh. – 75’	0 vehicle
2045 PM Peak Hour	0 vehicle	9 veh. – 225’	2 veh. – 50’	3 veh. – 75’	0 vehicle

Synchro/SimTraffic was used to evaluate the operations of the other intersections in the corridor. The analysis results are shown in Table 8 below.

Table 8. OR43 Interchange Traffic Operations Analysis Results (2045) - Roundabout Alternative

Intersection	Peak Hour	Delay (sec/veh)	LOS	V/C
OR43 at McKillican St	AM	74.9	E	0.94
	PM	49.8	D	0.98
OR43 at I-205 SB Ramp Terminal	AM	38.9	D	0.85
	PM	18.6	B	0.77
OR43 at I-205 NB Ramp Terminal	AM	*5.4	*A	*0.49
	PM	*6.7	*A	*0.78
**OR43 at Willamette Falls Drive	AM	>120	F	---
	PM	>120	F	---

*Traffic operational results from Sidra Analysis
**For unsignalized intersections, the delay is reported for the minor street left turn movement under stop control. Intersection v/c ratio is not reported for unsignalized intersections.

In addition to the Synchro/SimTraffic and Sidra analysis for the study area, Vissim was used to evaluate the operations of vehicles exiting the roundabout in the corridor to ensure they would not be interrupted by queues from downstream intersections. Vissim is a widely-used, behavior-based, multi-purpose traffic micro-simulation program that tracks individual vehicle movements and interactions more realistically than typical Highway Capacity Manual methods. An existing condition Vissim model was developed for the study area, following the guidance in the 2011 ODOT Vissim Protocol. The existing conditions model was qualitatively calibrated based on field observations and served as the basis for developing the Design Year 2045 Build Condition model, which has been reviewed and ratified by ODOT Region 1 Traffic staff for use.

The OR43 southbound right turn movement and the OR43 northbound left turn movement to the reconstructed I-205 northbound entrance loop ramp will operate under free flow condition after exiting the roundabout as the entrance ramp will not have a ramp meter that would otherwise require vehicles to stop, interrupting the roundabout operations. The OR43 northbound through vehicles exiting the roundabout would not be interrupted by the downstream signal at the I-205 southbound ramp terminal as the vehicle queue in the northbound approach lanes to the intersection is determined to be 228 feet and 166 feet in the 2045 AM and PM peak hours, respectively. The available storage for the two northbound through lanes is approximately 610 feet for each of the two northbound through lanes at I-205 southbound ramp terminal. A summary of the Vissim analysis results is provided in the Appendix E.

In regards to the OR43 southbound vehicles exiting the roundabout, the Project Team has identified an existing operational deficiency associated with the downstream signalized intersection at the south end of the Oregon City Arch Bridge, which is approximately 1/4 mile south of the OR43/I-205 northbound ramp terminal and 1,200 feet south of the OR43/Willamette Falls Drive intersection. This condition results in recurring backup of southbound traffic that extends across the Oregon City Arch Bridge and occasionally through the OR43/Willamette Falls Drive and I-205 northbound ramp terminal intersection. Based on site observations, this condition is experienced in the PM peak hour. While operational improvements at the Arch Bridge signal are outside the scope of the Project, a preliminary evaluation of the corridor operations was performed to assess the potential impact of recurring queuing into the roundabout. This analysis was conducted using Vissim by creating a “simulated” southbound queue that extended through the roundabout intersection. Because of the low volume of the I-205 northbound exit-ramp and the fact that the competing left turn movements from OR43 northbound take priority over the OR43 southbound entering traffic, the analysis does not show any significant impact by the Oregon City Arch Bridge signal to the roundabout operations.

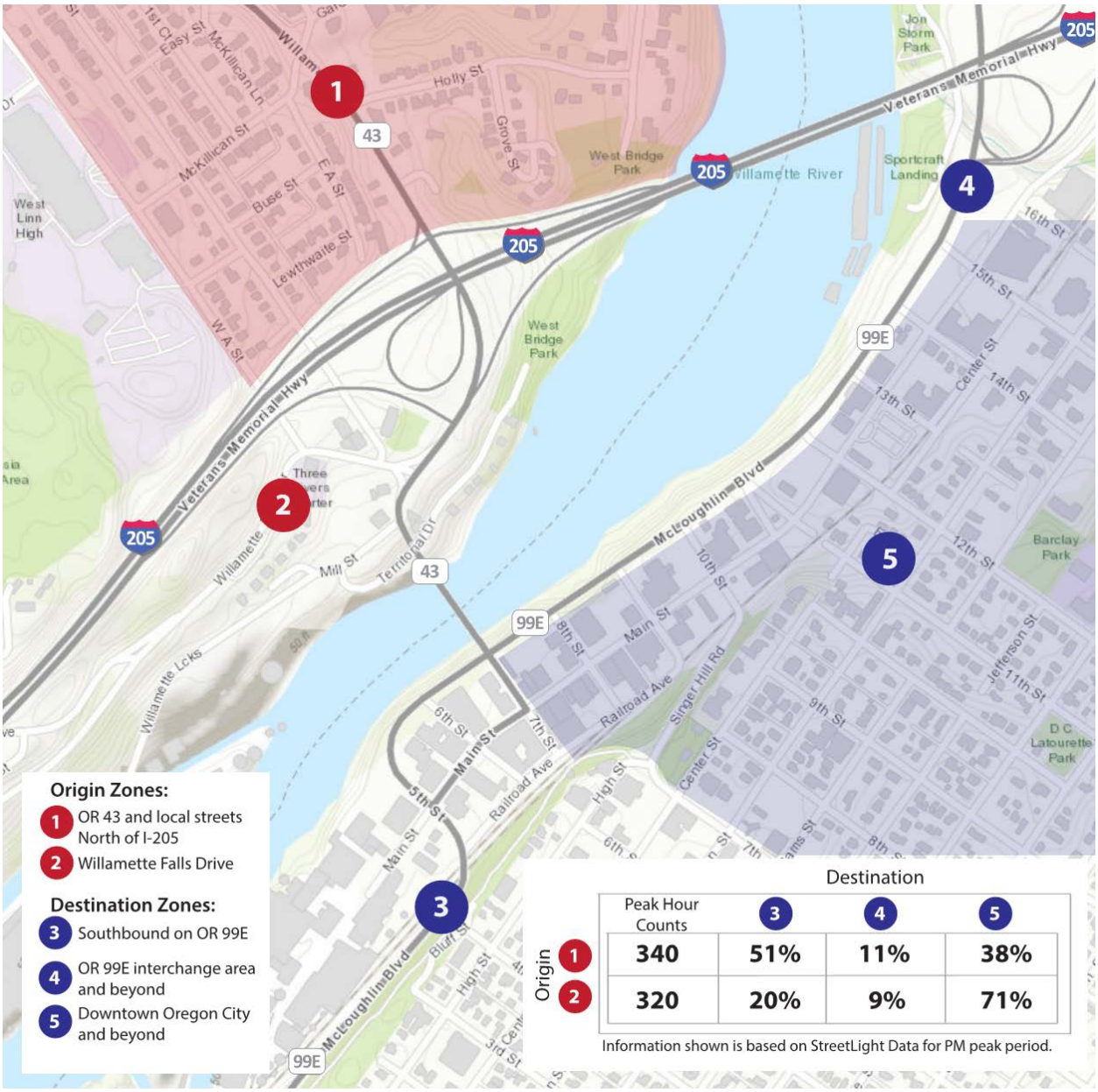
One of the main reasons as to why the Oregon City Arch Bridge signal causes a long queue in the southbound direction on OR43 is due to the high right-turning traffic volume (424 vehicles) from Willamette Falls Drive destined to Oregon City in the PM peak hour. To further understand the make-up of the Willamette Falls Drive and Oregon City Arch Bridge traffic, origin-destination (OD) data was obtained from StreetLight Data to determine the origin of these trips. StreetLight OD data revealed that during the PM peak hour, approximately 200 (28.5 percent) of the 701 (277 vph left turn and 424 vph right turn movements) total eastbound approach vehicles accessing the Willamette Falls Drive intersection with OR43 originated from: (i) I-5 north and south, and (ii) Stafford Road north and south of I-205. What this indicates is that (i) some of the I-205 northbound traffic coming from I-5 would rather exit off at the Stafford Road Interchange to access OR43 via Willamette Falls Drive than continue traveling on I-205 mainline and exit off at the OR43 Interchange, and (ii) traffic originated from Stafford Road north and south of I-205 would rather travel on Willamette Falls Drive to access OR43 than enter northbound I-205 at the Stafford Road Interchange and exit off at the OR43 Interchange. This traffic diversion phenomenon, illustrated in Figure 6, is indicative of traffic trying to avoid the severe congestion on I-205 northbound in the 2-lane section between the Stafford Road and OR43 Interchanges in the PM peak period and using Willamette Falls Drive as a by-pass route. Additionally, the StreetLight OD data presented in Figure 7 showed that 71 percent of the Willamette Falls Drive traffic was destined to areas of

Oregon City between OR43 and OR99E and 10% of the total PM peak period traffic using the Arch Bridge was continuing on to destinations north of the OR99E Interchange area. These conditions were also validated by multiple field observations during congested periods and input received during public outreach events.

Figure 6. Traffic by-passing I-205 NB

Source: StreetLight Data - StreetLight collects massive volume of geospatial information created by mobile phones, GPS devices, connected cars and commercial trucks, fitness trackers, and more.

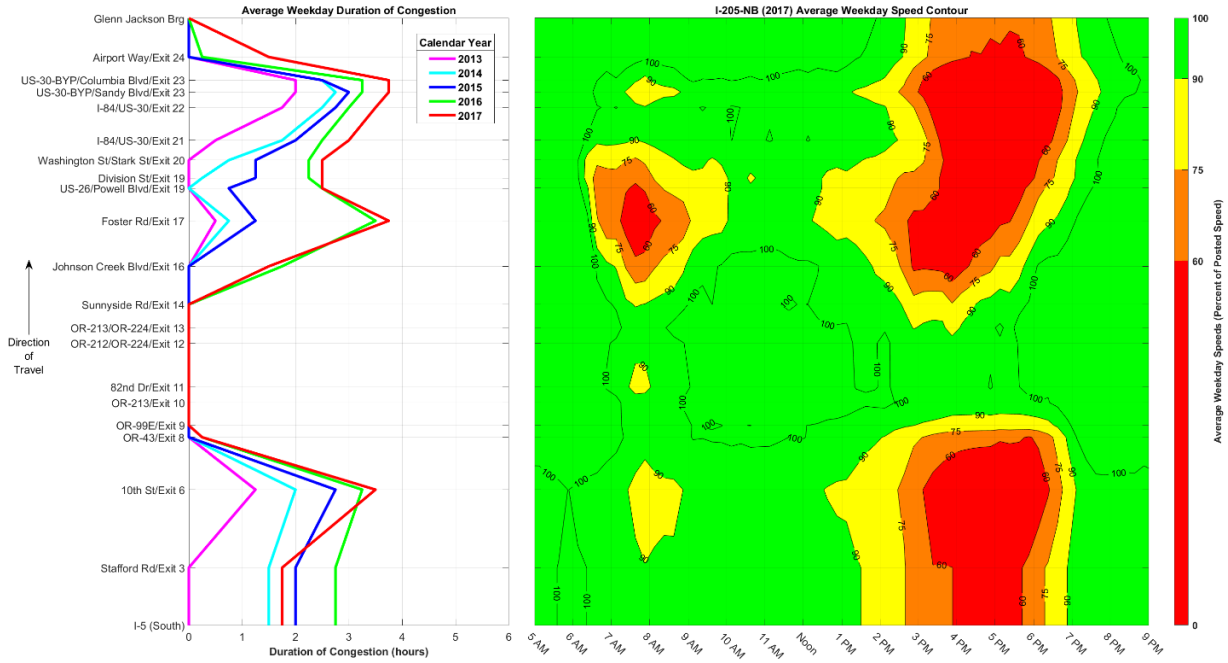
Figure 7. StreetLight Data for Willamette Falls Drive and OR43



Source: StreetLight Data - StreetLight collects massive volume of geospatial information created by mobile phones, GPS devices, connected cars and commercial trucks, fitness trackers, and more.

To illustrate the congestion on I-205 northbound between the Stafford Road and OR99E Interchanges, traffic speed data for I-205 was obtained from HERE data. The speed data was then aggregated and averaged for weekdays (excluding holidays) in the entire year of 2017. Figure 8 shows the 2017 average weekday speed data for I-205 northbound. As illustrated in the speed contour map, the northbound section between the Stafford Road and OR99E Interchanges experiences 3 hours of congestion in the afternoon between 3:30 PM and 6:30 PM.

Figure 8. I-205 Northbound 2017 Average Weekday Speed Contour



Source: HERE Data - HERE collects billions of GPS data points every day and leverages over 100 different incident sources to provide a robust foundation for traffic services. Information is collected from a variety of devices across the globe including vehicle sensor data, smartphones, PNDs (Provider Network Data System), road sensors, and connected cars.

With the I-205 corridor widening between Stafford Road and OR213, the majority of traffic currently using Willamette Falls Drive to avoid congestion on I-205 is expected to stay on I-205 and exit off the freeway at the OR99E Interchange to access Oregon City instead of exiting off at the Stafford Interchange to head to Willamette Falls Drive. As a result, there would be reduced traffic demand on OR43 southbound across the Oregon City Arch Bridge, alleviating the existing recurring backup of southbound traffic on OR43.

4.2 Safety Performance Comparison

The proposed roundabout control would have fewer conflict points and reduce crash severity due to slower vehicle speeds and differing potential collision types as compared to the signal control. The Federal Highway Administration Crash Modification Factor (CMF) clearinghouse and Highway Safety Manual provide a CMF 0.520 for converting a signal controlled intersection to a single lane or multi-lane roundabout (Clearinghouse CMF ID 225[1]). It can be estimated that, in the future, the intersection of OR43 and I-205 northbound ramp terminal operating under roundabout control would have 48 percent fewer crashes per year. The 48 percent reduction in crashes would apply to 10 out of the 11 crashes cited in Section 2.2.2 that occurred in the five-year 2012-2016 period.

[1] http://www.cmfclearinghouse.org/cmfpdf.cfm?facid=225

5 Preferred Intersection Control Alternative

The roundabout alternative would improve intersection safety in terms of both crash frequency and severity and reduce overall queuing on OR43. It would not create driveway conflicts with queued vehicles on OR43 and degrade existing operations of an impacted facility as the Signal Control Alternative would. The roundabout is consistent with the City of West Linn's long term vision for OR43 as its Transportation System Plan calls for an additional roundabout at the OR43/Willamette Falls Drive intersection. The current design for the roundabout at the I-205 northbound ramp terminal does not preclude any future improvements associated with the City of West Linn Transportation System Plan or the West Linn Water Front Development Plan that is currently in development.

A scale drawing showing the conceptual design of the proposed roundabout with horizontal and vertical geometry and layout elements is provided in Appendix F.

6 Accommodation for other modes of Transportation

6.1 Freight Mobility

The Project Team has had a number of conversations and discussions with the Freight Mobility Advisory Committee early on in the project development phase. The roundabout concept has been vetted through the Committee and has received acceptance to move forward. The current layout is designed for a WB-67 Interstate truck circulating through the roundabout from all approaches. The Oregon City Arch Bridge has weight and size restrictions and Willamette Falls Drive is not a designated truck route. The Motor Carrier Freight Mobility Map identifies OR43 as a Black and Yellow route, indicating that the route is highly restricted to truck and oversize traffic.

6.2 Bicyclist and Pedestrian

There will be significant bike and pedestrian improvements along OR43 within the project limits. ADA ramps will be upgraded at the OR43/I-205 southbound ramp terminal and the OR43/Willamette Falls Drive intersection. A shared-use path will be constructed along the east side of OR43 from the I-205 southbound ramp terminal to Willamette Falls Drive. Way finding signs will be installed to help guide bicyclists and pedestrians to navigate through the corridor. A rectangular rapid flashing beacon is proposed on OR43 at Willamette Falls Drive to enhance pedestrian crossing safety. Bicycles will also be permitted to use the highway shoulders along OR43 and may access through the roundabout.

Due to the dual-lane approaches, crosswalks will not be provided within proposed roundabout. One of the design considerations of the roundabout alternative, however, is that pedestrians at each leg would face the prospect of crossing multiple lanes of traffic to travel across the roundabout. The heavy vehicular movements, particularly from southbound OR43 in addition to the multilane approach and exit conditions involving northbound OR43, would result in conflicts with pedestrian movements. Studies have shown that conflicts between multilane roundabout approaches and crosswalks create a hazard for sight impaired pedestrians as they cannot

effectively determine gaps in traffic. Legally closing the unmarked crosswalks at the roundabout and providing pedestrians a new route will significantly improve safety in the area. Pedestrians within the interchange area will instead use the proposed shared-use path to access safer striped crosswalks at either a signalized intersection or proposed enhanced crossing with a new rectangular rapid flashing beacon. These alternate crossings are within close proximity to the proposed crossing closure and will result in little, if any, out-of-direction travel incurred by closing the crossings. A separate approval request for the crosswalk closure at the proposed roundabout will be submitted to the State Traffic Engineer through the Region Traffic Engineer.

7 Conclusion

The roundabout alternative effectively accommodates the safety, capacity and multimodal needs of the proposed intersection. Compared to the signal control alternative, a roundabout satisfied the following key criteria:

- Provide sufficient capacity and better operational performance for the forecasted movements onto the freeway in both AM and PM peak hours
- Minimize project footprint
- Will not worsen operational conditions to adjacent local streets as compared to the existing conditions
- Providing better safety performance (reductions in crash severity, injuries and in all crashes) due to slower vehicle speeds and fewer conflict points.

Other benefits include reduced pollution, lower traffic noise and fuel use through fewer stops and hard accelerations as well as significant life-cycle cost savings due to no signal equipment installation, power or maintenance costs.

Appendix A Crash Data (2012-2016) for OR43 between McKillican Street and Willamette Falls Drive

OREGON DEPARTMENT OF TRANSPORTATION - TRANSPORTATION DEVELOPMENT DIVISION
TRANSPORTATION DATA SECTION - CRASH ANAYLYSIS AND REPORTING UNIT
SYSTEM CRASH VEHICLE DIRECTION LIST

Highway 003 MAINLINE, MP 10.88 to 11.36 01/01/2012 to 12/31/2016, Both Add and Non-Add mileage

1 - 76 of 76 Crash records shown.

HWY #	RDWY #	COM P	CONN #	MLG TYP	MILE POINT	CRASH DATE	TIME	LIGHT	SURF	RD CH	OFF RD	COLL TYPE	PEOPLE INJURY K	A	B	C	VEHICLE 1 TYPE	FR	TO	VEHICLE 2 TYPE	FR	TO	VEHICLE 3 TYPE	FR	TO	ADD VEH
003	1	MN		0	10.88	07/10/2012	12P	DAY	DRY	3	N	REAR	0	0	0	0	01	NW	SE	01	NW	SE				
003	1	MN		0	10.90	08/29/2015	4P	DAY	WET	3	N	REAR	0	0	0	6	01	SE	NW	01	SE	NW				
003	1	MN		0	10.91	08/07/2014	2P	DAY	DRY	3	N	REAR	0	0	0	1	01	NW	SE	01	NW	SE				
003	1	MN		0	10.92	06/12/2013	3P	DAY	DRY	1	N	ANGL	0	0	0	0	01	SW	NE	01	NW	SE				
003	1	MN		0	10.92	09/13/2013	5P	DAY	DRY	1	N	TURN	0	0	0	0	01	NE	SE	01	NW	NE				
003	1	MN		0	10.92	12/09/2013	2P	DAY	WET	1	N	REAR	0	0	0	0	01	SE	NW	01	SE	NW				
003	1	MN		0	10.92	03/20/2015	12P	DAY	DRY	1	N	REAR	0	0	0	1	01	SE	NW	01	SE	NW				
003	1	MN		0	10.92	03/21/2015	2P	DAY	DRY	1	N	REAR	0	0	0	1	01	SE	NW	01	SE	NW				
003	1	MN		0	10.92	04/04/2015	3P	DAY	DRY	1	N	TURN	0	0	1	0	01	SE	SW							
003	1	MN		0	10.92	02/07/2016	2P	DAY	DRY	1	N	TURN	0	0	0	0	01	NE	SE	01	NW	NE				
003	1	MN		0	10.92	02/16/2016	4A	DLIT	WET	1	N	ANGL	0	0	0	1	01	SW	NE	01	NW	SE				
003	1	MN		0	10.92	08/14/2016	1P	DAY	DRY	1	N	TURN	0	0	0	1	01	NW	SE	01	SE	SW				
003	1	MN		0	10.92	09/23/2016	3P	DAY	DRY	1	N	REAR	0	0	0	0	01	SE	NW	01	SE	NW				
003	1	MN		0	10.92	09/25/2016	12P	DAY	DRY	1	N	TURN	0	0	0	1	01	SE	NW	01	NW	NE				
003	1	MN		0	10.94	04/04/2012	12P	DAY	WET	3	N	SS-M	0	0	0	2	01	SE	NW	01	NW	SE	01	NW	SE	
003	1	MN		0	10.94	08/27/2015	8A	DAY	DRY	3	N	SS-O	0	0	0	0	01	S	N	01	S	N				
003	1	MN		0	10.96	06/05/2012	3P	DAY	WET	3	N	REAR	0	0	0	4	01	S	N	01	S	N	01	S	N	
003	1	MN		0	10.96	09/14/2015	2P	DAY	DRY	3	N	SS-O	0	0	0	0	05	SE	NW	01	SE	NW				
003	1	MN		0	10.97	09/16/2012	3P	DAY	DRY	3	N	REAR	0	0	0	0	01	NW	SE	01	NW	SE				
003	1	MN		0	10.99	01/20/2012	4P	DUSK	WET	1	N	TURN	0	0	0	0	01	SE	NW	01	NE	SE				

OREGON DEPARTMENT OF TRANSPORTATION - TRANSPORTATION DEVELOPMENT DIVISION
TRANSPORTATION DATA SECTION - CRASH ANAYLYSIS AND REPORTING UNIT
SYSTEM CRASH VEHICLE DIRECTION LIST

Highway 003 MAINLINE, MP 10.88 to 11.36 01/01/2012 to 12/31/2016, Both Add and Non-Add mileage

1 - 76 of 76 Crash records shown.

