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TECHNICAL MEMORANDUM

December 9, 2022   Project#27376.8

To: Zachary Weigel
         City of Wilsonville

From: Wade Scarbrough, PE; Kelly Laustsen, PE; and Keisuke Harry, PE

RE: Intersection Control Evaluation (ICE) for Boeckman Road & Canyon Creek Road

Introduction

Boeckman Road is an east/west minor arterial in the City of Wilsonville. It is one of three corridors that directly connect the east and west sides of the city across Interstate-5. The City is pursuing a project on Boeckman Road between the intersection at Canyon Creek Road and Stafford Road to improve multimodal mobility, capacity, and safety. The project includes improving the intersection of Boeckman Road and Canyon Creek Road, currently all-way stop-controlled.

Kittelson & Associates, Inc. (Kittelson) conducted an intersection control evaluation (ICE) to assess both a traffic signal and roundabout. An ICE is a "data–driven, performance–based framework to screen intersection alternatives and identify an optimal solution" (Reference 1). An ICE provides objective performance metrics and results in balanced, cost-effective solutions. This evaluation, documented in this memorandum, consists of the following elements:

- Assessment of existing conditions, including crash data and traffic volumes;
- Conceptual designs for the alternatives;
- Operational analysis of the existing intersection and proposed alternatives under weekday PM peak hour existing (2021) and 2040 conditions;
- Analysis of safety performance;
- Identification of freight mobility, multimodal operations, constructability, and right-of-way needs; and
- A life-cycle cost analysis that includes both hard and soft costs.

Existing Conditions

The existing conditions analysis identifies current site conditions, crash trends, and traffic volumes at the intersection.

Site Conditions and Adjacent Land Uses

The intersection of Boeckman Road and Canyon Creek Road currently operates as an all-way stop-controlled (AWSC) intersection. Figure 1 shows the intersection layout and current lane configurations. As

shown, all approaches have separated left-turn lanes and shared through/right-turn lanes. There are crosswalks on all approaches.

The intersection is located approximately half-a-mile east of I-5. There is not access to I-5 from Boeckman Road, with the nearest interchanges at Elligsen Road to the north and Wilsonville Road to the south. The areas to the south and east of the intersection are generally residential. There is a commercial park on the northwest corner of the intersection with access to Boeckman Road approximately 500 feet[1] west of the intersection. The church on the northeast corner of the intersection has access to Canyon Creek Road approximately 150 feet[1] north of the intersection. Existing accesses within the immediate intersection vicinity are called out on Figure 1.

Figure 1: Intersection Aerial

Image source: Google Earth

Transportation Facilities

Table 1 summarizes the functional classification and the existing street characteristics of Boeckman Road and Canyon Creek Road.

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[1] Measured centerline to centerline

Table 1: Existing Transportation Roadway Facilities and Roadway Designation

Roadway	Classification[1]	Number of Lanes	Posted Speed	Sidewalks	Bicycle Lanes	On-Street Parking
Boeckman Road	Minor Arterial	2-3	40 mph	Intermittent	West of Canyon Creek Road	No
Canyon Creek Road	Minor Arterial	2-3	30-35 mph	Intermittent	Yes	No

1 Classifications are based on the City of Wilsonville Transportation System Plan (TSP, Reference 2)

Crash Data

The Oregon Department of Transportation (ODOT) provided crash records for the intersection for the ten-year period from January 1, 2011 through December 31, 2020. Table 2 summarizes the crash data. Appendix A contains the ODOT crash data.

Table 2: Crash Summary (January 2011 – December 2020)

	Crash Type						Crash Severity		
	Angle	Turning	Pedes-trian	Rear-End	Fixed Object	Backing	PDO[1]	Injury	Total
2011									-
2012	1							1	1
2013									-
2014		1						1	1
2015		1	1			1	1	2	3
2016	1							1	1
2017	1			1			1	1	2
2018	1							1	1
2019	2				1		3		3
2020	1							1	1
Total	**7**	**2**	**1**	**1**	**1**	**1**	**5**	**8**	**13**

1 PDO = Property Damage Only

As shown in the table, 13 crashes were reported at the intersection over the 10-year period from 2011 through 2020, an average of 1.3 crashes per year. Angle crashes are the most frequent crash type, with seven of the reported crashes falling into this category. Five of the angle crashes included the error code "disregarded stop sign." One pedestrian crash occurred, which was a possible injury crash with a driver error code of "failure to yield right-of-way to pedestrian."

Traffic Data

Twenty-four-hour tube counts were collected on July 8, 2021 on Boeckman Road west of Canyon Creek Road. The daily traffic profile on Boeckman Road is shown in Figure 2. As illustrated in the graph, there are distinct peaks in traffic flow during the weekday AM and PM peak hours, with the weekday PM peak hour

the most critical hour. The westbound and eastbound volumes are closely balanced during each hour of the day. The average weekday daily traffic for Boeckman Road is approximately 6,030 vehicles per day. Appendix B includes the tube count data.