HWY #	RDWY #	COM P	CONN #	MLG TYP	MILE POINT	CRASH DATE	TIME	LIGHT	SURF	RD CH	OFF RD	COLL TYPE	PEOPLE INJURY K	A	B	C	VEHICLE 1 TYPE	FR	TO	VEHICLE 2 TYPE	FR	TO	VEHICLE 3 TYPE	FR	TO	ADD VEH
003	1	MN		0	10.99	01/09/2014	3P	DAY	WET	1	N	TURN	0	0	0	1	01	E	SE	01	SE	NW				
003	1	MN		0	10.99	10/21/2014	7A	DLIT	DRY	1	N	TURN	0	0	0	0	01	NE	SE	01	NW	SE				
003	1	MN		0	10.99	12/04/2014	3P	DAY	WET	1	N	TURN	0	0	0	0	01	SE	NW	01	NE	SE				
003	1	MN		0	10.99	07/06/2015	4P	DAY	DRY	1	N	TURN	0	0	0	0	01	NE	NW	01	SE	NW				
003	1	MN		0	10.99	09/21/2016	6P	DAY	DRY	1	N	REAR	0	0	0	0	01	NW	SE	01	NW	SE				
003	1	MN		0	10.99	10/03/2016	10A	DAY	DRY	1	N	TURN	0	0	0	0	01	NE	SE	01	NW	SE				
003	1	MN		0	11.01	11/15/2012	3P	DAY	DRY	3	N	REAR	0	0	0	1	01	N	S	01	N	S				
003	1	MN		0	11.03	09/02/2015	2P	DAY	DRY	3	N	REAR	0	0	0	1	01	SE	NW	01	SE	NW				
003	1	MN		0	11.03	08/03/2016	12P	DAY	DRY	2	N	TURN	0	0	0	0	01	SW	NW	01	NW	NE				
003	1	MN		0	11.04	03/31/2012	12P	DAY	DRY	3	N	REAR	0	0	0	1	01	N	S	01	N	S	01	N	S	
003	1	MN		0	11.04	03/11/2013	4P	DAY	DRY	2	N	TURN	0	0	0	0	01	NW	SE	01	SW	NW				
003	1	MN		0	11.04	01/10/2015	1P	DAY	WET	2	N	TURN	0	0	0	0	01	NW	SE	01	SW	NW				
003	1	MN		0	11.05	02/21/2012	4P	DAY	WET	2	N	TURN	0	0	0	0	01	NE	SE	01	NW	SE				
003	1	MN		0	11.05	10/03/2013	11A	DAY	DRY	3	N	REAR	0	0	0	0	01	SE	NW	01	SE	NW				
003	1	MN		0	11.05	01/06/2016	1P	DAY	DRY	2	N	TURN	0	0	1	1	01	SE	NW	01	NE	SE				
003	1	MN		0	11.05	03/24/2016	8A	DAWN	DRY	3	N	REAR	0	0	0	0	01	NW	SE	01	NW	SE				
003	1	MN		0	11.05	04/14/2016	9A	DAY	WET	2	N	TURN	0	0	1	0	01	SE	NW	01	NE	SE				
003	1	MN		0	11.06	04/17/2012	3P	DAY	DRY	1	N	TURN	0	0	0	2	01	SW	NW	01	NW	SE				
003	1	MN		0	11.06	05/07/2013	3P	DAY	DRY	1	N	TURN	0	0	0	0	01	NW	SE	01	SW	NW				
003	1	MN		0	11.06	08/07/2015	11A	DAY	DRY	1	N	TURN	0	0	0	0	01	NW	SE	01	SW	NW				

OREGON DEPARTMENT OF TRANSPORTATION - TRANSPORTATION DEVELOPMENT DIVISION
TRANSPORTATION DATA SECTION - CRASH ANAYLYSIS AND REPORTING UNIT
SYSTEM CRASH VEHICLE DIRECTION LIST

Highway 003 MAINLINE, MP 10.88 to 11.36 01/01/2012 to 12/31/2016, Both Add and Non-Add mileage

1 - 76 of 76 Crash records shown.

HWY #	RDWY #	COM P	CONN #	MLG TYP	MILE POINT	CRASH DATE	TIME	LIGHT	SURF	RD CH	OFF RD	COLL TYPE	PEOPLE INJURY K	A	B	C	VEHICLE 1 TYPE	FR	TO	VEHICLE 2 TYPE	FR	TO	VEHICLE 3 TYPE	FR	TO	ADD VEH
003	1	MN		0	11.07	01/31/2013	8A	DAY	WET	2	N	TURN	0	0	0	1	01	SW	NW	01	NW	SE				
003	1	MN		0	11.10	01/26/2012	5P	UNK	UNK	3	N	REAR	0	0	0	0	01	NW	SE	01	NW	SE				
003	1	MN		0	11.11	05/05/2013	12P	DAY	DRY	3	N	SS-O	0	0	0	0	01	SE	NW	99	SE	NW				
003	1	MN		0	11.11	07/17/2013	9A	DAY	DRY	3	N	REAR	0	0	0	0	99	NW	SE	01	NW	SE	01	NW	SE	
003	1	MN		0	11.11	07/16/2014	5P	DAY	DRY	3	N	REAR	0	0	1	0	01	NW	SE	01	NW	SE				
003	1	MN		0	11.11	05/18/2015	2P	DAY	DRY	3	N	REAR	0	0	0	1	01	NW	SE	01	NW	SE				
003	1	MN		0	11.13	11/05/2012	9A	DAY	WET	1	N	TURN	0	1	0	0	01	SE	NW	01	NE	SE				
003	1	MN		0	11.13	12/23/2013	9P	DLIT	WET	1	N	ANGL	0	0	0	0	01	NE	SW	01	NW	SE				
003	1	MN		0	11.13	12/25/2014	6P	DLIT	WET	1	N	REAR	0	0	0	2	01	NW	SE	01	NW	SE				
003	1	MN		0	11.13	01/09/2015	6A	DLIT	DRY	1	N	TURN	0	0	0	1	01	NW	SE	01	SE	SW				
003	1	MN		0	11.13	04/25/2015	2P	DAY	DRY	1	N	SS-O	0	0	1	0	01	N	S							
003	1	MN		0	11.13	07/12/2015	3P	DAY	DRY	1	N	TURN	0	0	0	1	01	SE	NW	01	E	SE				
003	1	MN		0	11.13	09/16/2015	6A	DAWN	WET	1	N	TURN	0	0	0	1	01	NW	SE	01	SE	SW				
003	1	MN		0	11.13	12/02/2015	5P	DLIT	WET	1	N	TURN	0	0	0	0	01	SE	NW	01	NE	SE				
003	1	MN		0	11.13	01/21/2016	5P	DUSK	DRY	1	N	REAR	0	0	0	1	01	NW	SE	01	NW	SE				
003	1	MN		0	11.14	06/06/2012	10A	DAY	DRY	1	Y	FIX	0	0	1	0	09	SE	SW							
003	1	MN		0	11.14	03/25/2014	5P	DAY	WET	1	N	ANGL	0	0	0	0	01	E	W	01	N	S				
003	1	MN		0	11.16	08/25/2013	9P	DARK	UNK	3	Y	FIX	0	0	0	1	01	N	S							
003	1	MN		0	11.27	04/08/2014	10A	DAY	DRY	3	N	SS-O	0	0	0	1	01	SW	NE	01	SW	NE				
003	1	MN		0	11.29	02/11/2014	10A	DAY	WET	1	N	TURN	0	0	0	0	01	NW	NE	01	NE	SW				

OREGON DEPARTMENT OF TRANSPORTATION - TRANSPORTATION DEVELOPMENT DIVISION
TRANSPORTATION DATA SECTION - CRASH ANAYLYSIS AND REPORTING UNIT
SYSTEM CRASH VEHICLE DIRECTION LIST

Highway 003 MAINLINE, MP 10.88 to 11.36 01/01/2012 to 12/31/2016, Both Add and Non-Add mileage

1 - 76 of 76 Crash records shown.

HWY #	RDWY #	COM P	CONN #	MLG TYP	MILE POINT	CRASH DATE	TIME	LIGHT	SURF	RD CH	OFF RD	COLL TYPE	PEOPLE INJURY K	A	B	C	VEHICLE 1 TYPE	FR	TO	VEHICLE 2 TYPE	FR	TO	VEHICLE 3 TYPE	FR	TO	ADD VEH
003	1	MN		0	11.29	12/11/2014	8A	DAY	WET	1	N	TURN	0	0	0	0	01	NE	SW	01	NW	NE				
003	1	MN		0	11.29	10/27/2016	9A	DAY	UNK	1	N	TURN	0	0	0	1	01	NE	SW	01	NW	NE				
003	1	MN		0	11.32	05/09/2016	6P	DAY	DRY	3	N	REAR	0	0	0	2	01	SW	NE	01	SW	NE				
003	1	MN		0	11.32	05/17/2016	10P	DARK	DRY	3	N	SS-O	0	0	0	2	01	NE	SW	01	NE	SW				
003	1	MN		0	11.34	11/27/2012	6P	DUSK	DRY	3	N	REAR	0	0	0	2	01	S	N	01	S	N				
003	1	MN		0	11.35	11/19/2012	7A	DAY	WET	1	N	TURN	0	0	0	0	01	SW	NW	01	NW	NE				
003	1	MN		0	11.35	02/26/2014	5P	DUSK	DRY	1	N	REAR	0	0	0	1	01	NW	SE	01	NW	SE				
003	1	MN		0	11.35	03/05/2014	6P	DLIT	WET	1	N	TURN	0	0	0	0	01	NW	NE	01	NE	SW				
003	1	MN		0	11.35	03/14/2014	3P	DAY	DRY	1	N	REAR	0	0	0	0	01	N	S	01	N	S				
003	1	MN		0	11.35	08/12/2014	6A	DAY	DRY	1	Y	FIX	0	0	1	0	04	NE	NW							
003	1	MN		0	11.35	12/10/2014	3P	DAY	WET	1	N	TURN	0	0	0	2	01	NW	NE	01	SW	NW				
003	1	MN		0	11.35	01/13/2015	11A	DAY	DRY	1	N	REAR	0	0	0	1	01	SW	NE	01	SW	NE				
003	1	MN		0	11.35	06/06/2015	11A	DAY	DRY	1	N	TURN	0	0	0	0	01	NW	NE	01	NE	SW				
003	1	MN		0	11.35	09/19/2015	12A	DLIT	DRY	1	N	REAR	0	0	0	0	99	SW	NE	01	SW	NE				
003	1	MN		0	11.35	11/22/2015	1P	DAY	WET	1	N	OTH	0	0	0	1	09	N	S							
003	1	MN		0	11.36	05/08/2016	12P	DAY	DRY	2	N	REAR	0	0	0	1	01	NW	SE	01	NW	SE				

Appendix B Crash Data (2012-2016) for OR43 at I-205 NB Exit-Ramp

OREGON DEPARTMENT OF TRANSPORTATION - TRANSPORTATION DEVELOPMENT DIVISION
TRANSPORTATION DATA SECTION - CRASH ANALYSIS AND REPORTING UNIT
CONTINUOUS SYSTEM CRASH LISTING
Highway 064 CONNECTIONS, MP 8.79 to 8.79, Both Add and Non-Add mileage, 01/01/2012 to 12/31/2016
Total Crash Records = 4
*******CRASH DE-CODER V5.1.3 PRC REPORT PRINTABLE EQUIVALENT*******

SER # / ID # / INVEST / RD DPT / UNLOC?	SPEED	ALCOHOL	DRUG	SCH ZONE	WORK ZONE	DATE / DAY / TIME / LAT	COUNTY / CITY / URB AREA / LONG	RD # / FUNCTIONAL CLASS / COMPONENT / MILEPOINT	CONN # / FIRST STREET / SECOND STREET / LRS	RD CHAR / DIRECT / LOCTN	INT-TYP (MEDIAN) / LEGS (# LANES)	INT-REL / TRAF-CONTL	OFF RD / RNDBT / DRVWY	WTHR / SURF / LIGHT	CRASH / COLL / SVRTY	VEHICLE #	SPCL USE / TRLR QTY / OWNER / TYPE	MOVE / FROM / TO	PARTC #	PARTC TYPE	INJURY SEVERITY	AGE	SEX	LICNS / RES	NON-MTRST / LOCATION	ERROR	ACTION / VEHICLE (PARTICIPANT)	EVENT / CRASH	EVENT / VEHICLE	EVENT / PARTICIPANT	CAUSE / CRASH	CAUSE / VEHICLE	CAUSE / PARTICIPANT
00561 1457817 CITY N False	Y	Y	N	N	N	02/12/2012 Sunday 4A 45.36121	Clackamas West Linn PORTLAND UA -122.60967	1-Undiv Hwy or +Mile of Div Hwy 11-Urb Prin Art - IntSt 6-Connection 8.79	1 TERRITORIAL DR EB EX TERRITORIAL 0064AO100S00	INTER SE 05	3-LEG () 0 ()	N TRF SIGNAL	Y N N	CLR DRY DLIT	FIX OBJ FIX INJ	2756362	NONE 0 PRVTE PSNGR CAR	STRGHT NW-SE	1	DRVR	INJB	24	F	OR-Y OR<25		047-Violation Basic Rule 081-Ran Off Road	000-No Action (000-No Action)	058-Other Sign 072-Other Wall 062-Tree/Stump	058-Other Sign 072-Other Wall 062-Tree/Stump		01-Too Fast For Cond	00-No Code	01-Too Fast For Cond
04245 1492842 NONE N False	N	N	N	N	N	11/01/2012 Thursday 3P 45.36121	Clackamas West Linn PORTLAND UA -122.60967	1-Undiv Hwy or +Mile of Div Hwy 11-Urb Prin Art - IntSt 6-Connection 8.79	1 TERRITORIAL DR EB EX TERRITORIAL 0064AO100S00	INTER NW 06	3-LEG () 0 ()	N TRF SIGNAL	N N N	CLR DRY DAY	S-1STOP REAR PDO	2821984	NONE 0 PRVTE PSNGR CAR	STRGHT NW-SE	1	DRVR	NONE	0	M	OR-Y OR<25		026-Faild Avoid Stop Veh	000-No Action (000-No Action)				07-Followed too Closely	00-No Code	07-Followed too Closely
																2821985	NONE 0 PRVTE PSNGR CAR	STOP NW-SE	1	DRVR	NONE	45	F	OR-Y OR<25		000-No Error	011-Stop In Traf-No Lturn (000-No Action)				00-No Code	00-No Code
00944 1508699 CITY N False	N	N	N	N	N	03/19/2013 Tuesday 4P 45.36121	Clackamas West Linn PORTLAND UA -122.60967	1-Undiv Hwy or +Mile of Div Hwy 11-Urb Prin Art - IntSt 6-Connection 8.79	1 TERRITORIAL DR EB EX TERRITORIAL 0064AO100S00	INTER NW 06	3-LEG () 0 ()	N TRF SIGNAL	N N N	RAIN WET DAY	S-1STOP REAR PDO	2850798	NONE 0 UNKN PSNGR CAR	STRGHT NW-SE	1	DRVR	NONE	0	M	UNK UNK		026-Faild Avoid Stop Veh	000-No Action (000-No Action)	013-Forced By Impact			07-Followed too Closely	00-No Code	07-Followed too Closely
																2850799	NONE 0 PRVTE PSNGR CAR	STOP NW-SE	1	DRVR	NONE	32	M	OR-Y OR<25		000-No Error	011-Stop In Traf-No Lturn (000-No Action)		013-Forced By Impact			00-No Code	00-No Code
																2850800	NONE 0 PRVTE PSNGR CAR	STOP NW-SE	1	DRVR	NONE	42	F	OR-Y OR<25		000-No Error	022-Struck Obj Prior Coll (000-No Action)					00-No Code	00-No Code
05064 1651113 CITY N False	N	N	N	N	N	11/30/2015 Monday 7P 45.36121	Clackamas West Linn PORTLAND UA -122.60967	1-Undiv Hwy or +Mile of Div Hwy 11-Urb Prin Art - IntSt 6-Connection 8.79	1 TERRITORIAL DR EB EX TERRITORIAL 0064AO100S00	INTER CN 03	3-LEG () 1 ()	N TRF SIGNAL	N N N	RAIN WET DARK	ANGL-OTH TURN PDO	3117513	NONE 0 PRVTE PSNGR CAR	STRGHT NE-SW	1	DRVR	NONE	48	F	OR-Y OR<25		016-Inattention 020-Disrg Traffic Signal	000-No Action (038-Driver Distracted)				27-Inattention 04-Disregard Traf. Signal	00-No Code	27-Inattention 04-Disregard Traf. Signal
																3117514	NONE 0 PRVTE PSNGR CAR	TURN-L NW-NE	1	DRVR	NONE	34	M	OR-Y OR<25		000-No Error	000-No Action (000-No Action)					00-No Code	00-No Code
																			2	PSNG	NO<5	3	F			000-No Error	(000-No Action)					00-No Code

OREGON DEPARTMENT OF TRANSPORTATION - TRANSPORTATION DEVELOPMENT DIVISION
TRANSPORTATION DATA SECTION - CRASH ANALYSIS AND REPORTING UNIT
CONTINUOUS SYSTEM CRASH LISTING
Highway 003 MAINLINE, MP 11.27 to 11.34, Both Add and Non-Add mileage, 01/01/2012 to 12/31/2016
Total Crash Records = 7
*******CRASH DE-CODER V5.1.3 PRC REPORT PRINTABLE EQUIVALENT*******