Figure 2: Boeckman Road Daily Traffic Profile
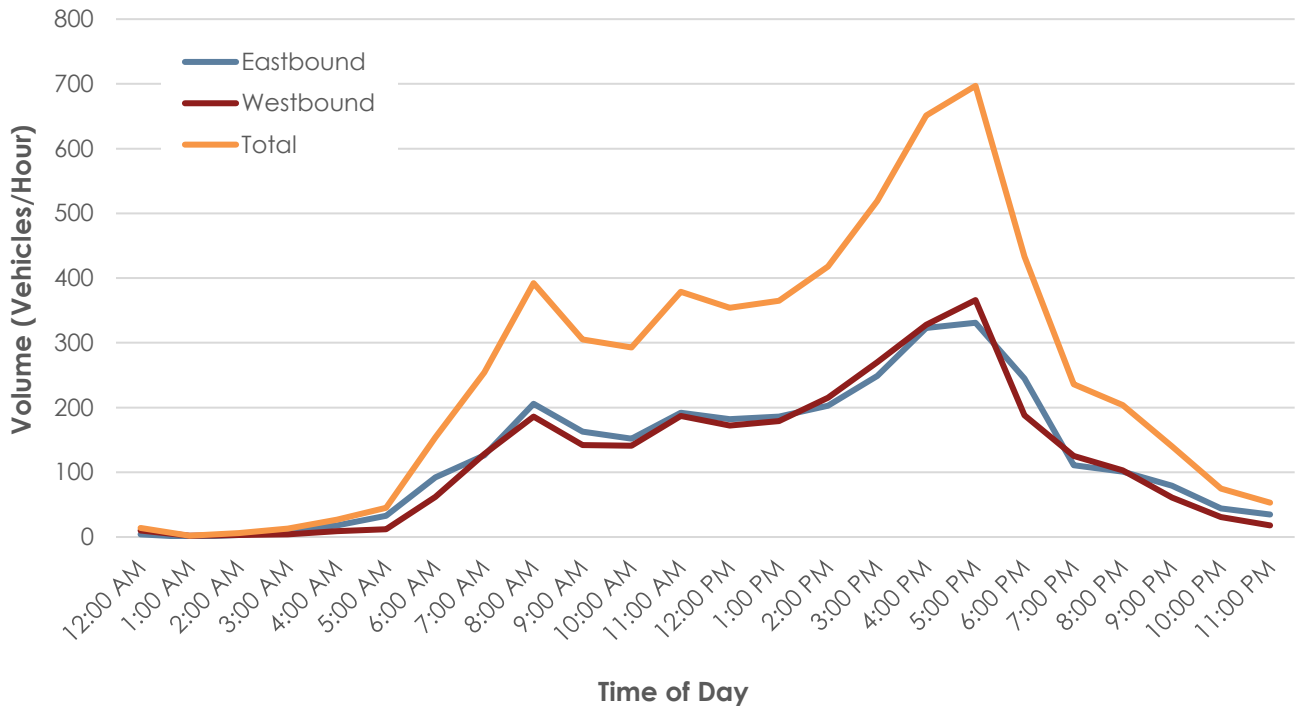
Existing and Future Intersection Volumes

Intersection turning movement counts were collected at the study intersection during the weekday PM peak hour on Thursday, September 30th, 2021. The peak hour occurred from 4:45–5:45 PM. Kittelson utilized estimated future weekday PM peak hour 2040 traffic volumes developed as part of the Frog Pond East/South Plan (currently under development). Figure 3 illustrates the 2021 and 2040 traffic volumes. Appendix B includes the turning movement counts.

Figure 3. 2021 and 2040 Weekday PM Peak Hour Traffic Volumes
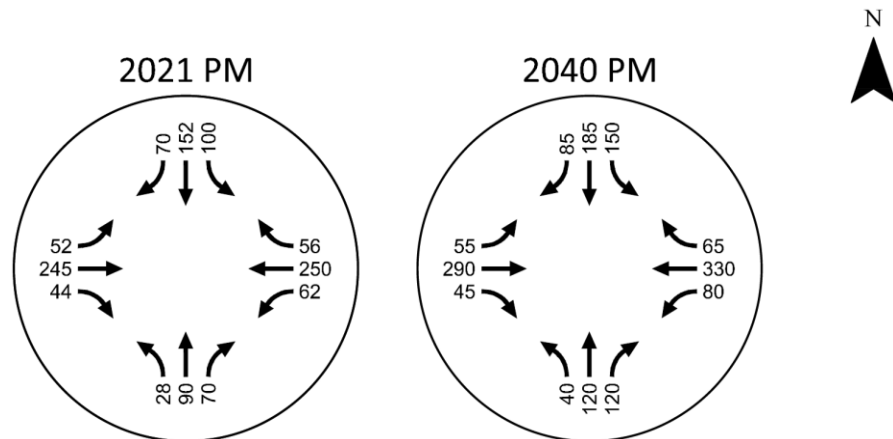
Description of Alternatives

For this analysis, two alternatives were evaluated to replace the existing all-way stop, including a traffic signal and single-lane roundabout.

Alternative 1: Traffic Signal

The traffic signal alternative is shown in Figure 4. This concept is centered on the existing intersection and includes separate left-turn lanes on each approach. The concept reflects key design features, including:

- Left-turn lanes on Boeckman Road and Canyon Creek Road are designed to accommodate 2040 weekday PM peak hour 95th percentile queues and allow for adequate deceleration before vehicles reach the back of queue.

- A 60 second cycle length is assumed, with detection on all approaches and permitted left-turn signal phasing[2] on all approaches.

- Existing travel lanes on Canyon Creek Rd are 12 feet in width, with 14-foot left-turn lanes. Travel lanes on Boeckman Rd are 11 feet in width, with 11-foot left-turn lanes.

- Bicycle lanes are provided on all approaches within the intersection area and connect to the existing bicycle lanes to the west, north and south and planned buffered bicycle lanes to the east.

- Sidewalks are added or maintained on all approaches within the intersection area. Signal-controlled crosswalks are provided on all legs of the intersection with accessible sidewalk ramps and pushbuttons at each corner.

- Curb radii and relevant striping are designed for fire trucks and 40-foot school buses while accommodating a WB-62 vehicle. Turning movement analysis shows that fire trucks and school buses can complete turning movements without encroaching into other travel lanes, but a WB-62 will encroach into the opposing lanes to complete right turns. The truck turning figures for the traffic signal alternative are shown in Appendix C.

- Existing access points to surrounding properties are maintained. The Canyon Creek Road South approach east of the intersection would remain closed given its close proximity to the intersection.

Figure 4.: Traffic Signal Alternative

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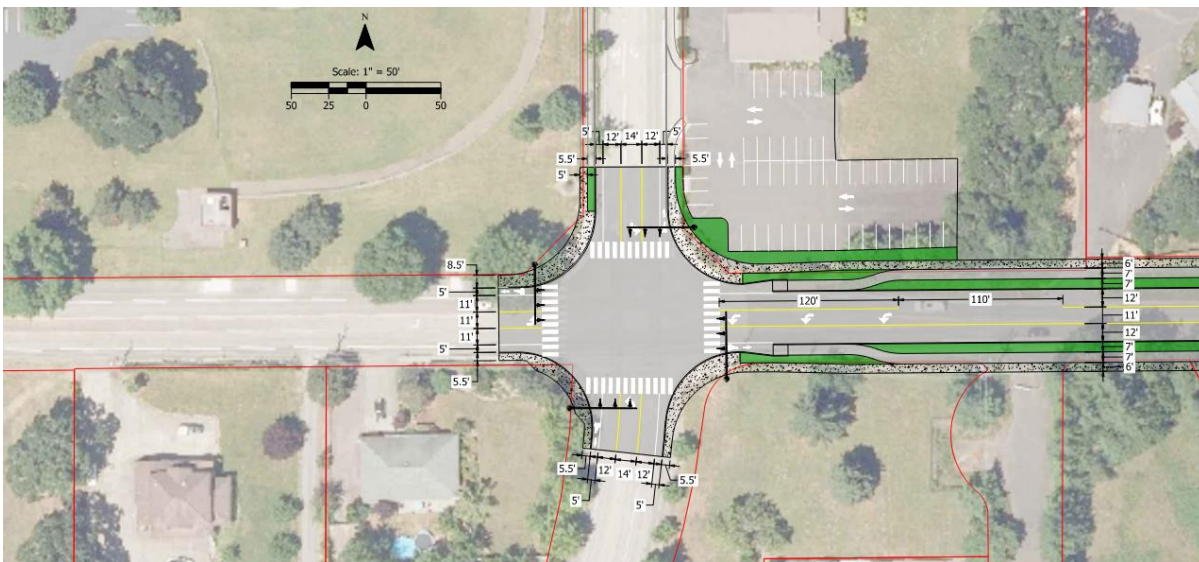
[2] Based on the guidance in ODOT's *Traffic Signal Policy and Guidelines (Reference 3)*

Alternative 2: Roundabout

The second alternative is a single-lane roundabout, shown in Figure 5. Key design features for the roundabout design concept include:

- An inscribed circle diameter (ICD) of 130 feet and 90-foot central island diameter, including a mountable truck apron approximately 15 feet in width. The roundabout is designed for fire trucks, 40-foot school buses, and WB-62 design vehicles. The truck turning figures for the roundabout alternative are shown in Appendix D.
- A 20-foot circulatory roadway.
- Single-lane entry and exits ranging from 16 feet to 21 feet in width. These widths were determined based on preliminary analysis of truck turning paths.
- 10-foot wide crosswalks set back approximately 5 feet from the circulatory roadway. Each crosswalk includes a pedestrian refuge area within the splitter island.
- Bicycle ramps on each approach and departure legs, typically located approximately 100 to 150 feet from the circulatory roadway (where the bicycle lanes are terminated).
- Detached 10-foot wide shared-use path between the bicycle ramps and around the perimeter of the roundabout.
- Bicycle lanes and sidewalks that tie into the existing infrastructure.
- 5-foot planter strips between the roadway curbs and shared path.
- Access to the church on the northeast corner of the property is provided via a new right-in/right-out access on Boeckman Road, with the existing access on Canyon Creek Road converted to right-in/right-out. All other access points are unmodified.

These dimensions and design features comply with the guidelines outlined in National Cooperative Highway Research Program (NCHRP) *Report 672 Roundabouts: An Informational Guide, 2nd Edition* (Reference 4).