SER # / ID # / INVEST / RD DPT / UNLOC?	SPEED	ALCOHOL	DRUG	SCH ZONE	WORK ZONE	DATE / DAY / TIME / LAT	COUNTY / CITY / URB AREA / LONG	RD # / FUNCTIONAL CLASS / COMPONENT / MILEAGE TYPE / MILEPOINT	CONN # / FIRST STREET / SECOND STREET / LRS	RD CHAR / DIRECT LOCTN	INT-TYP (MEDIAN) / LEGS (# LANES)	INT-REL / TRAF-CONTL	OFF RD / RNDBT / DRVWY	WTHR / SURF / LIGHT	CRASH / COLL / SVRTY	VEHICLE #	SPCL USE / TRLR QTY / OWNER / TYPE	MOVE / FROM / TO	PARTC #	PARTC TYPE	INJURY SEVERITY	AGE	SEX	LICNS / RES	NON-MTRST LOCATION	ERROR	ACTION / VEHICLE (PARTICIPANT)	EVENT / CRASH	EVENT / VEHICLE	EVENT / PARTICIPANT	CAUSE / CRASH	CAUSE / VEHICLE	CAUSE / PARTICIPANT
01355 1562468 CITY N False	N	N	N	N	N	04/08/2014 Tuesday 10A 45.36146	Clackamas West Linn PORTLAND UA -122.60945	1-Undiv Hwy or +Mile of Div Hwy 14-Urb Prin Art - Oth 0-Mainline 11.27	TERRITORIAL DR EB EX TERRITORIAL 000300100S00	STRGHT NE 05	(NONE) (4)	N NONE	N N N	CLR DRY DAY	S-STRGHT SS-O INJ	2950759	NONE 0 PRVTE PSNGR CAR	STRGHT SW-NE	1	DRVR	NONE	62	F	OR-Y OR<25		045-Improper Lane Chng	000-No Action (000-No Action)			13-Improper Lane Chng	00-No Code	13-Improper Lane Chng
																2950760	NONE 0 PRVTE PSNGR CAR	STRGHT SW-NE	1	DRVR	INJC	33	F	OR-Y OR<25		000-No Error	000-No Action (000-No Action)				00-No Code	00-No Code
00630 1555852 CITY N False	N	N	N	N	N	02/11/2014 Tuesday 10A 45.36121	Clackamas West Linn PORTLAND UA -122.60967	1-Undiv Hwy or +Mile of Div Hwy 14-Urb Prin Art - Oth 0-Mainline 11.29	TERRITORIAL DR EB EX TERRITORIAL 000300100S00	INTER NE 06	3-LEG () 0 ()	N TRF SIGNAL	N N N	RAIN WET DAY	ANGL-OTH TURN PDO	2938471	NONE 0 PRVTE PSNGR CAR	TURN-L NW-NE	1	DRVR	NONE	71	M	OR-Y OR<25		007-Turn Into Wrong Ln	000-No Action (000-No Action)			08-Improper Turn	00-No Code	08-Improper Turn
																2938472	NONE 0 PRVTE PSNGR CAR	STRGHT NE-SW	1	DRVR	NONE	60	F	OR-Y OR<25		000-No Error	007-Avoiding Maneuver (000-No Action)				00-No Code	00-No Code
																			2	PSNG	NO<5	3	F			000-No Error	000-No Action (000-No Action)					00-No Code
04999 1596305 NONE N False	Y	N	N	N	N	12/11/2014 Thursday 8A 45.36121	Clackamas West Linn PORTLAND UA -122.60967	1-Undiv Hwy or +Mile of Div Hwy 16-Urb Min Art 0-Mainline 11.29	TERRITORIAL DR EB EX TERRITORIAL 000300100S00	INTER CN 03	3-LEG () 2 ()	N TRF SIGNAL	N N N	RAIN WET DAY	ANGL-OTH TURN PDO	3014953	NONE 0 PRVTE PSNGR CAR	STRGHT NE-SW	1	DRVR	NONE	29	M	OR-Y OR<25		047-Violation Basic Rule 020-Disrg Traffic Signal	000-No Action (000-No Action)	124-Slide b/c of surface	124-Slide b/c of surface	01-Too Fast For Cond 04-Disregard Traf. Signal	00-No Code	01-Too Fast For Cond 04-Disregard Traf. Signal
																3014954	NONE 0 PRVTE PSNGR CAR	TURN-L NW-NE	1	DRVR	NONE	82	F	OR-Y OR<25		000-No Error	000-No Action (000-No Action)				00-No Code	00-No Code
04942 1684024 CITY N False	N	N	N	N	N	10/27/2016 Thursday 9A 45.36121	Clackamas West Linn PORTLAND UA -122.60967	1-Undiv Hwy or +Mile of Div Hwy 16-Urb Min Art 0-Mainline 11.29	TERRITORIAL DR EB EX TERRITORIAL 000300100S00	INTER CN 03	3-LEG () 0 ()	N TRF SIGNAL	N N N	UNK UNK DAY	ANGL-OTH TURN INJ	3179839	NONE 0 PRVTE PSNGR CAR	STRGHT NE-SW	1	DRVR	NONE	51	F	OR-Y OR<25		020-Disrg Traffic Signal	000-No Action (000-No Action)			04-Disregard Traf. Signal	00-No Code	04-Disregard Traf. Signal
																3179840	NONE 0 PRVTE PSNGR CAR	TURN-L NW-NE	1	DRVR	INJC	62	M	OR-Y OR<25		000-No Error	000-No Action (000-No Action)				00-No Code	00-No Code
02090 1687137 NONE N False	N	N	N	N	N	05/09/2016 Monday 6P 45.36084	Clackamas West Linn PORTLAND UA -122.61007	1-Undiv Hwy or +Mile of Div Hwy 16-Urb Min Art 0-Mainline 11.32	7TH ST WILLAMETTE FALLS 000300100S00	STRGHT N 04	(NONE) (2)	Y TRF SIGNAL	N N N	CLR DRY DAY	S-1STOP REAR INJ	3185876	NONE 0 PRVTE PSNGR CAR	STRGHT SW-NE	1	DRVR	NONE	40	M	OR-Y OR<25		026-Faild Avoid Stop Veh	000-No Action (000-No Action)			29-Fail avoid veh. Ahead	00-No Code	29-Fail avoid veh. Ahead
																3185877	NONE 0 PRVTE PSNGR CAR	STOP SW-NE	1	DRVR	INJC	18	M	OR-Y OR<25		000-No Error	011-Stop In Traf-No Lturn (000-No Action)				00-No Code	00-No Code
																			2	PSNG	INJC	66	F			000-No Error	000-No Action (000-No Action)					00-No Code
02223 1670224 CITY N False	N	N	N	N	N	05/17/2016 Tuesday 10P 45.36084	Clackamas West Linn PORTLAND UA -122.61007	1-Undiv Hwy or +Mile of Div Hwy 16-Urb Min Art 0-Mainline 11.32	7TH ST WILLAMETTE FALLS 000300100S00	STRGHT NE 04	(NONE) (3)	N R-GRN-SIG	N N N	CLR DRY DARK	S-STRGHT SS-O INJ	3153287	NONE 0 PRVTE PSNGR CAR	STRGHT NE-SW	1	DRVR	INJC	72	M	OR-Y OR<25		045-Improper Lane Chng	000-No Action (000-No Action)			13-Improper Lane Chng	00-No Code	13-Improper Lane Chng
																3153288	NONE 0 PRVTE PSNGR CAR	STRGHT NE-SW	1	DRVR	INJC	76	F	OR-Y OR<25		000-No Error	000-No Action (000-No Action)				00-No Code	00-No Code
04582 1494936 CITY N False	N	N	N	N	N	11/27/2012 Tuesday 6P 45.36065	Clackamas West Linn PORTLAND UA -122.61025	1-Undiv Hwy or +Mile of Div Hwy 16-Urb Min Art 0-Mainline 11.34	7TH ST WILLAMETTE FALLS 000300100S00	STRGHT UN 04	(NONE) (2)	N TRF SIGNAL	N N N	CLR DRY DUSK	S-1STOP REAR INJ	2825783	NONE 0 PRVTE PSNGR CAR	STRGHT S -N	1	DRVR	NONE	40	M	OR-Y OR<25		026-Faild Avoid Stop Veh	000-No Action (000-No Action)			07-Followed too Closely	00-No Code	07-Followed too Closely
																			2	PSNG	INJC	60	F			000-No Error	000-No Action (000-No Action)					00-No Code
																2825784	NONE 0 PRVTE PSNGR CAR	STOP S -N	1	DRVR	INJC	51	F	OR-Y OR<25		000-No Error	011-Stop In Traf-No Lturn (000-No Action)				00-No Code	00-No Code
																			2	PSNG	NONE	14	M			000-No Error	000-No Action (000-No Action)					00-No Code

Appendix C Synchro/SimTraffic Analysis Worksheets

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (vph)	41	22	132	84	18	6	7	554	6	71	844	57
Future Volume (vph)	41	22	132	84	18	6	7	554	6	71	844	57
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.87		1.00	0.96		1.00	1.00		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1805	1656		1719	1744		1735	1824		1703	1772	
Flt Permitted	0.95	1.00		0.95	1.00		0.10	1.00		0.25	1.00	
Satd. Flow (perm)	1805	1656		1719	1744		189	1824		451	1772	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	44	24	142	90	19	6	8	596	6	76	908	61
RTOR Reduction (vph)	0	126	0	0	5	0	0	0	0	0	2	0
Lane Group Flow (vph)	44	40	0	90	20	0	8	602	0	76	967	0
Confl. Peds. (#/hr)							10		1	1		10
Confl. Bikes (#/hr)									3			3
Heavy Vehicles (%)	0%	0%	0%	5%	5%	5%	4%	4%	4%	6%	6%	6%
Turn Type	Prot	NA		Prot	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	3	8		7	4		5	2		1	6	
Permitted Phases							2			6		
Actuated Green, G (s)	4.0	8.3		5.8	10.1		39.6	38.7		47.6	42.7	
Effective Green, g (s)	4.0	8.3		5.8	10.1		39.6	38.7		47.6	42.7	
Actuated g/C Ratio	0.05	0.11		0.08	0.13		0.52	0.51		0.63	0.56	
Clearance Time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
Vehicle Extension (s)	2.3	2.3		2.3	2.3		2.3	4.2		2.3	4.2	
Lane Grp Cap (vph)	95	181		131	232		117	932		364	999	
v/s Ratio Prot	0.02	c0.02		c0.05	0.01		0.00	0.33		c0.01	c0.55	
v/s Ratio Perm							0.03			0.12		
v/c Ratio	0.46	0.22		0.69	0.09		0.07	0.65		0.21	0.97	
Uniform Delay, d1	34.8	30.7		34.1	28.8		14.6	13.5		7.9	15.8	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	2.1	0.4		12.2	0.1		0.1	1.8		0.2	21.0	
Delay (s)	36.9	31.1		46.3	28.8		14.8	15.3		8.0	36.9	
Level of Service	D	C		D	C		B	B		A	D	
Approach Delay (s)		32.3			42.5			15.3			34.8	
Approach LOS		C			D			B			C	

Intersection Summary			
HCM 2000 Control Delay	29.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	75.7	Sum of lost time (s)	18.0
Intersection Capacity Utilization	80.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL2	WBL	WBR	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NER
Lane Configurations											
Traffic Volume (vph)	162	3	575	263	397	0	0	666	104	0	0
Future Volume (vph)	162	3	575	263	397	0	0	666	104	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		4.5	4.5			4.5			
Lane Util. Factor	1.00	1.00		1.00	0.95			0.95			
Frpb, ped/bikes	1.00	1.00		1.00	1.00			1.00			
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00			
Frt	1.00	0.85		1.00	1.00			0.98			
Flt Protected	0.95	1.00		0.95	1.00			1.00			
Satd. Flow (prot)	1687	1510		1752	3505			3423			
Flt Permitted	0.95	1.00		0.19	1.00			1.00			
Satd. Flow (perm)	1687	1510		354	3505			3423			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	176	3	625	286	432	0	0	724	113	0	0
RTOR Reduction (vph)	0	322	0	0	0	0	0	18	0	0	0
Lane Group Flow (vph)	176	306	0	286	432	0	0	819	0	0	0
Confl. Peds. (#/hr)				1					1		
Confl. Bikes (#/hr)						3			3		
Heavy Vehicles (%)	7%	7%	7%	3%	3%	3%	3%	3%	3%	0%	0%
Turn Type	Prot	Prot		pm+pt	NA			NA			
Protected Phases	4	4		1	6			2			
Permitted Phases				6							
Actuated Green, G (s)	15.5	15.5		32.2	32.2			22.0			
Effective Green, g (s)	15.5	15.5		32.2	32.2			22.0			
Actuated g/C Ratio	0.27	0.27		0.56	0.56			0.38			
Clearance Time (s)	5.0	5.0		4.5	4.5			4.5			
Vehicle Extension (s)	2.3	2.3		2.3	4.2			4.2			
Lane Grp Cap (vph)	457	409		338	1973			1316			
v/s Ratio Prot	0.10	c0.20		c0.08	0.12			0.24			
v/s Ratio Perm				c0.39							
v/c Ratio	0.39	0.75		0.85	0.22			0.62			
Uniform Delay, d1	17.0	19.1		8.6	6.2			14.2			
Progression Factor	1.00	1.00		1.00	1.00			1.00			
Incremental Delay, d2	0.3	6.7		17.0	0.1			1.1			
Delay (s)	17.3	25.8		25.7	6.3			15.3			
Level of Service	B	C		C	A			B			
Approach Delay (s)		23.9			14.0			15.3		0.0	
Approach LOS		C			B			B		A	

Intersection Summary			
HCM 2000 Control Delay	17.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	57.2	Sum of lost time (s)	14.0
Intersection Capacity Utilization	83.7%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	64	187	0	897	339	0
Future Volume (vph)	64	187	0	897	339	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00		0.95	0.95	
Frpb, ped/bikes	1.00	0.98		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	
Frt	1.00	0.85		1.00	1.00	
Flt Protected	0.95	1.00		1.00	1.00	
Satd. Flow (prot)	1719	1512		3539	3438	
Flt Permitted	0.95	1.00		1.00	1.00	
Satd. Flow (perm)	1719	1512		3539	3438	
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	65	191	0	915	346	0
RTOR Reduction (vph)	0	164	0	0	0	0
Lane Group Flow (vph)	65	27	0	915	346	0
Confl. Peds. (#/hr)			1			1
Confl. Bikes (#/hr)		3				3
Heavy Vehicles (%)	5%	5%	2%	2%	5%	5%
Turn Type	Prot	Perm		NA	NA	
Protected Phases	8			6	2	
Permitted Phases		8				
Actuated Green, G (s)	5.5	5.5		23.4	23.4	
Effective Green, g (s)	5.5	5.5		23.4	23.4	
Actuated g/C Ratio	0.14	0.14		0.60	0.60	
Clearance Time (s)	5.0	5.0		5.0	5.0	
Vehicle Extension (s)	2.3	2.3		4.5	4.2	
Lane Grp Cap (vph)	243	213		2128	2068	
v/s Ratio Prot	c0.04			c0.26	0.10	
v/s Ratio Perm		0.02				
v/c Ratio	0.27	0.13		0.43	0.17	
Uniform Delay, d1	14.9	14.6		4.2	3.4	
Progression Factor	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.3	0.2		0.2	0.1	
Delay (s)	15.2	14.8		4.4	3.5	
Level of Service	B	B		A	A	
Approach Delay (s)	14.9			4.4	3.5	
Approach LOS	B			A	A	

Intersection Summary			
HCM 2000 Control Delay	6.0	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.40		
Actuated Cycle Length (s)	38.9	Sum of lost time (s)	10.0
Intersection Capacity Utilization	38.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	173	192	383	724	313	213
Future Volume (Veh/h)	173	192	383	724	313	213
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	188	209	416	787	340	232
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	TWLTL	
Median storage veh)					2	
Upstream signal (ft)					275	
pX, platoon unblocked	0.98	0.98	0.98			
vC, conflicting volume	1959	340	572			
vC1, stage 1 conf vol	340					
vC2, stage 2 conf vol	1619					
vCu, unblocked vol	1969	315	552			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)	5.4					
tF (s)	3.5	3.3	2.2			
p0 queue free %	0	71	58			
cM capacity (veh/h)	101	710	1002			

Direction, Lane #	EB 1	EB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	188	209	416	787	340	232
Volume Left	188	0	416	0	0	0
Volume Right	0	209	0	0	0	232
cSH	101	710	1002	1700	1700	1700
Volume to Capacity	1.86	0.29	0.42	0.46	0.20	0.14
Queue Length 95th (ft)	386	31	52	0	0	0
Control Delay (s)	493.1	12.2	11.1	0.0	0.0	0.0
Lane LOS	F	B	B			
Approach Delay (s)	239.9		3.8		0.0	
Approach LOS	F					

Intersection Summary				
Average Delay	46.0			
Intersection Capacity Utilization	57.3%	ICU Level of Service	B	
Analysis Period (min)	15			

Intersection: 3: OR43 & McKillican

Movement	EB	EB	WB	WB	SE	SE	NW	NW	B77	B77
Directions Served	L	TR	L	TR	L	TR	L	TR	T	
Maximum Queue (ft)	84	147	108	90	31	327	209	568	144	71
Average Queue (ft)	27	64	48	23	4	146	58	308	31	18
95th Queue (ft)	64	117	91	67	20	268	170	580	183	147
Link Distance (ft)		206		166		445		534	322	322
Upstream Blk Time (%)		0	0	0				5	2	1
Queuing Penalty (veh)		0	0	0				44	9	3
Storage Bay Dist (ft)	150		50		180		110			
Storage Blk Time (%)		0	17	1		4	0	23		
Queuing Penalty (veh)		0	4	1		0	0	16		

Intersection: 4: I-205 SB On Ramp & I-205 SB Off Ramp & OR43

Movement	WB	WB	NB	NB	NB	SB	SB	B77
Directions Served	<	LR	L	T	T	T	TR	T
Maximum Queue (ft)	184	279	218	203	124	299	331	23
Average Queue (ft)	91	128	101	76	12	100	163	1
95th Queue (ft)	159	241	180	161	70	226	283	21
Link Distance (ft)		1110		288	288	322	322	534
Upstream Blk Time (%)			0	0	0	0	1	
Queuing Penalty (veh)			0	1	0	0	2	
Storage Bay Dist (ft)	500		180					
Storage Blk Time (%)			2	1				
Queuing Penalty (veh)			4	2				

Intersection: 5: I-205 NB Off Ramp & OR43

Movement	EB	EB	NB	NB	SB	SB
Directions Served	L	R	T	T	T	T
Maximum Queue (ft)	84	113	152	123	123	86
Average Queue (ft)	35	52	76	50	38	26
95th Queue (ft)	71	87	131	102	92	69
Link Distance (ft)		849	205	205	185	185
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	225					
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 6: OR43 & Willamette Falls Dr

Movement	EB	EB	NB	NB	SB	SB
Directions Served	L	R	L	T	T	R
Maximum Queue (ft)	149	137	188	69	10	75
Average Queue (ft)	134	62	72	4	0	6
95th Queue (ft)	143	128	141	78	5	50
Link Distance (ft)	128	128		672	205	205
Upstream Blk Time (%)	84	1		0		0
Queuing Penalty (veh)	153	1		0		0
Storage Bay Dist (ft)			200			
Storage Blk Time (%)			0			
Queuing Penalty (veh)			3			

Intersection: 29: OR43

Movement			
Directions Served			
Maximum Queue (ft)			
Average Queue (ft)			
95th Queue (ft)			
Link Distance (ft)			
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 61:

Movement	NB	NB	SB
Directions Served	T	T	TR
Maximum Queue (ft)	28	28	16
Average Queue (ft)	2	1	1
95th Queue (ft)	26	23	9
Link Distance (ft)	142	142	288
Upstream Blk Time (%)	0	0	
Queuing Penalty (veh)	0	0	
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Network Summary

Network wide Queuing Penalty: 421

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (vph)	109	20	253	164	73	12	3	787	3	81	703	106
Future Volume (vph)	109	20	253	164	73	12	3	787	3	81	703	106
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	0.97		1.00	1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.86		1.00	0.98		1.00	1.00		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1550		1805	1855		1703	1791		1787	1838	
Flt Permitted	0.95	1.00		0.95	1.00		0.17	1.00		0.11	1.00	
Satd. Flow (perm)	1770	1550		1805	1855		305	1791		206	1838	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	112	21	261	169	75	12	3	811	3	84	725	109
RTOR Reduction (vph)	0	230	0	0	6	0	0	0	0	0	4	0
Lane Group Flow (vph)	112	52	0	169	81	0	3	814	0	84	830	0
Confl. Peds. (#/hr)	2		8	8		2	1					1
Confl. Bikes (#/hr)									3			5
Heavy Vehicles (%)	2%	2%	2%	0%	0%	0%	6%	6%	6%	1%	1%	1%
Turn Type	Prot	NA		Prot	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	3	8		7	4		5	2		1	6	
Permitted Phases							2			6		
Actuated Green, G (s)	7.5	9.9		7.6	10.0		44.7	43.8		53.3	48.1	
Effective Green, g (s)	7.5	9.9		7.6	10.0		44.7	43.8		53.3	48.1	
Actuated g/C Ratio	0.09	0.12		0.09	0.12		0.53	0.52		0.63	0.57	
Clearance Time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
Vehicle Extension (s)	2.3	2.3		2.3	2.3		2.3	4.2		2.3	4.2	
Lane Grp Cap (vph)	157	181		162	219		176	928		227	1046	
v/s Ratio Prot	0.06	0.03		c0.09	c0.04		0.00	c0.45		c0.02	c0.45	
v/s Ratio Perm							0.01			0.21		
v/c Ratio	0.71	0.28		1.04	0.37		0.02	0.88		0.37	0.79	
Uniform Delay, d1	37.5	34.1		38.5	34.3		12.4	18.0		13.6	14.3	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	12.8	0.5		82.6	0.6		0.0	9.8		0.6	4.6	
Delay (s)	50.3	34.6		121.0	35.0		12.5	27.7		14.2	18.9	
Level of Service	D	C		F	C		B	C		B	B	
Approach Delay (s)		39.0			91.8			27.7			18.4	
Approach LOS		D			F			C			B	