Figure 5. Roundabout Concept
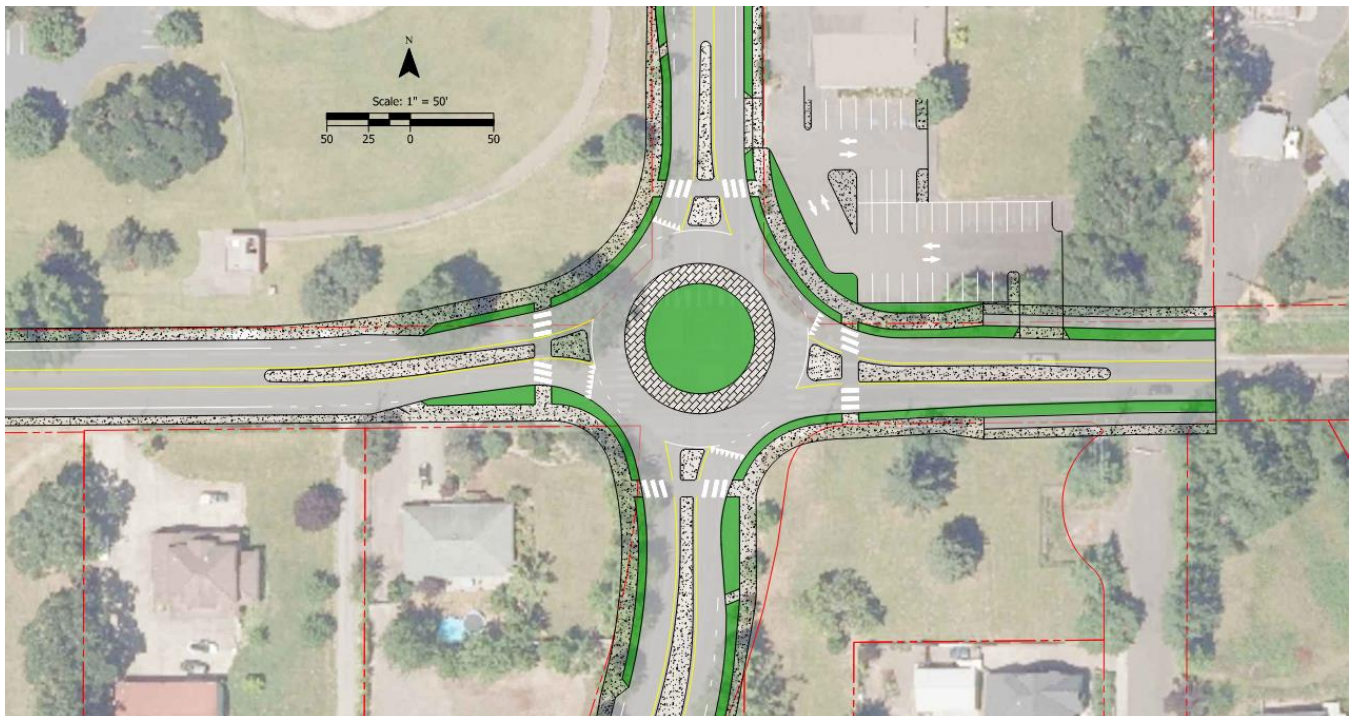
Alternatives Evaluation

The two alternatives were evaluated based on the following considerations:

- Traffic Operations
- Safety Performance
- Freight Mobility
- Multimodal Operations
- Construction Feasibility
- Life-Cycle Cost

The results of the evaluation are described in the following sections and summarized in Table 8.

Traffic Operations

The operational performance relates to the ability of the intersection to serve the existing 2021 volumes and predicted 2040 volumes. For this analysis, delay, level of service (LOS), volume-to-capacity ratio (V/C), and 95th percentile queues were measured, using the methodology in the *Highway Capacity Manual* (Reference 5). Table 3 provides a summary of operational results for the 2021 and 2040 weekday PM peak hours. All Vistro worksheets are included in Appendix E.

Table 3: Weekday Peak Period Operations Comparison

Approach	2021 Weekday PM Peak Hour			2040 Weekday PM Peak Hour		
	No-Build (AWSC)	Alt 1: Traffic Signal	Alt 2: Roundabout	No Build (AWSC)	Alt 1: Traffic Signal	Alt 2: Roundabout
Volume-to-Capacity (v/c) Ratio (LTR except where noted)						
Northbound	L = 0.07 TR = 0.36	L = 0.08 TR = 0.36	0.24	L = 0.11 TR = 0.62	L = 0.12 TR = 0.45	0.40
Southbound	L = 0.24 TR = 0.49	L = 0.25 TR = 0.48	0.39	L = 0.42 TR = 0.69	L = 0.44 TR = 0.48	0.57
Eastbound	L = 0.12 TR = 0.63	L = 0.15 TR = 0.52	0.40	L = 0.15 TR = 0.86	L = 0.21 TR = 0.56	0.51
Westbound	L = 0.15 TR = 0.66	L = 0.17 TR = 0.56	0.37	L = 0.22 TR = 1.01	L = 0.27 TR = 0.67	0.50
Average Delay (sec/veh)						
Northbound	13.8	8.6	6.7	22.6	11.0	9.8
Southbound	15.5	9.5	8.3	24.2	12.8	13.1
Eastbound	19.4	8.5	8.3	40.0	11.7	11.2
Westbound	20.4	8.7	7.1	46.2	12.6	9.4
Overall Intersection	**17.8**	**8.8**	**7.7**	**40.0**	**12.1**	**10.9**
Level of Service (LOS)						
Northbound	B	A	A	C	B	A
Southbound	C	A	A	C	B	B
Eastbound	C	A	A	E	B	B
Westbound	C	A	A	F	B	A
Overall Intersection	**C**	**A**	**A**	**E**	**B**	**B**