Intersection Summary			
HCM 2000 Control Delay	32.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	84.5	Sum of lost time (s)	18.0
Intersection Capacity Utilization	88.3%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL2	WBL	WBR	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NER
Lane Configurations											
Traffic Volume (vph)	237	0	674	107	216	0	0	1114	90	0	0
Future Volume (vph)	237	0	674	107	216	0	0	1114	90	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		4.5	4.5			4.5			
Lane Util. Factor	1.00	1.00		1.00	0.95			0.95			
Frpb, ped/bikes	1.00	1.00		1.00	1.00			1.00			
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00			
Frt	1.00	0.85		1.00	1.00			0.99			
Flt Protected	0.95	1.00		0.95	1.00			1.00			
Satd. Flow (prot)	1770	1583		1805	3610			3425			
Flt Permitted	0.95	1.00		0.11	1.00			1.00			
Satd. Flow (perm)	1770	1583		208	3610			3425			
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	249	0	709	113	227	0	0	1173	95	0	0
RTOR Reduction (vph)	0	528	0	0	0	0	0	7	0	0	0
Lane Group Flow (vph)	249	181	0	113	227	0	0	1261	0	0	0
Confl. Peds. (#/hr)	1			1		1	1		1		
Confl. Bikes (#/hr)						6			6		
Heavy Vehicles (%)	2%	2%	2%	0%	0%	0%	4%	4%	4%	0%	0%
Turn Type	Prot	Prot		pm+pt	NA			NA			
Protected Phases	4	4		1	6			2			
Permitted Phases				6							
Actuated Green, G (s)	14.2	14.2		40.6	40.6			32.0			
Effective Green, g (s)	14.2	14.2		40.6	40.6			32.0			
Actuated g/C Ratio	0.22	0.22		0.63	0.63			0.50			
Clearance Time (s)	5.0	5.0		4.5	4.5			4.5			
Vehicle Extension (s)	2.3	2.3		2.3	4.2			4.2			
Lane Grp Cap (vph)	390	349		233	2279			1704			
v/s Ratio Prot	c0.14	0.11		c0.03	0.06			c0.37			
v/s Ratio Perm				0.27							
v/c Ratio	0.64	0.52		0.48	0.10			0.74			
Uniform Delay, d1	22.7	22.0		8.5	4.7			12.8			
Progression Factor	1.00	1.00		1.00	1.00			1.00			
Incremental Delay, d2	2.8	0.8		0.9	0.0			1.9			
Delay (s)	25.5	22.8		9.4	4.7			14.8			
Level of Service	C	C		A	A			B			
Approach Delay (s)		23.5			6.3			14.8		0.0	
Approach LOS		C			A			B		A	

Intersection Summary			
HCM 2000 Control Delay	16.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	64.3	Sum of lost time (s)	14.0
Intersection Capacity Utilization	93.0%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	21	106	0	799	586	0
Future Volume (vph)	21	106	0	799	586	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00		0.95	0.95	
Frt	1.00	0.85		1.00	1.00	
Flt Protected	0.95	1.00		1.00	1.00	
Satd. Flow (prot)	1805	1615		3505	3539	
Flt Permitted	0.95	1.00		1.00	1.00	
Satd. Flow (perm)	1805	1615		3505	3539	
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	21	108	0	815	598	0
RTOR Reduction (vph)	0	94	0	0	0	0
Lane Group Flow (vph)	21	14	0	815	598	0
Heavy Vehicles (%)	0%	0%	3%	3%	2%	2%
Turn Type	Prot	Perm		NA	NA	
Protected Phases	8			6	2	
Permitted Phases		8				
Actuated Green, G (s)	4.9	4.9		24.2	24.2	
Effective Green, g (s)	4.9	4.9		24.2	24.2	
Actuated g/C Ratio	0.13	0.13		0.62	0.62	
Clearance Time (s)	5.0	5.0		5.0	5.0	
Vehicle Extension (s)	2.3	2.3		4.5	4.2	
Lane Grp Cap (vph)	226	202		2169	2190	
v/s Ratio Prot	c0.01			c0.23	0.17	
v/s Ratio Perm		0.01				
v/c Ratio	0.09	0.07		0.38	0.27	
Uniform Delay, d1	15.1	15.1		3.7	3.4	
Progression Factor	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.1	0.1		0.2	0.1	
Delay (s)	15.2	15.2		3.9	3.5	
Level of Service	B	B		A	A	
Approach Delay (s)	15.2			3.9	3.5	
Approach LOS	B			A	A	

Intersection Summary			
HCM 2000 Control Delay	4.7	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.33		
Actuated Cycle Length (s)	39.1	Sum of lost time (s)	10.0
Intersection Capacity Utilization	35.4%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	277	424	215	522	456	236
Future Volume (Veh/h)	277	424	215	522	456	236
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	301	461	234	567	496	257
Pedestrians				3	3	
Lane Width (ft)				12.0	12.0	
Walking Speed (ft/s)				3.5	3.5	
Percent Blockage				0	0	
Right turn flare (veh)						
Median type				None	TWLTL	
Median storage veh)					2	
Upstream signal (ft)					275	
pX, platoon unblocked	0.91	0.91	0.91			
vC, conflicting volume	1534	499	753			
vC1, stage 1 conf vol	496					
vC2, stage 2 conf vol	1038					
vCu, unblocked vol	1537	397	677			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)	5.4					
tF (s)	3.5	3.3	2.2			
p0 queue free %	0	22	72			
cM capacity (veh/h)	228	590	830			

Direction, Lane #	EB 1	EB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	301	461	234	567	496	257
Volume Left	301	0	234	0	0	0
Volume Right	0	461	0	0	0	257
cSH	228	590	830	1700	1700	1700
Volume to Capacity	1.32	0.78	0.28	0.33	0.29	0.15
Queue Length 95th (ft)	403	184	29	0	0	0
Control Delay (s)	212.9	29.4	11.0	0.0	0.0	0.0
Lane LOS	F	D	B			
Approach Delay (s)	101.9		3.2		0.0	
Approach LOS	F					

Intersection Summary				
Average Delay	34.6			
Intersection Capacity Utilization	61.3%	ICU Level of Service	B	
Analysis Period (min)	15			

Intersection: 3: OR43 & McKillican

Movement	EB	EB	WB	WB	SE	SE	NW	NW	B77	B77
Directions Served	L	TR	L	TR	L	TR	L	TR	T	
Maximum Queue (ft)	200	226	166	185	42	499	210	530	67	35
Average Queue (ft)	98	142	158	174	2	389	64	265	5	1
95th Queue (ft)	187	232	187	227	29	575	172	453	60	35
Link Distance (ft)		206		166		445		534	322	322
Upstream Blk Time (%)	0	5	45	73		22		1	0	0
Queuing Penalty (veh)	0	0	0	0		0		9	0	0
Storage Bay Dist (ft)	150		100		180		110			
Storage Blk Time (%)	8	10	92	2		36	0	24		
Queuing Penalty (veh)	22	10	78	4		1	3	20		

Intersection: 4: I-205 SB On Ramp & I-205 SB Off Ramp & OR43

Movement	WB	WB	NB	NB	NB	SB	SB	B77
Directions Served	<	LR	L	T	T	T	TR	T
Maximum Queue (ft)	254	357	100	103	42	362	396	253
Average Queue (ft)	124	160	43	42	3	172	240	19
95th Queue (ft)	207	295	79	89	23	329	371	145
Link Distance (ft)		1110		288	288	322	322	534
Upstream Blk Time (%)						0	2	0
Queuing Penalty (veh)						3	15	0
Storage Bay Dist (ft)	500		180					
Storage Blk Time (%)		0						
Queuing Penalty (veh)		0						

Intersection: 5: I-205 NB Off Ramp & OR43

Movement	EB	EB	NB	NB	SB	SB
Directions Served	L	R	T	T	T	T
Maximum Queue (ft)	56	80	105	130	140	98
Average Queue (ft)	14	36	39	60	56	29
95th Queue (ft)	41	62	82	113	114	72
Link Distance (ft)		849	205	205	185	185
Upstream Blk Time (%)					0	
Queuing Penalty (veh)					0	
Storage Bay Dist (ft)	225					
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 6: OR 43 & Willamette Falls Dr

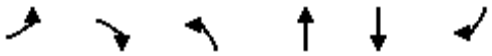
Movement	EB	EB	NB	SB	SB
Directions Served	L	R	L	T	R
Maximum Queue (ft)	145	142	112	6	9
Average Queue (ft)	135	110	50	0	0
95th Queue (ft)	143	166	90	6	6
Link Distance (ft)	128	128		205	205
Upstream Blk Time (%)	74	7			
Queuing Penalty (veh)	261	24			
Storage Bay Dist (ft)			200		
Storage Blk Time (%)					
Queuing Penalty (veh)					

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (vph)	41	22	207	116	18	6	7	799	6	71	855	152
Future Volume (vph)	41	22	207	116	18	6	7	799	6	71	855	152
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.86		1.00	0.96		1.00	1.00		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1805	1642		1719	1744		1736	1825		1703	1742	
Flt Permitted	0.95	1.00		0.95	1.00		0.07	1.00		0.16	1.00	
Satd. Flow (perm)	1805	1642		1719	1744		119	1825		289	1742	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	43	23	218	122	19	6	7	841	6	75	900	160
RTOR Reduction (vph)	0	183	0	0	5	0	0	0	0	0	4	0
Lane Group Flow (vph)	43	58	0	122	20	0	7	847	0	75	1056	0
Confl. Peds. (#/hr)							10		1	1		10
Confl. Bikes (#/hr)									3			3
Heavy Vehicles (%)	0%	0%	0%	5%	5%	5%	4%	4%	4%	6%	6%	6%
Turn Type	Prot	NA		Prot	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	3	8		7	4		5	2		1	6	
Permitted Phases							2			6		
Actuated Green, G (s)	3.9	10.3		7.5	13.9		62.0	62.0		73.4	73.4	
Effective Green, g (s)	3.9	10.3		7.5	13.9		62.0	62.0		73.4	73.4	
Actuated g/C Ratio	0.04	0.09		0.07	0.13		0.56	0.56		0.67	0.67	
Clearance Time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
Vehicle Extension (s)	2.3	2.3		2.3	2.3		2.3	4.2		2.3	4.2	
Lane Grp Cap (vph)	63	153		117	220		78	1028		349	1162	
v/s Ratio Prot	0.02	c0.04		c0.07	c0.01		0.00	c0.46		0.02	c0.61	
v/s Ratio Perm							0.05			0.12		
v/c Ratio	0.68	0.38		1.04	0.09		0.09	0.82		0.21	0.91	
Uniform Delay, d1	52.4	46.8		51.2	42.5		23.1	19.5		24.9	15.5	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		0.72	0.82	
Incremental Delay, d2	23.2	0.9		95.1	0.1		0.3	7.5		0.2	10.3	
Delay (s)	75.7	47.8		146.4	42.6		23.4	27.0		18.1	23.0	
Level of Service	E	D		F	D		C	C		B	C	
Approach Delay (s)		52.0			128.7			27.0			22.6	
Approach LOS		D			F			C			C	

Intersection Summary			
HCM 2000 Control Delay	34.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	90.6%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL2	WBL	WBR	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NER
Lane Configurations											
Traffic Volume (vph)	164	0	631	506	447	0	0	912	210	0	0
Future Volume (vph)	164	0	631	506	447	0	0	912	210	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	4.5	4.5	4.5			4.5			
Lane Util. Factor		1.00	1.00	1.00	0.95			0.95			
Frpb, ped/bikes		1.00	1.00	1.00	1.00			1.00			
Flpb, ped/bikes		1.00	1.00	1.00	1.00			1.00			
Frt		1.00	0.85	1.00	1.00			0.97			
Flt Protected		0.95	1.00	0.95	1.00			1.00			
Satd. Flow (prot)		1687	1509	1752	3505			3390			
Flt Permitted		0.95	1.00	0.00	1.00			1.00			
Satd. Flow (perm)		1687	1509	0	3505			3390			
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	173	0	664	533	471	0	0	960	221	0	0
RTOR Reduction (vph)	0	0	34	0	0	0	0	18	0	0	0
Lane Group Flow (vph)	0	173	630	533	471	0	0	1163	0	0	0
Confl. Peds. (#/hr)				1					1		
Confl. Bikes (#/hr)						3			3		
Heavy Vehicles (%)	7%	7%	7%	3%	3%	3%	3%	3%	3%	0%	0%
Turn Type	Perm	Prot	custom	pm+pt	NA			NA			
Protected Phases		4	5	1	6			2			
Permitted Phases	4		4	6							
Actuated Green, G (s)		16.1	74.8	38.4	21.2			41.5			
Effective Green, g (s)		16.1	74.8	38.4	21.2			41.5			
Actuated g/C Ratio		0.15	0.68	0.35	0.19			0.38			
Clearance Time (s)		5.0	4.5	4.5	4.5			4.5			
Vehicle Extension (s)		2.3	2.3	2.3	4.2			4.2			
Lane Grp Cap (vph)		246	1087	611	675			1278			
v/s Ratio Prot			0.31	c0.30	0.13			c0.34			
v/s Ratio Perm		0.10	0.11								
v/c Ratio		0.70	0.58	0.87	0.70			0.91			
Uniform Delay, d1		44.7	9.3	33.5	41.4			32.5			
Progression Factor		1.00	1.00	0.94	0.90			0.74			
Incremental Delay, d2		7.8	0.6	10.9	2.9			6.8			
Delay (s)		52.5	9.9	42.4	40.3			30.9			
Level of Service		D	A	D	D			C			
Approach Delay (s)		18.7			41.4			30.9		0.0	
Approach LOS		B			D			C		A	

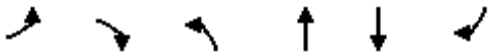
Intersection Summary			
HCM 2000 Control Delay	31.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	80.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	270	246	555	950	457	215
Future Volume (vph)	270	246	555	950	457	215
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	1787	1881	1827	1532
Flt Permitted	0.95	1.00	0.28	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	535	1881	1827	1532
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	284	259	584	1000	481	226
RTOR Reduction (vph)	0	210	0	0	0	81
Lane Group Flow (vph)	284	49	584	1000	481	145
Confl. Bikes (#/hr)						3
Heavy Vehicles (%)	2%	2%	1%	1%	4%	4%
Turn Type	Prot	Perm	pm+pt	NA	NA	Perm
Protected Phases	8		1	6	2	
Permitted Phases		8	6			2
Actuated Green, G (s)	21.0	21.0	81.0	81.0	44.0	44.0
Effective Green, g (s)	21.0	21.0	81.0	81.0	44.0	44.0
Actuated g/C Ratio	0.19	0.19	0.74	0.74	0.40	0.40
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	2.5	2.5	2.5	2.5	2.5	2.5
Lane Grp Cap (vph)	337	302	769	1385	730	612
v/s Ratio Prot	c0.16		0.23	c0.53	0.26	
v/s Ratio Perm		0.03	c0.33			0.09
v/c Ratio	0.84	0.16	0.76	0.72	0.66	0.24
Uniform Delay, d1	42.9	37.2	19.7	8.2	26.9	21.9
Progression Factor	1.00	1.00	1.00	1.00	1.23	1.66
Incremental Delay, d2	16.9	0.2	4.1	3.3	3.9	0.8
Delay (s)	59.8	37.4	23.8	11.5	37.1	37.0
Level of Service	E	D	C	B	D	D
Approach Delay (s)	49.1			16.0	37.1	
Approach LOS	D			B	D	

Intersection Summary			
HCM 2000 Control Delay	27.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	79.8%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	120	192	388	833	480	596
Future Volume (vph)	120	192	388	833	480	596
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	0.97	1.00	1.00	1.00
Frpb, ped/bikes	1.00	0.97	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1719	1499	3433	1863	1810	1538
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	1719	1499	3433	1863	1810	1538
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	122	196	396	850	490	608
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	122	196	396	850	490	608
Confl. Peds. (#/hr)			1			1
Confl. Bikes (#/hr)		3				3
Heavy Vehicles (%)	5%	5%	2%	2%	5%	5%
Turn Type	Prot	Perm	Prot	NA	NA	pt+ov
Protected Phases	8		1	6	2	2 8
Permitted Phases		8				
Actuated Green, G (s)	22.8	22.8	22.0	79.2	53.2	80.0
Effective Green, g (s)	22.8	22.8	22.0	79.2	53.2	80.0
Actuated g/C Ratio	0.21	0.21	0.20	0.72	0.48	0.73
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	2.5	2.5	2.5	2.5	2.5	
Lane Grp Cap (vph)	356	310	686	1341	875	1118
v/s Ratio Prot	0.07		0.12	c0.46	0.27	0.40
v/s Ratio Perm		c0.13				
v/c Ratio	0.34	0.63	0.58	0.63	0.56	0.54
Uniform Delay, d1	37.2	39.8	39.8	7.9	20.1	6.8
Progression Factor	1.00	1.00	1.00	1.18	0.25	0.47
Incremental Delay, d2	0.4	3.7	2.4	1.5	1.6	0.2
Delay (s)	37.6	43.4	42.2	10.9	6.6	3.4
Level of Service	D	D	D	B	A	A
Approach Delay (s)	41.2			20.8	4.8	
Approach LOS	D			C	A	

Intersection Summary			
HCM 2000 Control Delay	16.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	57.2%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Intersection: 5: OR43 & McKillican

Movement	EB	EB	WB	WB	SE	SE	NW	NW	B77	B77
Directions Served	L	TR	L	TR	L	TR	L	TR	T	
Maximum Queue (ft)	206	226	165	197	182	504	200	601	254	267
Average Queue (ft)	64	166	115	81	14	397	57	269	80	68
95th Queue (ft)	181	263	184	208	98	590	153	549	212	207
Link Distance (ft)		206		166		445		534	322	322
Upstream Blk Time (%)	0	21	12	16		37		3	0	0
Queuing Penalty (veh)	0	0	0	0		0		30	0	2
Storage Bay Dist (ft)	150		100		180		110			
Storage Blk Time (%)	0	32	45	1		43	2	17		
Queuing Penalty (veh)	0	13	11	1		3	17	12		

Intersection: 6: I-205 SB On Ramp & I-205 SB Off Ramp & OR43

Movement	WB	WB	NB	NB	NB	SB	SB	B77
Directions Served	<L	R	L	T	T	T	TR	T
Maximum Queue (ft)	363	423	280	772	820	376	406	532
Average Queue (ft)	176	128	279	734	751	274	344	259
95th Queue (ft)	346	325	289	828	992	406	461	655
Link Distance (ft)		1108		750	750	322	322	534
Upstream Blk Time (%)				23	43	5	27	9
Queuing Penalty (veh)				111	203	26	152	98
Storage Bay Dist (ft)	540		180					
Storage Blk Time (%)	1	0	81	3				
Queuing Penalty (veh)	4	0	181	15				

Intersection: 8: OR43 & Willamette Falls Dr

Movement	EB	EB	NB	NB	SB	SB
Directions Served	L	R	L	T	T	R
Maximum Queue (ft)	470	255	300	708	359	213
Average Queue (ft)	308	109	282	676	313	133
95th Queue (ft)	495	211	380	779	382	302
Link Distance (ft)	458	458		666	277	
Upstream Blk Time (%)	8	0		63	47	
Queuing Penalty (veh)	20	0		0	313	
Storage Bay Dist (ft)			200			113
Storage Blk Time (%)			12	65	48	
Queuing Penalty (veh)			113	360	103	

Intersection: 10: Willamette Falls Dr & W A St

Movement	EB	EB	WB	WB	SB
Directions Served	LT	T	T	TR	LR
Maximum Queue (ft)	228	79	21	52	246
Average Queue (ft)	74	5	1	2	85
95th Queue (ft)	178	54	21	28	252
Link Distance (ft)	593	593	458	458	585
Upstream Blk Time (%)					2
Queuing Penalty (veh)					0
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 22: I-205 NB Off Ramp

Movement	EB
Directions Served	T
Maximum Queue (ft)	307
Average Queue (ft)	57
95th Queue (ft)	271
Link Distance (ft)	502
Upstream Blk Time (%)	2
Queuing Penalty (veh)	0
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 3005: I-205 NB Off Ramp & OR43

Movement	EB	EB	NB	NB	NB	SB	SB
Directions Served	L	R	L	L	T	T	R
Maximum Queue (ft)	226	248	356	277	316	786	735
Average Queue (ft)	119	127	250	235	276	590	276
95th Queue (ft)	217	287	422	352	356	949	847
Link Distance (ft)	241	241	277	277	277	750	750
Upstream Blk Time (%)	2	11	17	15	35	20	4
Queuing Penalty (veh)	4	17	69	62	142	109	19
Storage Bay Dist (ft)							
Storage Blk Time (%)							
Queuing Penalty (veh)							