Approach	2021 Weekday PM Peak Hour			2040 Weekday PM Peak Hour		
	No Build	Alt 1: Traffic Signal	Alt 2: Roundabout	No Build	Alt 1: Traffic Signal	Alt 2: Roundabout
95th Percentile Queue by Lane (feet)[1] (LTR except where noted)						
Northbound	L = 25 TR = 50	L = 25 TR = 50	25	L = 25 TR = 100	L = 25 TR = 75	50
Southbound	L = 25 TR = 75	L = 25 TR = 50	50	L = 50 TR = 100	L = 75 TR = 100	100
Eastbound	L = 25 TR = 125	L = 25 TR = 50	50	L = 25 TR = 150	L = 25 TR = 100	75
Westbound	L = 25 TR = 125	L = 25 TR = 50	50	L = 25 TR = 225	L = 50 TR = 125	75

1 Queues rounded up to the nearest 25 feet.

2 L = Left, TR = Through-Right, LTR = Left-Through-Right

As shown in the table, the intersection is projected to operate under capacity and at an overall LOS of D or better under all scenarios, except for during the 2040 weekday PM peak hour conditions as an all-way stop-controlled intersection. During this scenario, the intersection is projected to operate at a LOS E with a delay of 40.0 seconds. While operations are relatively similar between the signal and roundabout alternative, delays and queues are notably longer under the no-build scenario.

SIGNAL WARRANT ANALYSIS

A signal warrant analysis for the intersection was conducted using the volume-based warrants in the Manual of Uniform Traffic Control Devices (MUTCD, Reference 6). The analysis was run using the weekday PM peak hour turning movement counts collected in September 2021 and extrapolating twenty-four hour counts based on the volume profile from the tube counts collected on Boeckman Road in July 2021. Based on the assessment, a signal is warranted based on the peak hour, four-hour, and eight-hour volume warrants. The supporting signal warrant worksheet is provided in Appendix F.

Safety Performance

The safety performance of each alternative was evaluated and compared to that of the existing all-way stop control. The Highway Safety Manual (HSM) provides crash prediction methods for traffic signals and roundabouts. These methods were used in conjunction with the local calibration coefficients developed by ODOT (References 7 and 8).

The HSM currently does not provide safety performance methods to predict crashes for all-way stop controlled intersections. To compare the build alternatives to the no-build scenario, Kittelson assumed that the predicted crash rate for an all-way stop controlled intersection would be a similar rate to that of a roundabout. Research cited in *NCHRP Report 672* justifies this, stating that the estimated percent reduction in crashes from converting an all-way stop controlled intersection to a roundabout are insignificant (Reference 9).

The evaluation was performed using the Federal Highway Administration (FHWA) Safety Performance for Intersection Control Evaluation (SPICE) Tool. Crash prediction results for the all-way stop, traffic signal, and roundabout are shown in Table 4 for the expected opening year of 2025 and the design year of 2040.

Table 4: Crash Prediction Results – Annual Crashes

	No-Build		Traffic Signal		Roundabout	
	Total Crashes	Fatal and Injury Crashes	Total Crashes	Fatal and Injury Crashes	Total Crashes	Fatal and Injury Crashes
Opening Year (2025)	1.2	0.2	1.6	0.5	1.2	0.2
Design Year (2040)	1.5	0.3	2.1	0.7	1.5	0.3

The safety performance results indicate that the roundabout is expected to have similar safety performance to the existing all-way stop-controlled intersection, while the signal is expected to increase crash frequency. More than twice as many fatal and injury crashes are expected with a traffic signal compared to an all-way stop-controlled intersection or roundabout.

These safety performance results will be used as inputs in the life-cycle cost analysis, based on monetary values assigned to the different severities of crashes.

Freight Mobility

Both the signal and roundabout alternatives are designed to accommodate an American Association of State Highway and Transportation Officials (AASHTO) WB-62 tractor-trailer design vehicles making turning movements at the intersection. Figure 6 displays the dimensions of the design vehicle.

Figure 6. AASHTO WB-62 Design Vehicle
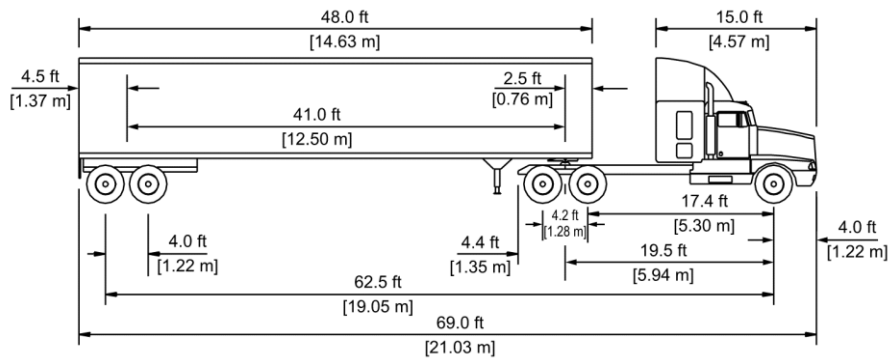
Appendix C includes the design vehicle turning paths for the critical turn movements at each leg for the signal alternative. Additionally, it includes representative turning paths for school buses. As shown in the exhibit, the signal is designed for bus turning movements and accommodates the WB-62 design vehicle (with encroachment across centerlines). Though not shown in the exhibit, the traffic signal is expected to accommodate all fire trucks, motorhomes, and other buses, as these vehicles have turning paths similar to the school bus.