Network Summary

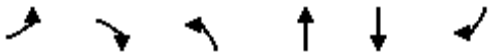
Network wide Queuing Penalty: 2209

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (vph)	109	20	277	164	73	12	3	950	3	81	801	267
Future Volume (vph)	109	20	277	164	73	12	3	950	3	81	801	267
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	0.96		1.00	1.00		1.00	1.00		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.86		1.00	0.98		1.00	1.00		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1540		1805	1854		1703	1792		1787	1799	
Flt Permitted	0.95	1.00		0.95	1.00		0.07	1.00		0.07	1.00	
Satd. Flow (perm)	1770	1540		1805	1854		127	1792		133	1799	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	112	21	286	169	75	12	3	979	3	84	826	275
RTOR Reduction (vph)	0	131	0	0	6	0	0	0	0	0	10	0
Lane Group Flow (vph)	112	176	0	169	81	0	3	982	0	84	1091	0
Confl. Peds. (#/hr)	2		8	8		2	1					1
Confl. Bikes (#/hr)									3			5
Heavy Vehicles (%)	2%	2%	2%	0%	0%	0%	6%	6%	6%	1%	1%	1%
Turn Type	Prot	NA		Prot	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	3	8		7	4		5	2		1	6	
Permitted Phases							2			6		
Actuated Green, G (s)	17.7	15.6		13.2	11.1		57.3	57.3		62.4	62.4	
Effective Green, g (s)	17.7	15.6		13.2	11.1		57.3	57.3		62.4	62.4	
Actuated g/C Ratio	0.16	0.14		0.12	0.10		0.52	0.52		0.57	0.57	
Clearance Time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
Vehicle Extension (s)	2.3	2.3		2.3	2.3		2.3	4.2		2.3	4.2	
Lane Grp Cap (vph)	284	218		216	187		77	933		164	1020	
v/s Ratio Prot	c0.06	c0.11		c0.09	0.04		0.00	c0.55		0.03	c0.61	
v/s Ratio Perm							0.02			0.26		
v/c Ratio	0.39	0.81		0.78	0.43		0.04	1.05		0.51	1.07	
Uniform Delay, d1	41.3	45.7		47.0	46.5		25.2	26.4		47.2	23.8	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		0.93	0.90	
Incremental Delay, d2	0.5	18.5		15.9	0.9		0.1	44.3		1.1	44.5	
Delay (s)	41.9	64.2		62.9	47.4		25.3	70.6		45.0	65.8	
Level of Service	D	E		E	D		C	E		D	E	
Approach Delay (s)		58.2			57.6			70.5			64.3	
Approach LOS		E			E			E			E	

Intersection Summary			
HCM 2000 Control Delay	65.0	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.99		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	104.8%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

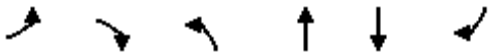
Movement	WBL2	WBL	WBR	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NER
Lane Configurations											
Traffic Volume (vph)	249	0	920	144	229	0	0	1286	105	0	0
Future Volume (vph)	249	0	920	144	229	0	0	1286	105	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	4.5	4.5	4.5			4.5			
Lane Util. Factor		1.00	1.00	1.00	0.95			0.95			
Frpb, ped/bikes		1.00	0.99	1.00	1.00			1.00			
Flpb, ped/bikes		0.99	1.00	1.00	1.00			1.00			
Frt		1.00	0.85	1.00	1.00			0.99			
Flt Protected		0.95	1.00	0.95	1.00			1.00			
Satd. Flow (prot)		1747	1572	1805	3610			3432			
Flt Permitted		0.95	1.00	0.66	1.00			1.00			
Satd. Flow (perm)		1747	1572	1246	3610			3432			
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	262	0	968	152	241	0	0	1354	111	0	0
RTOR Reduction (vph)	0	0	45	0	0	0	0	5	0	0	0
Lane Group Flow (vph)	0	262	923	152	241	0	0	1460	0	0	0
Confl. Peds. (#/hr)	9		9								
Confl. Bikes (#/hr)						3					
Heavy Vehicles (%)	2%	2%	2%	0%	0%	0%	4%	4%	4%	0%	0%
Turn Type	Perm	Prot	custom	pm+pt	NA			NA			
Protected Phases		4	5	1	6			2			
Permitted Phases	4		4	6							
Actuated Green, G (s)		19.9	81.9	14.1	14.1			68.1			
Effective Green, g (s)		19.9	81.9	14.1	14.1			68.1			
Actuated g/C Ratio		0.18	0.74	0.13	0.13			0.62			
Clearance Time (s)		5.0	4.5	4.5	4.5			4.5			
Vehicle Extension (s)		2.3	2.3	2.3	4.2			4.2			
Lane Grp Cap (vph)		316	1234	200	462			2124			
v/s Ratio Prot			c0.42	c0.06	0.07			0.43			
v/s Ratio Perm		0.15	0.17	c0.04							
v/c Ratio		0.83	0.75	0.76	0.52			0.69			
Uniform Delay, d1		43.4	8.1	45.9	44.8			13.9			
Progression Factor		1.00	1.00	1.02	1.01			0.45			
Incremental Delay, d2		15.8	2.3	14.4	1.5			0.4			
Delay (s)		59.2	10.4	61.0	46.9			6.7			
Level of Service		E	B	E	D			A			
Approach Delay (s)		20.8			52.3			6.7		0.0	
Approach LOS		C			D			A		A	

Intersection Summary			
HCM 2000 Control Delay	18.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	77.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	278	499	320	594	594	265
Future Volume (vph)	278	499	320	594	594	265
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	1770	1863	1863	1561
Flt Permitted	0.95	1.00	0.25	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	473	1863	1863	1561
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	293	525	337	625	625	279
RTOR Reduction (vph)	0	336	0	0	0	69
Lane Group Flow (vph)	293	189	337	625	625	210
Confl. Bikes (#/hr)						5
Turn Type	Prot	Perm	pm+pt	NA	NA	Perm
Protected Phases	8		1	6	2	
Permitted Phases		8	6			2
Actuated Green, G (s)	22.4	22.4	78.6	78.6	59.6	59.6
Effective Green, g (s)	22.4	22.4	78.6	78.6	59.6	59.6
Actuated g/C Ratio	0.20	0.20	0.71	0.71	0.54	0.54
Clearance Time (s)	4.0	4.0	4.0	5.0	5.0	5.0
Vehicle Extension (s)	2.5	2.5	2.5	2.5	2.5	2.5
Lane Grp Cap (vph)	360	322	514	1331	1009	845
v/s Ratio Prot	c0.17		c0.09	0.34	0.34	
v/s Ratio Perm		0.12	c0.38			0.13
v/c Ratio	0.81	0.59	0.66	0.47	0.62	0.25
Uniform Delay, d1	41.8	39.6	10.8	6.7	17.4	13.3
Progression Factor	1.00	1.00	1.00	1.00	0.56	0.14
Incremental Delay, d2	12.9	2.3	2.7	1.2	0.9	0.1
Delay (s)	54.7	41.9	13.5	7.9	10.6	2.0
Level of Service	D	D	B	A	B	A
Approach Delay (s)	46.5			9.9	8.0	
Approach LOS	D			A	A	

Intersection Summary			
HCM 2000 Control Delay	20.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	13.0
Intersection Capacity Utilization	75.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	30	163	529	343	695	840
Future Volume (vph)	30	163	529	343	695	840
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	0.97	1.00	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1805	1615	3400	1845	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	1805	1615	3400	1845	3539	1583
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	31	166	540	350	709	857
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	31	166	540	350	709	857
Heavy Vehicles (%)	0%	0%	3%	3%	2%	2%
Turn Type	Prot	Perm	Prot	NA	NA	pt+ov
Protected Phases	8		1	6	2	2 8
Permitted Phases		8				
Actuated Green, G (s)	18.0	18.0	28.2	83.0	50.8	72.8
Effective Green, g (s)	18.0	18.0	28.2	83.0	50.8	68.8
Actuated g/C Ratio	0.16	0.16	0.26	0.75	0.46	0.63
Clearance Time (s)	4.0	4.0	4.0	5.0	5.0	
Vehicle Extension (s)	2.5	2.5	2.5	4.5	4.5	
Lane Grp Cap (vph)	295	264	871	1392	1634	990
v/s Ratio Prot	0.02		c0.16	0.19	0.20	c0.54
v/s Ratio Perm		0.10				
v/c Ratio	0.11	0.63	0.62	0.25	0.43	0.87
Uniform Delay, d1	39.1	42.9	36.2	4.1	19.9	16.8
Progression Factor	1.00	1.00	0.93	1.11	1.01	0.50
Incremental Delay, d2	0.1	4.0	2.9	0.4	0.2	6.3
Delay (s)	39.3	46.9	36.5	4.9	20.4	14.7
Level of Service	D	D	D	A	C	B
Approach Delay (s)	45.7			24.1	17.3	
Approach LOS	D			C	B	

Intersection Summary			
HCM 2000 Control Delay	21.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	13.0
Intersection Capacity Utilization	74.6%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Intersection: 5: OR43 & McKillican

Movement	EB	EB	WB	WB	SE	SE	NW	NW	B77	B77
Directions Served	L	TR	L	TR	L	TR	L	TR	T	
Maximum Queue (ft)	206	256	166	185	150	498	210	608	329	346
Average Queue (ft)	157	226	154	173	9	426	102	440	172	175
95th Queue (ft)	284	243	184	214	79	616	211	773	359	389
Link Distance (ft)		206		166		445		534	322	322
Upstream Blk Time (%)	2	87	34	79		37		14	1	3
Queuing Penalty (veh)	0	0	0	0		0		156	5	16
Storage Bay Dist (ft)	150		100		180		110			
Storage Blk Time (%)	5	91	88	25		39	13	23		
Queuing Penalty (veh)	16	99	75	41		1	140	19		

Intersection: 6: I-205 SB On Ramp & I-205 SB Off Ramp & OR43

Movement	WB	WB	NB	NB	NB	SB	SB	B77
Directions Served	<L	R	L	T	T	T	TR	T
Maximum Queue (ft)	550	854	239	230	188	307	401	543
Average Queue (ft)	289	293	125	95	90	148	358	277
95th Queue (ft)	520	729	221	185	155	255	455	647
Link Distance (ft)		1108		736	736	322	322	534
Upstream Blk Time (%)		1				0	24	2
Queuing Penalty (veh)		0				1	169	34
Storage Bay Dist (ft)	540		180					
Storage Blk Time (%)	1	4	6	0				
Queuing Penalty (veh)	11	11	6	0				

Intersection: 8: OR43 & Willamette Falls Dr

Movement	EB	EB	NB	NB	SB	SB
Directions Served	L	R	L	T	T	R
Maximum Queue (ft)	302	390	299	517	286	213
Average Queue (ft)	158	197	183	220	249	124
95th Queue (ft)	261	331	305	458	316	296
Link Distance (ft)	458	458		666	263	
Upstream Blk Time (%)		0		1	10	
Queuing Penalty (veh)		0		0	89	
Storage Bay Dist (ft)			200			113
Storage Blk Time (%)			13	4	41	
Queuing Penalty (veh)			75	13	110	

Intersection: 10: Willamette Falls Dr & W A St

Movement	EB	EB	WB	SB
Directions Served	LT	T	TR	LR
Maximum Queue (ft)	115	15	2	511
Average Queue (ft)	36	1	0	184
95th Queue (ft)	88	10	2	425
Link Distance (ft)	593	593	458	585
Upstream Blk Time (%)				2
Queuing Penalty (veh)				0
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 22: I-205 NB Off Ramp

Movement	EB
Directions Served	T
Maximum Queue (ft)	124
Average Queue (ft)	17
95th Queue (ft)	109
Link Distance (ft)	502
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 3005: I-205 NB Off Ramp & OR43

Movement	EB	EB	NB	NB	NB	SB	SB	SB
Directions Served	L	R	L	L	T	T	T	R
Maximum Queue (ft)	150	237	243	272	275	756	772	600
Average Queue (ft)	31	140	168	184	112	495	501	352
95th Queue (ft)	97	241	240	254	246	789	813	717
Link Distance (ft)		228		263	263	736	736	
Upstream Blk Time (%)	0	6	0	0	0	3	5	
Queuing Penalty (veh)	0	13	0	2	2	23	35	
Storage Bay Dist (ft)	225		145					500
Storage Blk Time (%)	0	7	11	22			26	1
Queuing Penalty (veh)	0	2	29	57			220	3

Network Summary

Network wide Queuing Penalty: 1475

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (vph)	41	22	207	116	18	6	7	799	6	71	855	152
Future Volume (vph)	41	22	207	116	18	6	7	799	6	71	855	152
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.86		1.00	0.96		1.00	1.00		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1805	1642		1719	1744		1736	1825		1703	1742	
Flt Permitted	0.95	1.00		0.95	1.00		0.10	1.00		0.10	1.00	
Satd. Flow (perm)	1805	1642		1719	1744		179	1825		176	1742	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	43	23	218	122	19	6	7	841	6	75	900	160
RTOR Reduction (vph)	0	167	0	0	5	0	0	1	0	0	6	0
Lane Group Flow (vph)	43	74	0	122	20	0	7	846	0	75	1054	0
Confl. Peds. (#/hr)							10		1	1		10
Confl. Bikes (#/hr)									3			3
Heavy Vehicles (%)	0%	0%	0%	5%	5%	5%	4%	4%	4%	6%	6%	6%
Turn Type	Prot	NA		Prot	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	3	8		7	4		5	2		1	6	
Permitted Phases							2			6		
Actuated Green, G (s)	10.4	9.4		15.0	14.0		41.6	41.6		46.8	46.8	
Effective Green, g (s)	10.4	9.4		15.0	14.0		41.6	41.6		46.8	46.8	
Actuated g/C Ratio	0.12	0.10		0.17	0.16		0.46	0.46		0.52	0.52	
Clearance Time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
Vehicle Extension (s)	2.3	2.3		2.3	2.3		2.3	4.2		2.3	4.2	
Lane Grp Cap (vph)	208	171		286	271		96	843		193	905	
v/s Ratio Prot	0.02	c0.04		c0.07	0.01		0.00	c0.46		0.03	c0.60	
v/s Ratio Perm							0.03			0.18		
v/c Ratio	0.21	0.43		0.43	0.07		0.07	1.00		0.39	1.16	
Uniform Delay, d1	36.1	37.8		33.6	32.5		20.6	24.2		35.2	21.6	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		0.69	1.10	
Incremental Delay, d2	0.3	1.0		0.6	0.1		0.2	32.0		0.7	85.3	
Delay (s)	36.4	38.8		34.2	32.5		20.8	56.2		25.1	109.1	
Level of Service	D	D		C	C		C	E		C	F	
Approach Delay (s)		38.4			33.9			55.9			103.5	
Approach LOS		D			C			E			F	

Intersection Summary			
HCM 2000 Control Delay	74.9	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	90.6%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL2	WBL	WBR	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NER
Lane Configurations											
Traffic Volume (vph)	164	0	631	506	447	0	0	912	210	0	0
Future Volume (vph)	164	0	631	506	447	0	0	912	210	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	4.5	4.5	4.5			4.5			
Lane Util. Factor		1.00	1.00	1.00	0.95			0.95			
Frpb, ped/bikes		1.00	1.00	1.00	1.00			1.00			
Flpb, ped/bikes		1.00	1.00	1.00	1.00			1.00			
Frt		1.00	0.85	1.00	1.00			0.97			
Flt Protected		0.95	1.00	0.95	1.00			1.00			
Satd. Flow (prot)		1687	1509	1752	3505			3390			
Flt Permitted		0.95	1.00	0.21	1.00			1.00			
Satd. Flow (perm)		1687	1509	382	3505			3390			
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	173	0	664	533	471	0	0	960	221	0	0
RTOR Reduction (vph)	0	0	156	0	0	0	0	22	0	0	0
Lane Group Flow (vph)	0	173	508	533	471	0	0	1159	0	0	0
Confl. Peds. (#/hr)				1					1		
Confl. Bikes (#/hr)						3			3		
Heavy Vehicles (%)	7%	7%	7%	3%	3%	3%	3%	3%	3%	0%	0%
Turn Type	Perm	Prot	custom	pm+pt	NA			NA			
Protected Phases		4	5	1	6			2			
Permitted Phases	4		4	6							
Actuated Green, G (s)		11.4	56.7	54.8	19.3			29.1			
Effective Green, g (s)		11.4	56.7	54.8	19.3			29.1			
Actuated g/C Ratio		0.13	0.63	0.61	0.21			0.32			
Clearance Time (s)		5.0	4.5	4.5	4.5			4.5			
Vehicle Extension (s)		2.3	2.3	2.3	4.2			4.2			
Lane Grp Cap (vph)		213	1026	772	751			1096			
v/s Ratio Prot			0.25	c0.27	0.13			c0.34			
v/s Ratio Perm		0.10	0.09	0.15							
v/c Ratio		0.81	0.49	0.69	0.63			1.06			
Uniform Delay, d1		38.3	9.0	19.3	32.1			30.4			
Progression Factor		1.00	1.00	1.00	1.00			0.79			
Incremental Delay, d2		19.8	0.2	2.3	2.0			38.5			
Delay (s)		58.1	9.2	21.7	34.0			62.5			
Level of Service		E	A	C	C			E			
Approach Delay (s)		19.3			27.5			62.5		0.0	
Approach LOS		B			C			E		A	

Intersection Summary			
HCM 2000 Control Delay	38.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	80.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	270	246	555	950	457	215
Future Volume (Veh/h)	270	246	555	950	457	215
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	284	259	584	1000	481	226
Pedestrians				3	3	
Lane Width (ft)				12.0	12.0	
Walking Speed (ft/s)				3.5	3.5	
Percent Blockage				0	0	
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	2652	484	481			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2652	484	481			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	0	55	46			
cM capacity (veh/h)	12	581	1087			

Direction, Lane #	EB 1	EB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	284	259	584	1000	481	226
Volume Left	284	0	584	0	0	0
Volume Right	0	259	0	0	0	226
cSH	12	581	1087	1700	1700	1700
Volume to Capacity	24.32	0.45	0.54	0.59	0.28	0.13
Queue Length 95th (ft)	Err	57	83	0	0	0
Control Delay (s)	Err	16.1	12.1	0.0	0.0	0.0
Lane LOS	F	C	B			
Approach Delay (s)	5237.3		4.5		0.0	
Approach LOS	F					

Intersection Summary				
Average Delay	1006.0			
Intersection Capacity Utilization	79.8%	ICU Level of Service	D	
Analysis Period (min)	15			

Intersection: 5: OR43 & McKillican

Movement	EB	EB	WB	WB	SE	SE	NW	NW	B77	B77
Directions Served	L	TR	L	TR	L	TR	L	TR	T	
Maximum Queue (ft)	162	223	157	159	202	503	209	641	320	323
Average Queue (ft)	43	135	82	38	12	460	74	514	173	172
95th Queue (ft)	118	222	145	112	92	528	191	749	376	396
Link Distance (ft)		206		166		445		534	322	322
Upstream Blk Time (%)	0	3	0	1		56		21	1	3
Queuing Penalty (veh)	0	0	0	0		0		223	7	17
Storage Bay Dist (ft)	150		100		180		110			
Storage Blk Time (%)	0	9	10	0		54	1	33		
Queuing Penalty (veh)	0	4	3	0		4	9	24		

Intersection: 6: I-205 SB On Ramp & I-205 SB Off Ramp & OR43

Movement	WB	WB	NB	NB	NB	SB	SB	B77
Directions Served	<L	R	L	T	T	T	TR	T
Maximum Queue (ft)	443	635	358	446	365	388	417	546
Average Queue (ft)	152	242	246	212	147	306	359	270
95th Queue (ft)	345	563	368	387	295	404	449	652
Link Distance (ft)		1108		669	669	322	322	534
Upstream Blk Time (%)		0		0	0	6	26	3
Queuing Penalty (veh)		0		0	0	33	145	29
Storage Bay Dist (ft)	540		270					
Storage Blk Time (%)		3	19	8				
Queuing Penalty (veh)		5	42	39				

Intersection: 8: OR43 & Willamette Falls Dr

Movement	EB	EB	NB	NB	SB
Directions Served	L	R	L	T	T
Maximum Queue (ft)	500	496	289	505	24
Average Queue (ft)	466	232	139	30	1
95th Queue (ft)	482	580	251	235	11
Link Distance (ft)	458	458		666	182
Upstream Blk Time (%)	92	17		0	
Queuing Penalty (veh)	237	43		0	
Storage Bay Dist (ft)			200		
Storage Blk Time (%)			4	0	
Queuing Penalty (veh)			38	0	