Appendix D includes the design vehicle turning paths for the critical turn movements at each leg for the roundabout alternative. Additionally, it includes representative turning paths for school buses. As shown in the exhibit, the roundabout is designed for bus turning movements as well as the WB-62 design vehicle. Though not shown in the exhibit, the roundabout is expected to accommodate all fire trucks, motorhomes, and other buses, as these vehicles have turning paths similar to the school bus.

Multimodal Operations

The design for both intersection alternatives includes pedestrian crossings and sidewalks on all approaches at the intersection. The traffic signal includes signal-controlled crosswalks while the roundabout provides marked crosswalks with pedestrian refuge areas in the splitter islands.

Both alternatives include bicycle facilities that connect to existing bicycle lanes to the west, north and south and planned buffered bicycle lanes to the east. The roundabout alternative also includes a 10-foot shared path on all corners of the intersection, allowing cyclists the option to navigate through the roundabout either as a vehicle or as a pedestrian.

Construction Feasibility

Considerations related to maintenance of traffic and construction phasing for each alternative are noted in Table 5.

Table 5: Construction Feasibility Considerations

	Traffic Signal	Roundabout
Maintenance of Traffic	• The east leg of the intersection would be constructed during the roadway closure (during construction of bridge over Boeckman Creek), so there would be limited movements through the intersection to maintain. • Maintenance of traffic would be simpler for the traffic signal compared to the roundabout, as the intersection could be maintained as a stop-controlled intersection during construction.	• The east leg of the intersection would be constructed during the roadway closure (during construction of the bridge over Boeckman Creek), so there would be limited movements through the intersection to maintain. • Construction may require more temporary pavement and grading compared to the traffic signal. • Roundabout will require more storm drainage improvements compared to the traffic signal. • Maintenance of traffic will be more involved since construction of the approach legs and center circle will be phased.
Construction Phasing/ Schedule	• Overhead power on the south leg may conflict with traffic signal poles and arms and will likely need to be relocated prior to signal installation. • If it is possible to keep the existing concrete pavement through the intersection, phasing would be very simple and include curb/sidewalk modifications, minimal pavement changes, and installation of signal equipment. • Procurement of signal equipment could impact schedule. • Likely faster to construct due to minimal infrastructure (curbs, sidewalks, pavement), fewer phases, and little to no temporary pavement required.	• Likely will not require overhead power relocation. • Likely more certain schedule, although right-of-way needed could impact schedule. • Longer schedule due to multiple phases need to construct roundabout.

As shown in the table, the roundabout alternative will likely require a more involved plan to maintain traffic during construction and take longer to construct.

Right-of-Way Needs

Right-of-way acquisition is necessary for both intersection control alternatives. Considerations related to the right-of-way impacts for each alternative are discussed below.

Traffic Signal Alternative

The right-of-way needs associated with the traffic signal alternative are driven by the proposed addition of buffered bicycle lanes and sidewalks, design vehicle turning requirements, and area required for the placement of signal equipment. The total amount of right-of-way acquisition for the signalized alternative is estimated at 3,325 square feet.

It is anticipated that right-of-way needs for the signal alternative, as shown, will occur at the corners of the northwest, northeast, southwest, and southeast parcels. Impacts to the function of businesses and residents at these corners will be minimal; the northeast parcel will be the most impacted, requiring minor reconstruction of the parking lot resulting in the loss of up to two (2) parking spaces. No other functional loss is anticipated for the remaining parcels. However, existing landscaping in both the northwest and southwest parcels will likely be impacted.

Roundabout Alternative

The right-of-way impacts of the roundabout alternative are driven by the 130-foot ICD which is placed slightly north of the Boeckman Road centerline to minimize impacts to the residential property at the southwest corner. Additionally, the roundabout design requires widening of all approaches to accommodate the addition of splitter islands and shared-use paths. The total amount of right-of-way acquisition for the roundabout alternative is estimated at 11,750 square feet.

Right-of-way is needed on all four corners of the intersection. Impacts to the function of businesses and residents at the northwest, southwest and southeast corners will be minimal, with no functional loss of these parcels anticipated. The northeast parcel will be the most impacted, resulting in the loss of up to 24 parking spaces. A more detailed analysis of site circulation and parking is needed to better understand the parking impact and access needs.

Life-Cycle Cost Analysis

A life-cycle cost analysis was conducted to compare costs over a 16-year life cycle (assuming a design year of 2040) for both alternatives and the existing all-way stop-controlled intersection. The analysis was conducted using a variation of the spreadsheet-based Life-Cycle Cost Estimation Tool (LCCET) developed as part of NCHRP *Web-Only Document 220: Estimating the Life-Cycle Cost of Intersection Designs* (Reference 10). The tool used was a modified version of the LCCET developed by the Florida Department of Transportation (Reference 11).

The life-cycle cost includes both "hard" costs incurred by the City (construction, right-of-way, operations and maintenance) and "soft" costs incurred by society (value of users' time, fuel, crash costs). The cost estimates provided are 2025 values, and the net present value calculations are based on a base year of 2025. A discount rate of four percent (Reference 10) was applied to all future costs to calculate the net present value of the costs, with more details on the assumed costs summarized below.

The design year 2040 was selected given the City's typical planning horizon and the availability of volume projections for the year 2040. It should be noted that roundabouts typically have longer functional lives than roundabouts and therefore in 2040 the roundabout option is likely to have significantly more useful years of service left, whereas a traffic signal may be closer to needing replacement. Several agencies

reflect longer service lives for a roundabout compared to a traffic signal, as does NCHRP *Report 672*. Indiana DOT (Reference 12) indicates the "service life of a roundabout is 25 years (vs. the 10-year service life of signal equipment)" and Nevada DOT (Reference 13) indicates the "service life of a roundabout is approximately 25 years, versus approximately 10-20 years of service life for traffic signals."

CALCULATION OF HARD COSTS

The project design-build team prepared planning-level cost estimates for construction of each alternative based on the conceptual design drawings. The cost estimates include an itemized breakdown of major earthwork, pavement structure, and other identifiable major components, (e.g., signing and pavement marking and street lighting). Groups of items (such as work zone traffic control) are presented as lump sum items, and the estimates provided are based on similar work from other recent projects. The assumed unit costs, estimated quantities, and cost estimates are provided in Appendix G.

Other assumptions used in developing the cost estimates include:

- Roadway widening would include full-depth pavement construction consistent with the City standard pavement section.
- Sidewalks, curbs, and ramps would be constructed as shown on the concept design drawings.
- Stormwater management and treatment facilities will be provided in accordance with City requirements.
- Signal installation (complete) is estimated at $672,500.
- Construction cost excludes costs for construction management.
- The cost estimates for right-of-way acquisitions are based on an anticipated cost of $17.80 per square foot for partial takings of property. The costs presented assume that full taking of the affected properties will not be required.

Based on these assumptions, the preliminary construction cost and project cost estimates are summarized in Table 6.

Table 6: Preliminary Construction Cost Estimates for Alternatives (2022 Costs)

	Traffic Signal	Roundabout
Construction Cost	$1,440,000	$2,090,000
Right-of-Way Cost	$60,000	$210,000
Additional Engineering/Design Cost*	-	$155,000
Owner's Rep Cost		$50,000
Survey Work Cost	$20,000	$30,000
Contingency (20% of Construction Costs)	$290,000	$420,000
Total Construction Cost (Including Contingency)	**$1,810,000**	**$2,955,000**

Notes: Costs rounded to the nearest $5,000
*Engineering/design cost is already included in the City's design-build contract. Additional design cost would be necessary for roundabout alternative. The additional design cost for the roundabout is covered under contingency Task 14 in the design-build contract.

The City of Wilsonville provided estimated costs for typical maintenance activities associated with each alternative, based on average numbers from the city budget reports. Assumed post-construction costs associated with operations and maintenance are as follows:

- All Way Stop (No Build)
  - None
- Traffic Signal:
  - Signal retiming: $10,000 every three years
  - Lighting: $1,000 annually
  - Signal maintenance: $13,000 annually
- Roundabout
  - Landscaping maintenance: $1,000 annually

CALCULATION OF SOFT COSTS

Delay costs were based on value of user time from the 2021 TTI Urban Mobility Report (Reference 14). The assumed value of time used to calculate delay costs are:

- Auto passenger delay: $19.64 per person hour
- Truck delay: $55.24 per truck hour

Crash cost estimates attempt to account for the economic costs (monetary impacts) of crashes including property damage, medical costs, crash response, lost wages, productivity loss, insurance administration, etc. The cost of a severe crashes is higher than that of property damage only (PDO) crash. The crash costs are based on the ODOT Highway Safety Improvement Program (HSIP) Guide and are comprehensive economic values per crash type calculated by ODOT (Reference 15). The costs used are:

- Cost per PDO crash: $19,400
- Cost per fatal or injury crash: $271,800

Appendix H provides details on how the cost per fatal or injury crash was developed.

ANALYSIS FINDINGS

Table 7 summarizes the estimated life-cycle costs given a design year of 2040.

Table 7. Life-Cycle Cost Analysis: Net Present Value of Costs (2025 Dollars)

Cost Categories	No Build (AWSC)	Traffic Signal	Roundabout
Construction Cost	$0	$1,810,000	$2,955,000
Post-Construction Cost (Operations & Maintenance)	$0	$215,000	$10,000
Auto Passenger Delay Cost	$10,650,000	$3,875,000	$3,415,000
Truck Delay Cost	$550,000	$200,000	$175,000
Crash Cost	$1,105,000	$2,170,000	$1,105,000
Total Cost	**$12,305,000**	**$8,270,000**	**$7,660,000**

Note: Costs rounded to the nearest $5,000

As shown in the table, the roundabout has the lowest life-cycle cost. Although the signalized alternative has a lower construction cost than the roundabout, it has a slightly higher total cost due to the higher

post-construction cost, vehicular delay cost, and crash cost. The no-build alternative (i.e. existing all-way stop-controlled intersection) has no construction cost or post-construction cost, but it has the highest overall cost due to the vehicular delay cost. The auto passenger delay cost is the largest contributor to the total cost for all three alternatives. Figure 7 graphs the estimated net present value of total costs.