Intersection: 10: Willamette Falls Dr & W A St

Movement	EB	EB	WB	WB	SB
Directions Served	LT	T	T	TR	LR
Maximum Queue (ft)	638	626	84	95	603
Average Queue (ft)	607	607	7	8	582
95th Queue (ft)	628	624	82	86	626
Link Distance (ft)	593	593	458	458	585
Upstream Blk Time (%)	98	95	0	0	96
Queuing Penalty (veh)	0	0	0	0	0
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 22: I-205 NB Off Ramp

Movement	EB
Directions Served	T
Maximum Queue (ft)	18
Average Queue (ft)	1
95th Queue (ft)	13
Link Distance (ft)	502
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 3005: I-205 NB Off Ramp & OR43

Movement	EB	NB	NB	SB	SB
Directions Served	LR	LT	T	T	R
Maximum Queue (ft)	151	182	191	141	89
Average Queue (ft)	61	63	16	32	3
95th Queue (ft)	117	143	95	102	74
Link Distance (ft)	161	182	182	669	669
Upstream Blk Time (%)	0	0	0		0
Queuing Penalty (veh)	1	1	1		0
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Network Summary

Network wide Queuing Penalty: 907

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (vph)	109	20	277	164	73	12	3	950	3	81	801	267
Future Volume (vph)	109	20	277	164	73	12	3	950	3	81	801	267
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	0.96		1.00	1.00		1.00	1.00		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.86		1.00	0.98		1.00	1.00		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1540		1805	1854		1703	1792		1787	1800	
Flt Permitted	0.95	1.00		0.95	1.00		0.06	1.00		0.07	1.00	
Satd. Flow (perm)	1770	1540		1805	1854		116	1792		135	1800	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	112	21	286	169	75	12	3	979	3	84	826	275
RTOR Reduction (vph)	0	145	0	0	5	0	0	0	0	0	10	0
Lane Group Flow (vph)	112	162	0	169	82	0	3	982	0	84	1091	0
Confl. Peds. (#/hr)	2		8	8		2	1					1
Confl. Bikes (#/hr)									3			5
Heavy Vehicles (%)	2%	2%	2%	0%	0%	0%	6%	6%	6%	1%	1%	1%
Turn Type	Prot	NA		Prot	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	3	8		7	4		5	2		1	6	
Permitted Phases							2			6		
Actuated Green, G (s)	14.4	12.8		11.2	9.6		62.5	62.5		67.3	67.3	
Effective Green, g (s)	14.4	12.8		11.2	9.6		62.5	62.5		67.3	67.3	
Actuated g/C Ratio	0.13	0.12		0.10	0.09		0.57	0.57		0.61	0.61	
Clearance Time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
Vehicle Extension (s)	2.3	2.3		2.3	2.3		2.3	4.2		2.3	4.2	
Lane Grp Cap (vph)	231	179		183	161		76	1018		165	1101	
v/s Ratio Prot	c0.06	c0.11		c0.09	0.04		0.00	c0.55		0.03	c0.61	
v/s Ratio Perm							0.02			0.29		
v/c Ratio	0.48	0.91		0.92	0.51		0.04	0.96		0.51	0.99	
Uniform Delay, d1	44.4	48.0		49.0	47.9		25.5	22.7		42.8	21.0	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		0.92	0.88	
Incremental Delay, d2	0.9	40.9		44.7	1.5		0.1	20.9		1.0	20.6	
Delay (s)	45.3	88.9		93.7	49.4		25.6	43.6		40.2	39.1	
Level of Service	D	F		F	D		C	D		D	D	
Approach Delay (s)		77.2			78.6			43.5			39.2	
Approach LOS		E			E			D			D	

Intersection Summary			
HCM 2000 Control Delay	49.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	104.8%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL2	WBL	WBR	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NER
Lane Configurations											
Traffic Volume (vph)	249	0	920	144	229	0	0	1286	105	0	0
Future Volume (vph)	249	0	920	144	229	0	0	1286	105	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	4.5	4.5	4.5			4.5			
Lane Util. Factor		1.00	1.00	1.00	0.95			0.95			
Frpb, ped/bikes		1.00	0.99	1.00	1.00			1.00			
Flpb, ped/bikes		0.99	1.00	1.00	1.00			1.00			
Frt		1.00	0.85	1.00	1.00			0.99			
Flt Protected		0.95	1.00	0.95	1.00			1.00			
Satd. Flow (prot)		1747	1572	1805	3610			3432			
Flt Permitted		0.95	1.00	0.74	1.00			1.00			
Satd. Flow (perm)		1747	1572	1407	3610			3432			
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	262	0	968	152	241	0	0	1354	111	0	0
RTOR Reduction (vph)	0	0	51	0	0	0	0	5	0	0	0
Lane Group Flow (vph)	0	262	917	152	241	0	0	1460	0	0	0
Confl. Peds. (#/hr)	9		9								
Confl. Bikes (#/hr)						3					
Heavy Vehicles (%)	2%	2%	2%	0%	0%	0%	4%	4%	4%	0%	0%
Turn Type	Perm	Prot	custom	pm+pt	NA			NA			
Protected Phases		4	5	1	6			2			
Permitted Phases	4		4	6							
Actuated Green, G (s)		19.9	81.9	14.1	14.1			67.4			
Effective Green, g (s)		19.9	81.9	14.1	14.1			67.4			
Actuated g/C Ratio		0.18	0.74	0.13	0.13			0.61			
Clearance Time (s)		5.0	4.5	4.5	4.5			4.5			
Vehicle Extension (s)		2.3	2.3	2.3	4.2			4.2			
Lane Grp Cap (vph)		316	1234	211	462			2102			
v/s Ratio Prot			c0.42	c0.06	0.07			0.43			
v/s Ratio Perm		0.15	0.16	c0.04							
v/c Ratio		0.83	0.74	0.72	0.52			0.69			
Uniform Delay, d1		43.4	8.0	45.7	44.8			14.4			
Progression Factor		1.00	1.00	1.00	1.00			0.54			
Incremental Delay, d2		15.8	2.3	10.4	1.5			0.5			
Delay (s)		59.2	10.3	56.1	46.3			8.3			
Level of Service		E	B	E	D			A			
Approach Delay (s)		20.7			50.1			8.3		0.0	
Approach LOS		C			D			A		A	

Intersection Summary			
HCM 2000 Control Delay	18.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	77.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	278	499	320	594	594	265
Future Volume (Veh/h)	278	499	320	594	594	265
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	293	525	337	625	625	279
Pedestrians				3	3	
Lane Width (ft)				12.0	12.0	
Walking Speed (ft/s)				3.5	3.5	
Percent Blockage				0	0	
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1927	628	625			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1927	628	625			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	0	0	65			
cM capacity (veh/h)	47	481	956			

Direction, Lane #	EB 1	EB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	293	525	337	625	625	279
Volume Left	293	0	337	0	0	0
Volume Right	0	525	0	0	0	279
cSH	47	481	956	1700	1700	1700
Volume to Capacity	6.20	1.09	0.35	0.37	0.37	0.16
Queue Length 95th (ft)	Err	425	40	0	0	0
Control Delay (s)	Err	96.7	10.8	0.0	0.0	0.0
Lane LOS	F	F	B			
Approach Delay (s)	3643.6		3.8		0.0	
Approach LOS	F					

Intersection Summary				
Average Delay	1111.8			
Intersection Capacity Utilization	74.4%	ICU Level of Service	D	
Analysis Period (min)	15			

Intersection: 5: OR43 & McKillican

Movement	EB	EB	WB	WB	SE	SE	NW	NW	B77	B77
Directions Served	L	TR	L	TR	L	TR	L	TR	T	
Maximum Queue (ft)	206	249	166	185	72	500	209	611	310	335
Average Queue (ft)	157	226	155	172	5	400	95	418	117	109
95th Queue (ft)	290	240	181	218	52	628	196	744	283	297
Link Distance (ft)		206		166		445		534	322	322
Upstream Blk Time (%)	2	86	33	79		20		10	0	1
Queuing Penalty (veh)	0	0	0	0		0		115	0	4
Storage Bay Dist (ft)	150		100		180		110			
Storage Blk Time (%)	4	89	87	25		27	11	22		
Queuing Penalty (veh)	12	97	74	41		1	112	18		

Intersection: 6: I-205 SB On Ramp & I-205 SB Off Ramp & OR43

Movement	WB	WB	NB	NB	NB	SB	SB	B77
Directions Served	<L	R	L	T	T	T	TR	T
Maximum Queue (ft)	433	475	184	161	169	352	392	185
Average Queue (ft)	226	181	92	74	79	221	262	14
95th Queue (ft)	407	433	162	131	135	365	386	109
Link Distance (ft)		1108		669	669	322	322	534
Upstream Blk Time (%)		0				1	2	
Queuing Penalty (veh)		0				5	14	
Storage Bay Dist (ft)	540		180					
Storage Blk Time (%)	0	1	1	0				
Queuing Penalty (veh)	1	2	1	0				

Intersection: 8: OR43 & Willamette Falls Dr

Movement	EB	EB	NB	NB	SB
Directions Served	L	R	L	T	T
Maximum Queue (ft)	493	509	207	40	39
Average Queue (ft)	467	370	89	1	3
95th Queue (ft)	482	647	159	30	19
Link Distance (ft)	458	458		666	182
Upstream Blk Time (%)	85	31			
Queuing Penalty (veh)	332	121			
Storage Bay Dist (ft)			200		
Storage Blk Time (%)			1	0	
Queuing Penalty (veh)			4	0	

Intersection: 10: Willamette Falls Dr & W A St

Movement	EB	EB	WB	WB	SB
Directions Served	LT	T	T	TR	LR
Maximum Queue (ft)	641	649	68	99	613
Average Queue (ft)	595	593	4	5	587
95th Queue (ft)	719	739	45	55	659
Link Distance (ft)	593	593	458	458	585
Upstream Blk Time (%)	88	86			97
Queuing Penalty (veh)	0	0			0
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 22: I-205 NB Off Ramp

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 3005: I-205 NB Off Ramp & OR43

Movement	EB	NB	NB	SB	SB
Directions Served	LR	LT	T	T	R
Maximum Queue (ft)	83	165	56	214	8
Average Queue (ft)	36	37	2	51	0
95th Queue (ft)	76	112	35	142	6
Link Distance (ft)	161	182	182	669	669
Upstream Blk Time (%)		0	0		
Queuing Penalty (veh)		0	0		
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Network Summary

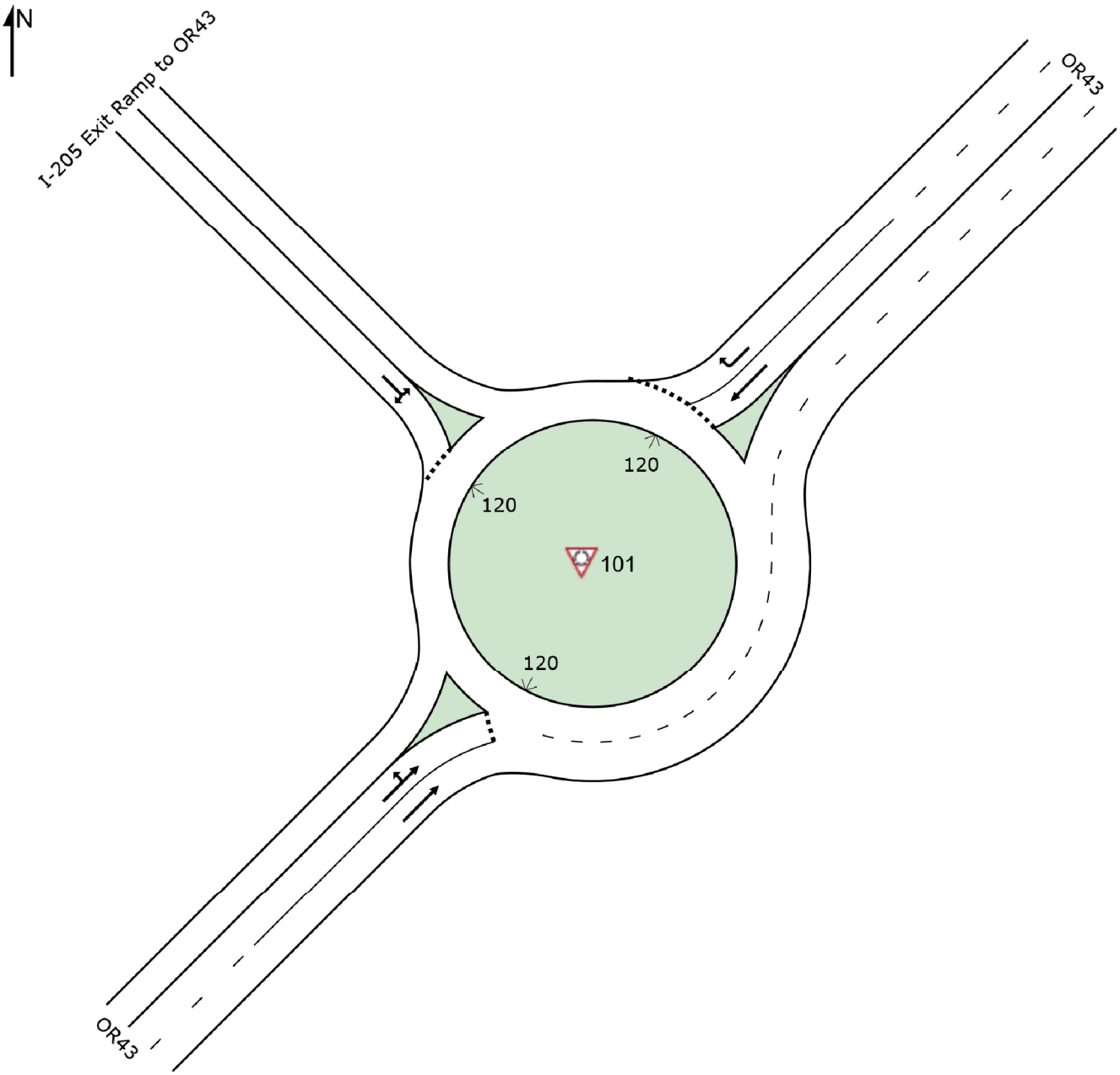
Network wide Queuing Penalty: 954

Appendix D Sidra Roundabout Analysis Worksheets

SITE LAYOUT

Site: 101 [1 lane onramp 2045 PM (adopted)]

New Site
Roundabout



MOVEMENT SUMMARY

Site: 101 [1 lane onramp 2045 PM (adopted)]

New Site
Roundabout

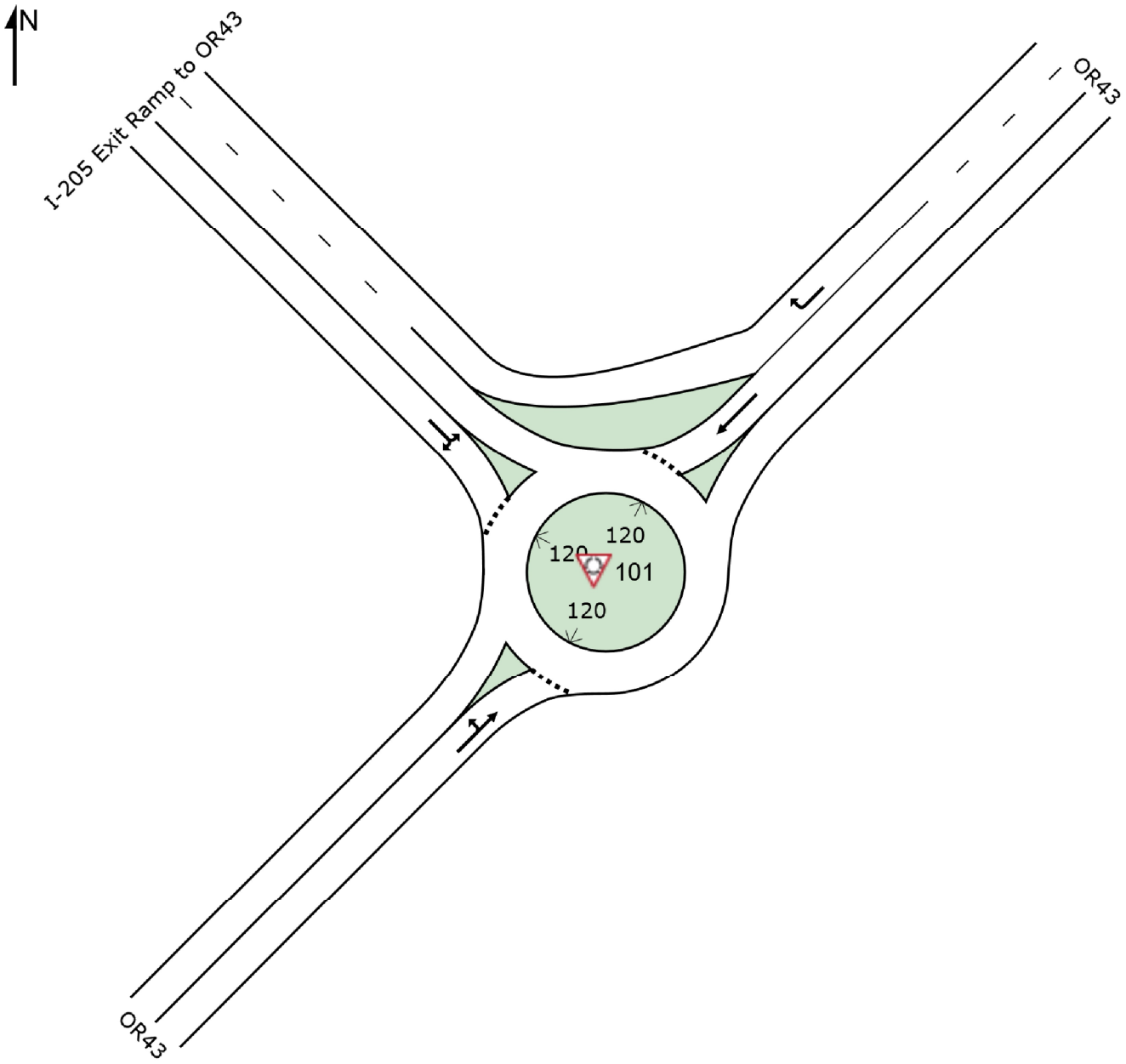
Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
NorthEast: OR43											
8	T1	709	2.0	0.783	10.1	LOS A	8.1	206.7	0.90	1.12	30.7
18	R2	857	2.0	0.946	20.7	LOS D	18.4	468.4	1.00	1.56	24.7
Approach		1566	2.0	0.946	15.9	LOS B	18.4	468.4	0.96	1.36	27.2
NorthWest: I-205 Exit Ramp to OR43											
1	L2	31	0.0	0.273	14.0	LOS A	1.2	29.8	0.66	0.82	35.2
16	R2	166	0.0	0.273	7.6	LOS A	1.2	29.8	0.66	0.82	34.6
Approach		197	0.0	0.273	8.5	LOS A	1.2	29.8	0.66	0.82	34.7
SouthWest: OR43											
7	L2	540	3.0	0.382	10.2	LOS A	2.2	57.1	0.15	0.61	35.0
4	T1	350	3.0	0.182	3.7	LOS A	0.0	0.0	0.00	0.34	38.3
Approach		890	3.0	0.382	7.7	LOS A	2.2	57.1	0.09	0.51	36.0
All Vehicles		2653	2.2	0.946	12.6	LOS B	18.4	468.4	0.64	1.04	30.6

Site Level of Service (LOS) Method: Delay & Degree of Saturation (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
Intersection and Approach LOS values are based on average delay for all movements (v/c not used).
Roundabout Capacity Model: US HCM 6.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SITE LAYOUT

Site: 101 [2 lane onramp 2045 AM NB 1 lane test]

New Site
Roundabout



MOVEMENT SUMMARY

Site: 101 [2 lane onramp 2045 AM NB 1 lane test]

New Site
Roundabout

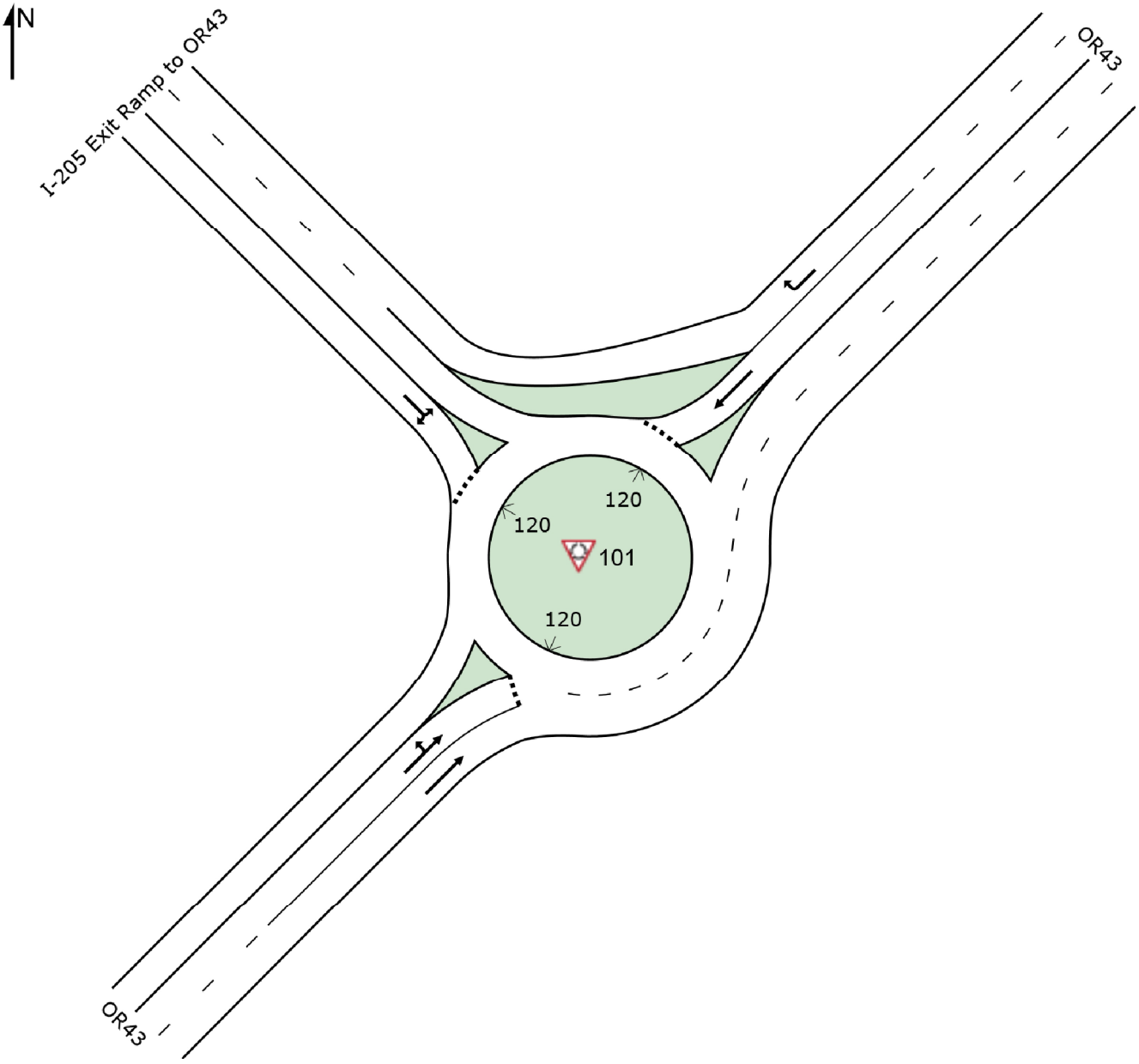
Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
NorthEast: OR43											
8	T1	490	5.0	0.488	4.8	LOS A	2.7	71.0	0.61	0.53	32.6
18	R2	608	5.0	0.381	2.5	LOS A	0.0	0.0	0.00	0.34	33.6
Approach		1098	5.0	0.488	3.6	LOS A	2.7	71.0	0.27	0.42	33.1
NorthWest: I-205 Exit Ramp to OR43											
1	L2	122	5.0	0.379	13.0	LOS A	1.8	47.2	0.63	0.81	34.4
16	R2	196	5.0	0.379	6.6	LOS A	1.8	47.2	0.63	0.81	34.3
Approach		318	5.0	0.379	9.1	LOS A	1.8	47.2	0.63	0.81	34.3
SouthWest: OR43											
7	L2	396	2.0	0.991	25.3	LOS E	44.2	1122.9	1.00	0.91	30.4
4	T1	850	2.0	0.991	18.9	LOS E	44.2	1122.9	1.00	0.91	28.1
Approach		1246	2.0	0.991	21.0	LOS C	44.2	1122.9	1.00	0.91	28.9
All Vehicles		2662	3.6	0.991	12.4	LOS B	44.2	1122.9	0.66	0.70	31.1

Site Level of Service (LOS) Method: Delay & Degree of Saturation (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
Intersection and Approach LOS values are based on average delay for all movements (v/c not used).
Roundabout Capacity Model: US HCM 6.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SITE LAYOUT

Site: 101 [2 lane onramp 2045 AM (adopted)]

New Site
Roundabout



Organisation: HDR | Created: Friday, August 10, 2018 11:46:24 AM
Project: c:\pwworking\west01\d0683504\Sidra Roundabout_OR43_exitramp_20180718.sip7

MOVEMENT SUMMARY

Site: 101 [2 lane onramp 2045 AM (adopted)]

New Site
Roundabout

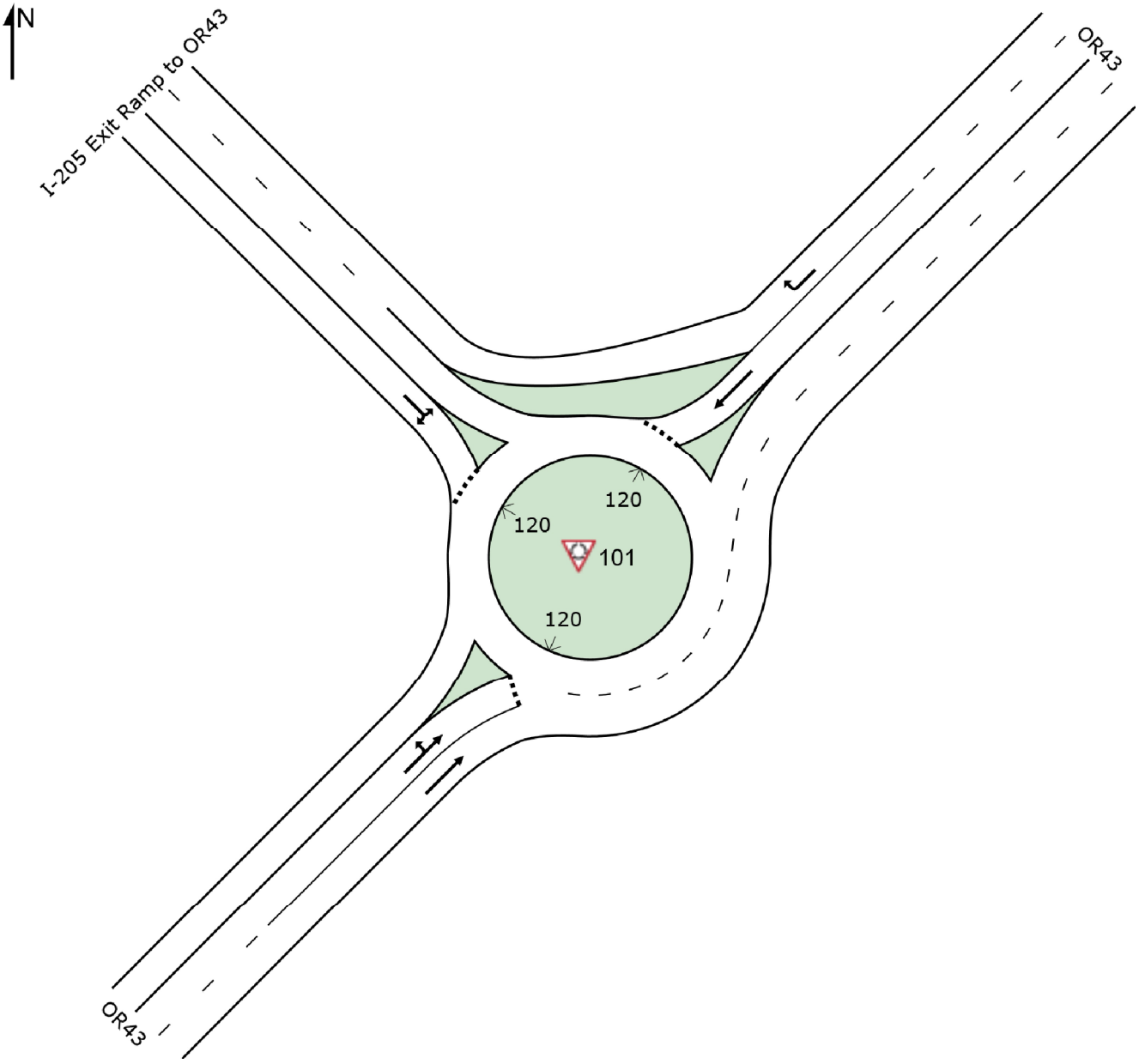
Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
NorthEast: OR43											
8	T1	490	5.0	0.488	4.8	LOS A	2.7	71.0	0.61	0.53	32.6
18	R2	608	5.0	0.381	2.5	LOS A	0.0	0.0	0.00	0.34	33.6
Approach		1098	5.0	0.488	3.6	LOS A	2.7	71.0	0.27	0.42	33.1
NorthWest: I-205 Exit Ramp to OR43											
1	L2	122	5.0	0.379	13.0	LOS A	1.8	47.2	0.63	0.81	34.4
16	R2	196	5.0	0.379	6.6	LOS A	1.8	47.2	0.63	0.81	34.3
Approach		318	5.0	0.379	9.1	LOS A	1.8	47.2	0.63	0.81	34.3
SouthWest: OR43											
7	L2	396	2.0	0.384	10.7	LOS A	2.2	54.8	0.34	0.60	35.3
4	T1	850	2.0	0.384	3.8	LOS A	2.2	54.8	0.04	0.38	37.7
Approach		1246	2.0	0.384	6.0	LOS A	2.2	54.8	0.14	0.45	36.8
All Vehicles		2662	3.6	0.488	5.4	LOS A	2.7	71.0	0.25	0.48	35.0

Site Level of Service (LOS) Method: Delay & Degree of Saturation (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
Intersection and Approach LOS values are based on average delay for all movements (v/c not used).
Roundabout Capacity Model: US HCM 6.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SITE LAYOUT

Site: 101 [2 lane onramp 2045 PM (adopted)]

New Site
Roundabout



MOVEMENT SUMMARY

Site: 101 [2 lane onramp 2045 PM (adopted)]

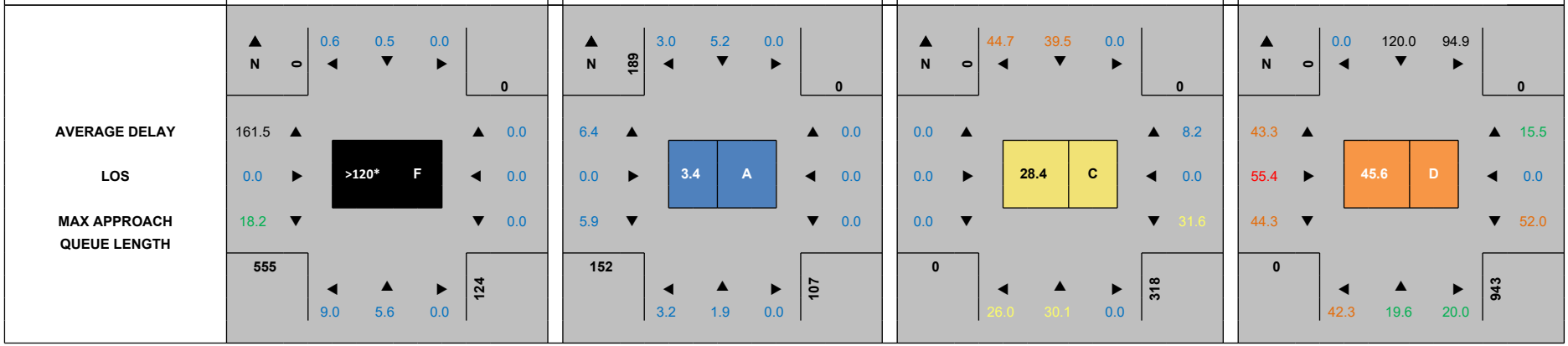
New Site
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
NorthEast: OR43											
8	T1	709	2.0	0.783	10.1	LOS A	8.1	206.7	0.90	1.12	30.7
18	R2	857	2.0	0.522	2.5	LOS A	0.0	0.0	0.00	0.34	33.6
Approach		1566	2.0	0.783	6.0	LOS A	8.1	206.7	0.41	0.69	32.2
NorthWest: I-205 Exit Ramp to OR43											
1	L2	31	0.0	0.273	14.0	LOS A	1.2	29.8	0.66	0.82	35.2
16	R2	166	0.0	0.273	7.6	LOS A	1.2	29.8	0.66	0.82	34.6
Approach		197	0.0	0.273	8.5	LOS A	1.2	29.8	0.66	0.82	34.7
SouthWest: OR43											
7	L2	540	3.0	0.382	10.2	LOS A	2.2	57.1	0.15	0.61	35.0
4	T1	350	3.0	0.182	3.7	LOS A	0.0	0.0	0.00	0.34	38.3
Approach		890	3.0	0.382	7.7	LOS A	2.2	57.1	0.09	0.51	36.0
All Vehicles		2653	2.2	0.783	6.7	LOS A	8.1	206.7	0.32	0.64	33.8

Site Level of Service (LOS) Method: Delay & Degree of Saturation (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
Intersection and Approach LOS values are based on average delay for all movements (v/c not used).
Roundabout Capacity Model: US HCM 6.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Appendix E Vissim Analysis Worksheets

2045 Build AM - Roundabout	1 OR 43 & Willamette Falls Drive				2 OR 43 & I-205 NB Ramps				3 OR 43 & I-205 SB Ramps				4 OR 43 & McKillican Street			
	MVMNT	DELAY	LOS	QUEUE	MVMNT	DELAY	LOS	QUEUE	MVMNT	DELAY	LOS	QUEUE	MVMNT	DELAY	LOS	QUEUE
	ALL	18.0	B	555	ALL	3.4	A	206	ALL	28.4	C	1015	ALL	45.6	D	1201
	NBL	9.0	A	124	NBL	3.2	A	107	NBL	26.0	C	318	NBL	42.3	D	118
	NBT	5.6	A	0	NBT	1.9	A	107	NBT	30.1	C	228	NBT	19.6	B	910
	NBR	0.0	A	0	NBR	0.0	A	0	NBR	0.0	A	0	NBR	20.0	B	943
	EBL	161.5	F	542	EBL	6.4	A	152	EBL	0.0	A	0	EBL	43.3	D	111
VISSIM RESULTS	EBT	0.0	A	0	EBT	0.0	A	0	EBT	0.0	A	0	EBT	55.4	E	282
	EBR	18.2	B	555	EBR	5.9	A	152	EBR	0.0	A	0	EBR	44.3	D	297
	SBL	0.0	A	0	SBL	0.0	A	0	SBL	0.0	A	0	SBL	94.9	F	52
	SBT	0.5	A	0	SBT	5.2	A	189	SBT	39.5	D	1015	SBT	120.0	F	1201
	SBR	0.6	A	0	SBR	3.0	A	0	SBR	44.7	D	997	SBR	0.0	A	1180
	WBL	0.0	A	0	WBL	0.0	A	0	WBL	31.6	C	208	WBL	52.0	D	169
	WBT	0.0	A	0	WBT	0.0	A	0	WBT	0.0	A	0	WBT	0.0	A	0
	WBR	0.0	A	0	WBR	0.0	A	0	WBR	8.2	A	247	WBR	15.5	B	70

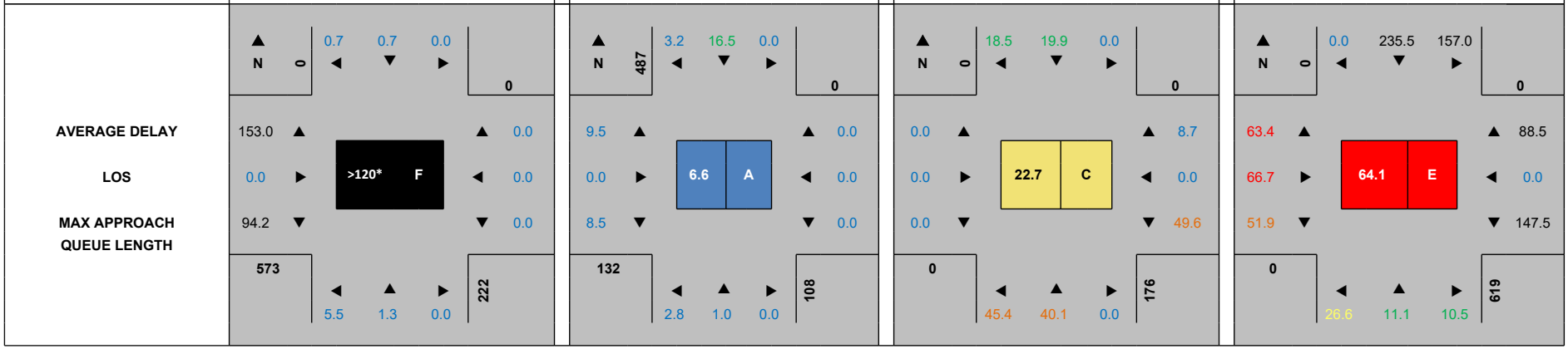


LOS
A
B
C
D
E
F

* = for EB left turn stop-controlled movement

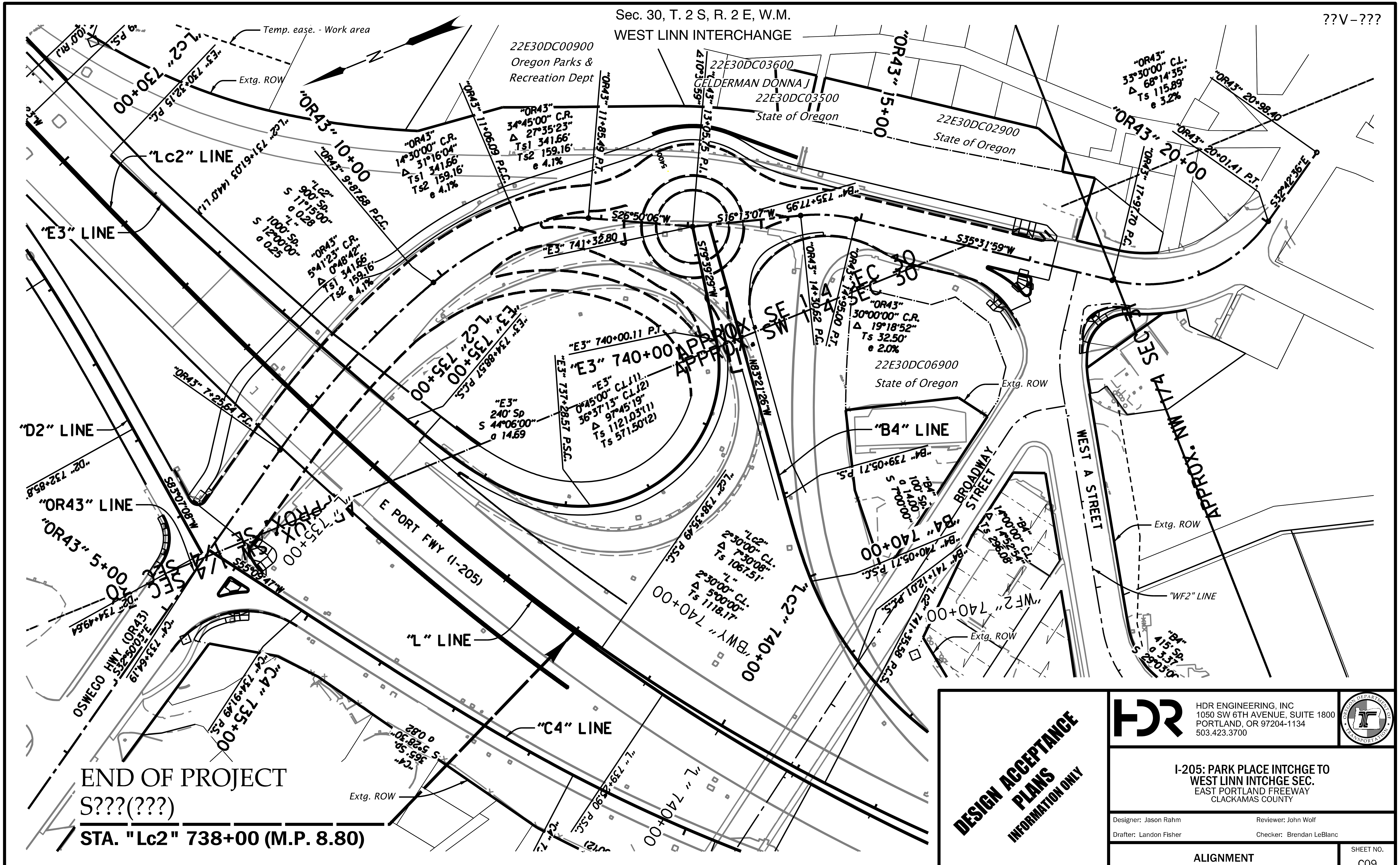
2045 Build PM - Roundabout	1 OR 43 & Willamette Falls Drive				2 OR 43 & I-205 NB Ramps				3 OR 43 & I-205 SB Ramps				4 OR 43 & McKillican Street			
VISSIM RESULTS	MVMNT	DELAY	LOS	QUEUE	MVMNT	DELAY	LOS	QUEUE	MVMNT	DELAY	LOS	QUEUE	MVMNT	DELAY	LOS	QUEUE
	ALL	33.7	C	637	ALL	6.6	A	487	ALL	22.7	C	889	ALL	64.1	E	1442
	NBL	5.5	A	222	NBL	2.8	A	108	NBL	45.4	D	176	NBL	26.6	C	127
	NBT	1.3	A	0	NBT	1.0	A	108	NBT	40.1	D	166	NBT	11.1	B	587
	NBR	0.0	A	0	NBR	0.0	A	0	NBR	0.0	A	0	NBR	10.5	B	619
	EBL	153.0	F	560	EBL	9.5	A	132	EBL	0.0	A	0	EBL	63.4	E	254
	EBT	0.0	A	0	EBT	0.0	A	0	EBT	0.0	A	0	EBT	66.7	E	498
	EBR	94.2	F	573	EBR	8.5	A	132	EBR	0.0	A	0	EBR	51.9	D	513
	SBL	0.0	A	0	SBL	0.0	A	0	SBL	0.0	A	0	SBL	157.0	F	28
	SBT	0.7	A	0	SBT	16.5	B	487	SBT	19.9	B	889	SBT	235.5	F	1442
	SBR	0.7	A	0	SBR	3.2	A	0	SBR	18.5	B	39	SBR	0.0	A	1186
	WBL	0.0	A	0	WBL	0.0	A	0	WBL	49.6	D	416	WBL	147.5	F	295
	WBT	0.0	A	0	WBT	0.0	A	0	WBT	0.0	A	0	WBT	0.0	A	0
	WBR	0.0	A	0	WBR	0.0	A	0	WBR	8.7	A	313	WBR	88.5	F	305

LOS: A, B, C, D, E, F



* = for EB left turn stop-controlled movement

Appendix F Conceptual Design of the Proposed Roundabout



DESIGN ACCEPTANCE PLANS
INFORMATION ONLY

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: PARK PLACE INTCHGE TO WEST LINN INTCHGE SEC.
EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Jason Rahm | Reviewer: John Wolf
Drafter: Landon Fisher | Checker: Brendan LeBlanc

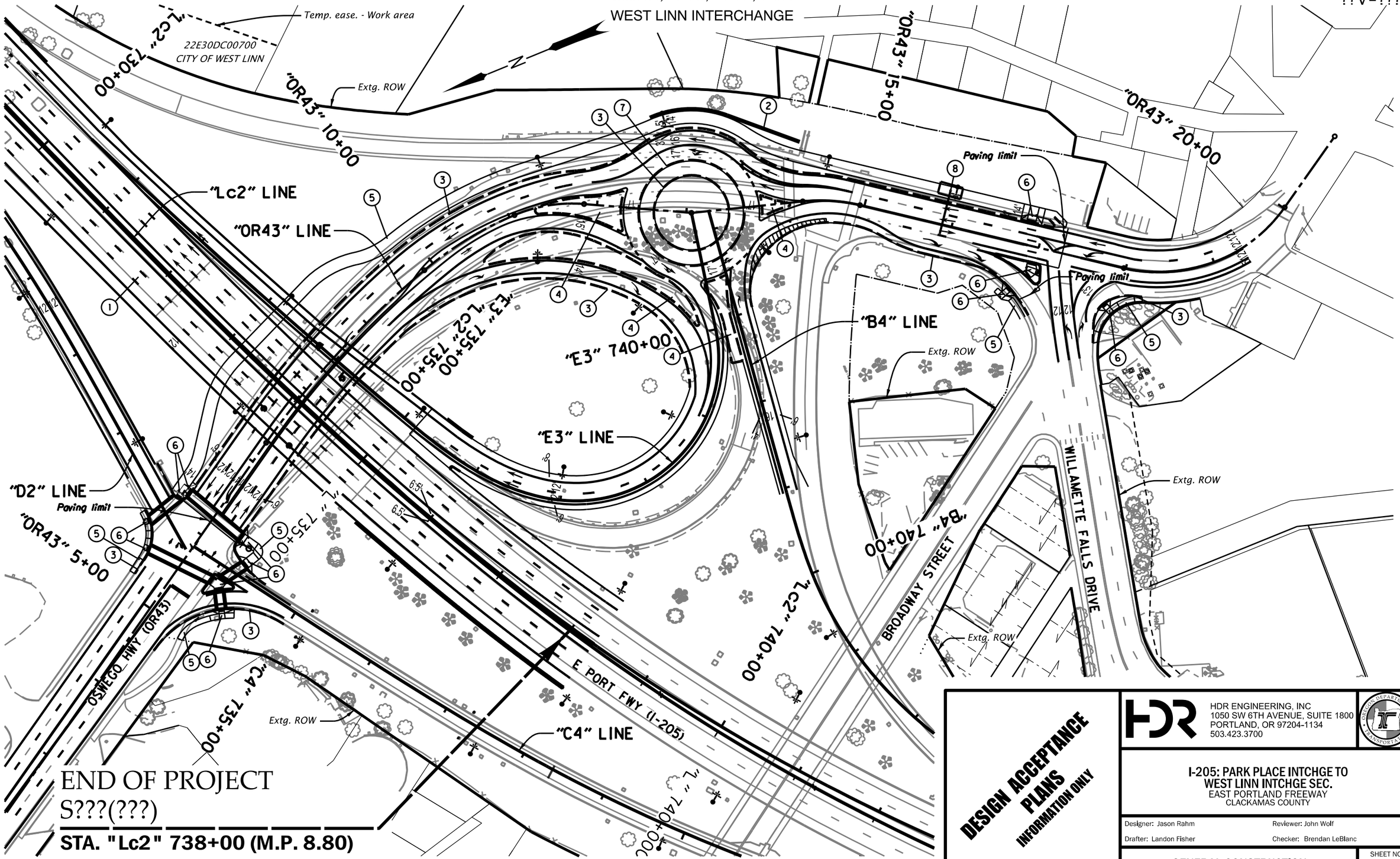
ALIGNMENT

SHEET NO. C09

Sec. 30, T. 2 S, R. 2 E, W.M.

WEST LINN INTERCHANGE

??V-???



DESIGN ACCEPTANCE PLANS
INFORMATION ONLY

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: PARK PLACE INTCHGE TO WEST LINN INTCHGE SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Jason Rahm
Reviewer: John Wolf
Drafter: Landon Fisher
Checker: Brendan LeBlanc

GENERAL CONSTRUCTION

SHEET NO.
C09A

1. *See sht. C06B, note XX*
   Widen extg. structure
   (For drg. nos., see sht. XX)

2. *Structure no. XXXXX*
   Sta. "XX" XXX+XX.X to Sta. "XX" XXX+XX.X, Lt.
   Const. retaining wall
   (For drg. nos., see sht. XX)

3. *Const. conc. curb*
   (See drg. no. RD700)

4. *Const. type "X" conc. island*
   (See drg. nos. RD705 & RD710)

5. *Const. P.C. conc. sidewalk*
   (See drg. no. RD725)

6. *Const. perpendicular sidewalk ramp*
   Install truncated domes
   (For details see shts., BCXX-BCXX)
   (See drg. nos. RD755 & RD760)

7. *Const. mountable conc. curb*
   (See drg. no. RD700)

8. *Sta. "XX" XXX+XX.X, Lt.*
   Const. sign cantilever
   (For drg. nos. see sht. XX)

DESIGN ACCEPTANCE PLANS
INFORMATION ONLY

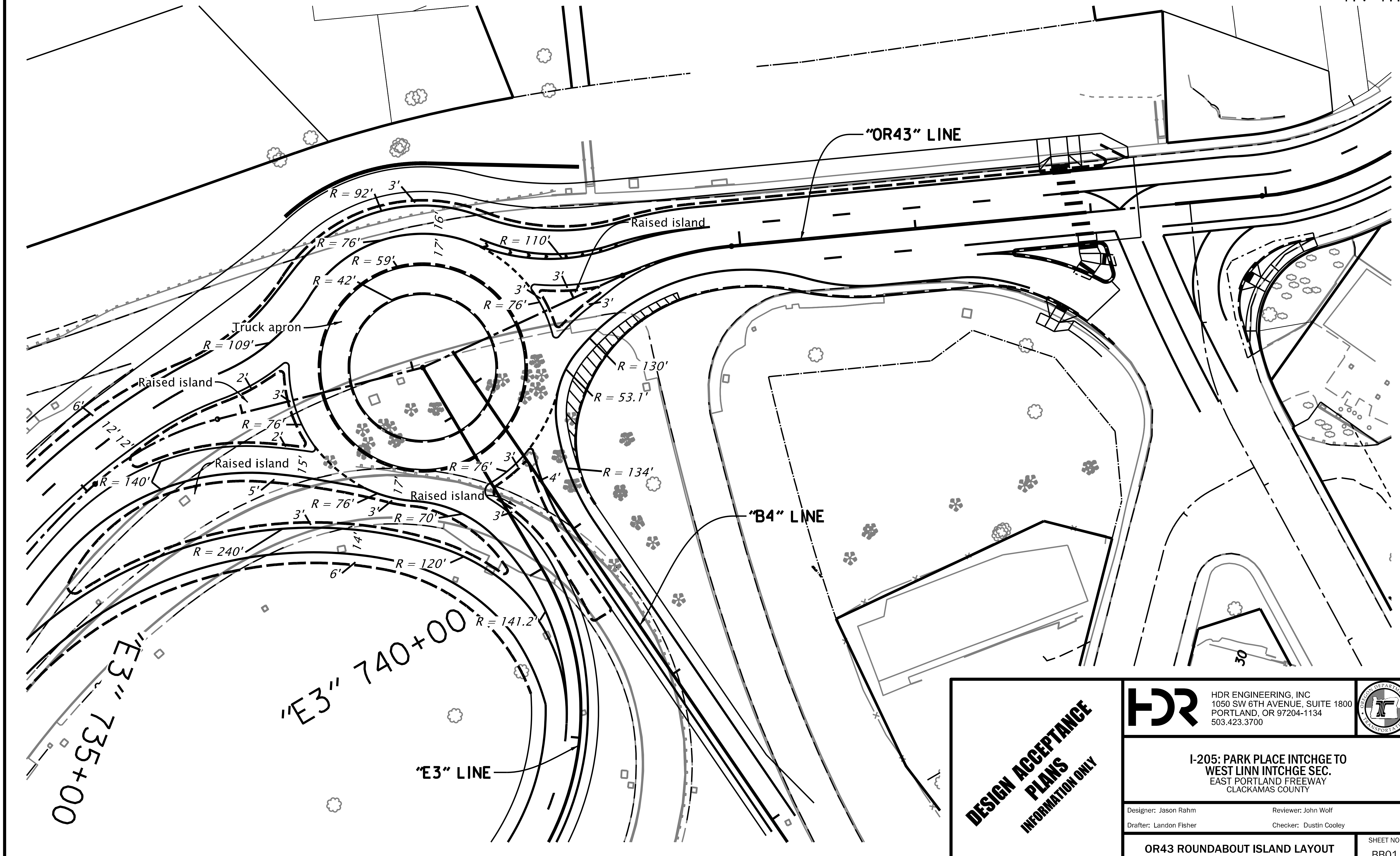
HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

I-205: PARK PLACE INTCHGE TO WEST LINN INTCHGE SEC.
EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Jason Rahm
Reviewer: John Wolf
Drafter: Landon Fisher
Checker: Brendan LeBlanc

GENERAL CONSTRUCTION NOTES

SHEET NO.
C09B



DESIGN ACCEPTANCE PLANS
INFORMATION ONLY

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: PARK PLACE INTCHGE TO WEST LINN INTCHGE SEC.
EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Jason Rahm
Reviewer: John Wolf
Drafter: Landon Fisher
Checker: Dustin Cooley

OR43 ROUNDABOUT ISLAND LAYOUT

SHEET NO.
BB01

??V-???

"E3" LINE

170
160
150
140
130
120
110
100
90
80

730+00
735+00
740+00

150.82
152.91
127.81
+28.10
+49.33
+59.89
+72.10
125.66

Profile grade @ CL
0.94%
20"
Subgrade @ CL
210' V.C.
Bridge No. XXXXX
Extg. ground at CL
-6.11%
68' V.C.
20"
1.92%
Subgrade @ CL

DESIGN ACCEPTANCE PLANS
INFORMATION ONLY

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: PARK PLACE INTCHGE TO WEST LINN INTCHGE SEC.
EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Jason Rahm
Reviewer: John Wolf
Drafter: Landon Fisher
Checker: Brendan LeBlanc

PROFILE

SHEET NO.
C08G

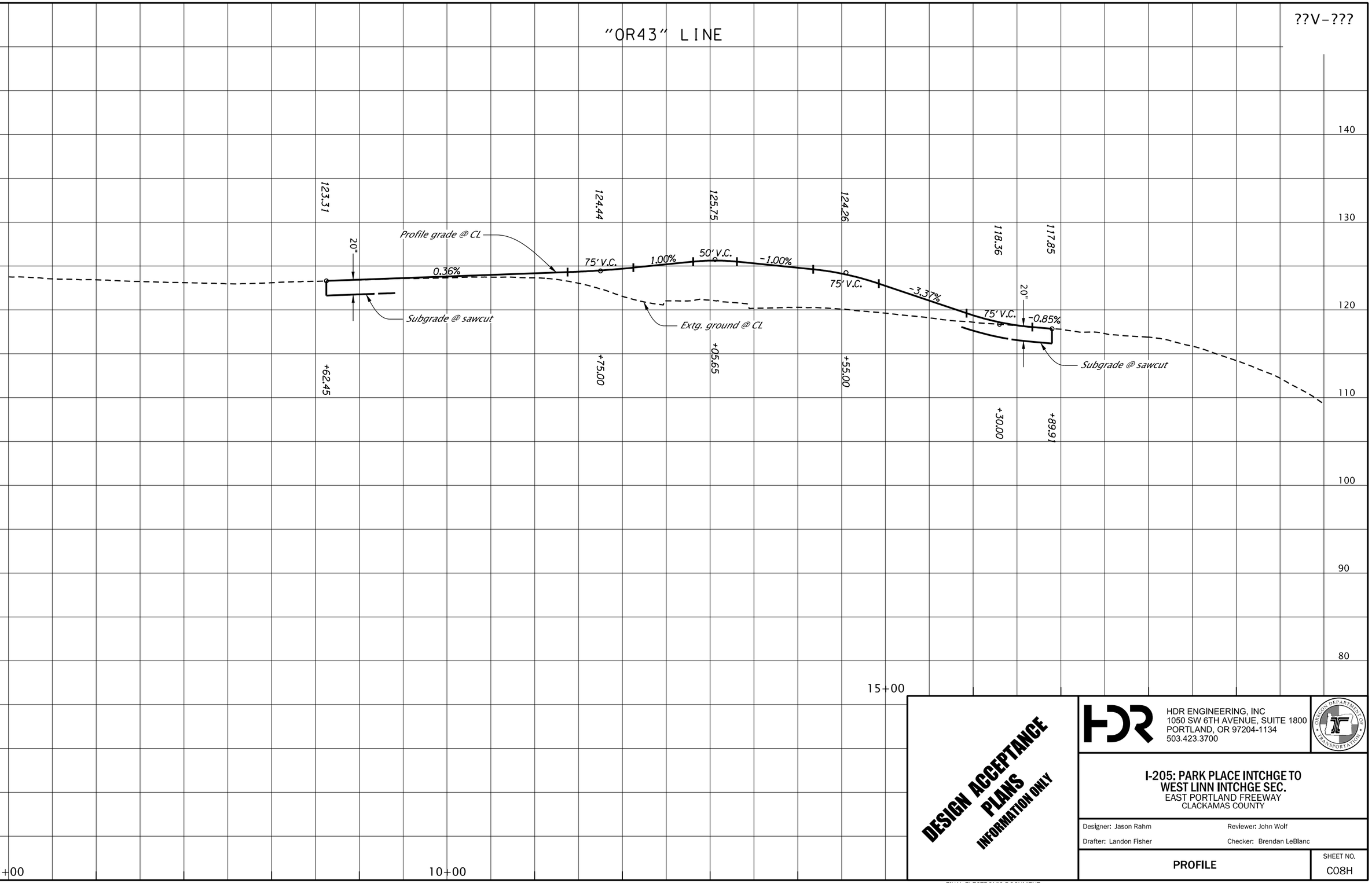
FINAL ELECTRONIC DOCUMENT
AVAILABLE UPON REQUEST

R_K19786_HDR_pf_01.dgn :: C08E 10/4/2018 10:45:21 AM LAFISHE

Rotation: 0° Scale: 1"=100'

??V-???

"OR43" LINE



DESIGN ACCEPTANCE PLANS
INFORMATION ONLY

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: PARK PLACE INTCHGE TO WEST LINN INTCHGE SEC.
EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

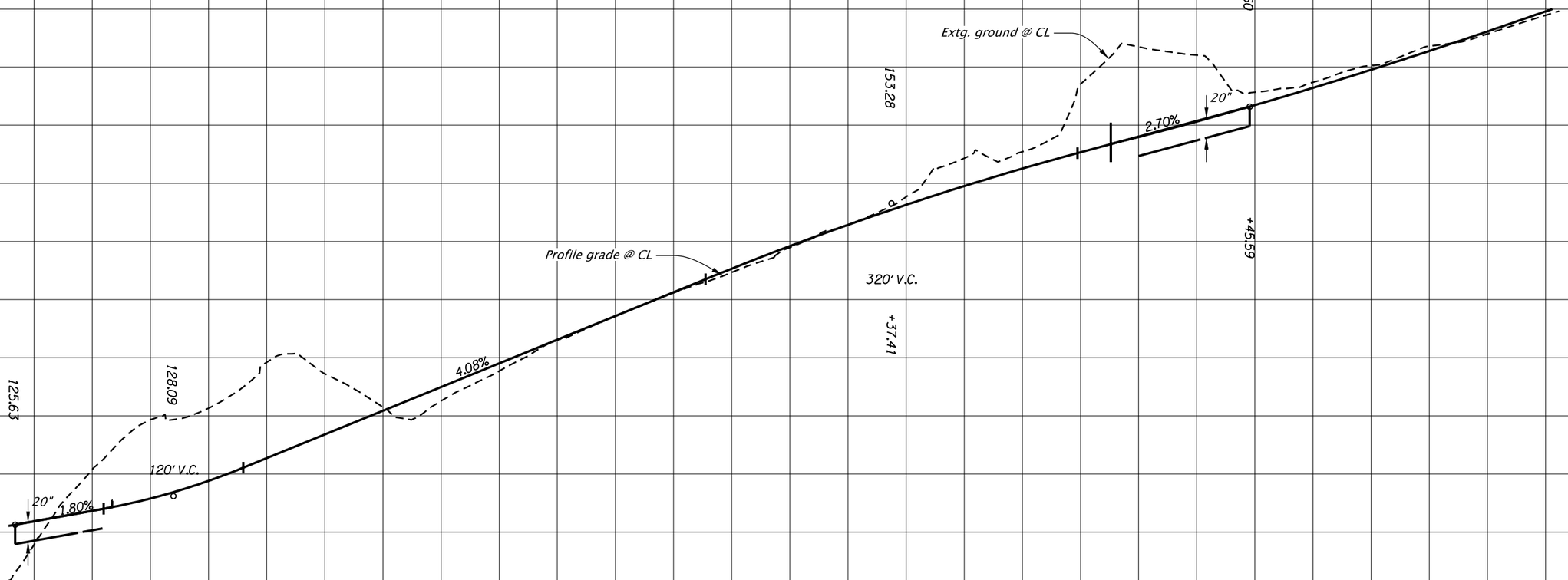
Designer: Jason Rahm
Reviewer: John Wolf
Drafter: Landon Fisher
Checker: Brendan LeBlanc

PROFILE

SHEET NO.
C08H

??V-???

"B4" LINE



DESIGN ACCEPTANCE PLANS
INFORMATION ONLY

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: OSWEGO HWY (OR43) TO STAFFORD RD SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Jason Rahm
Reviewer: John Wolf
Drafter: Landon Fisher
Checker: Brendan LeBlanc

PROFILE

SHEET NO.
C01G

FINAL ELECTRONIC DOCUMENT
AVAILABLE UPON REQUEST