Figure 7: Net Present Value of Total Costs
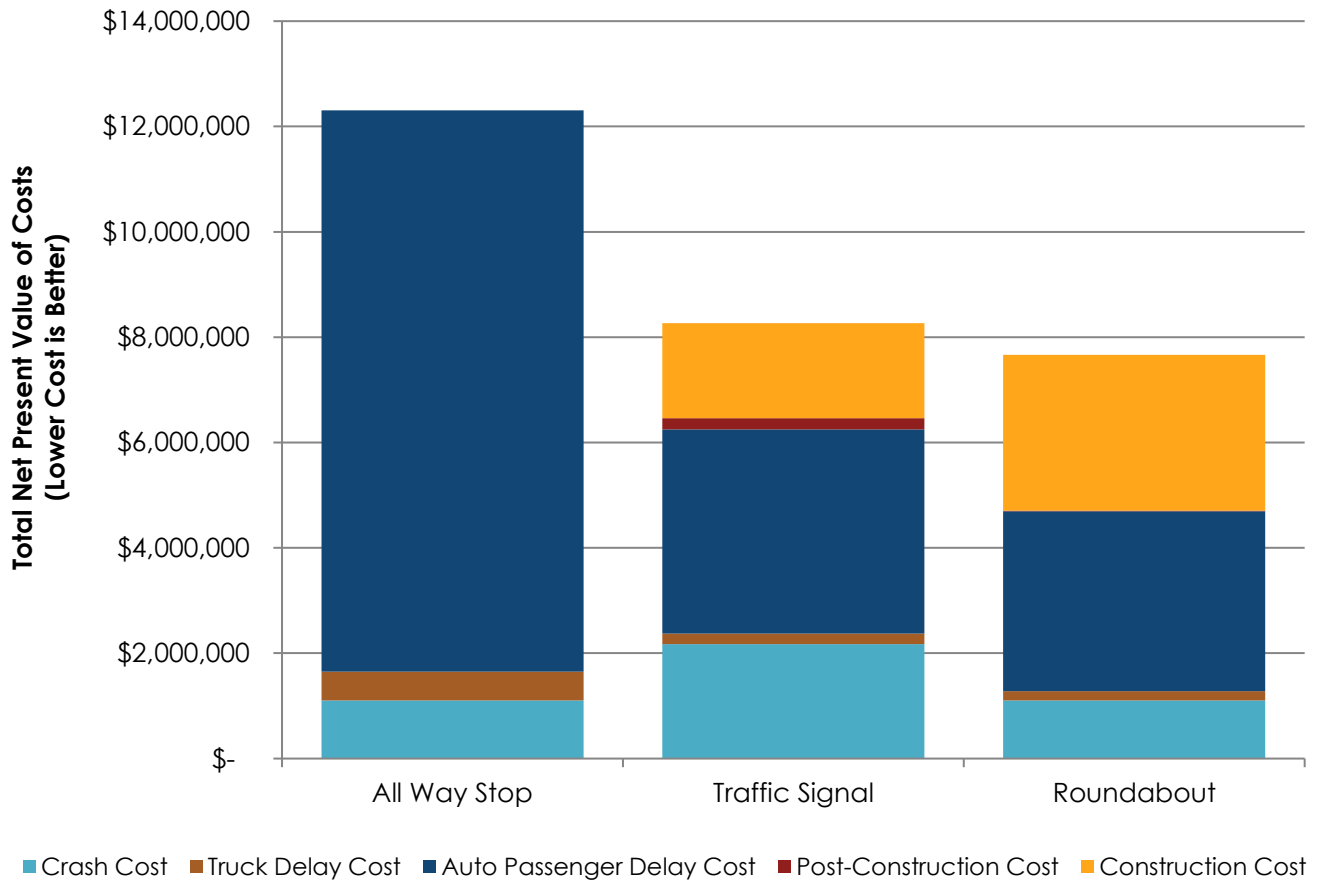
Appendix I provides the outputs for the life-cycle costs analysis.

Conclusion

The evaluations of each alternative, as described in the previous sections, are summarized in Table 8.

Table 8. Evaluation Summary

Consideration	Alt 1: Traffic Signal	Alt 2: Roundabout
Traffic Operations	Operates at a LOS B under 2040 weekday PM peak hour conditions.	Operates at a LOS B under 2040 weekday PM peak hour conditions.
Safety Performance	2.1 total crashes/year including 0.7 fatal/injury crashes per year in 2040.	1.5 total crashes/year including 0.3 fatal/injury crashes per year in 2040.
Freight Mobility	Accommodates a WB-62 design vehicle.	Designed for a WB-62 design vehicle.
Multimodal Operations	Provides bicycle lanes through intersection and sidewalks with signal-controlled crosswalks.	Includes a 10-foot shared path on all corners of the intersection, allowing cyclists the option to navigate through the roundabout either as a vehicle or as a pedestrian. Provides sidewalks and marked pedestrian crossings with pedestrian refuge in the splitter island.
Construction Feasibility	Maintenance of traffic would be simpler compared to the roundabout. Overhead power on the south leg may need to be relocated, which could impact the schedule. Likely faster to construct due to minimal infrastructure, fewer phases, and little to no temporary pavement required.	Maintenance of traffic will be more involved since construction of the approach legs and center circle will be phased. Likely more certain schedule, although right-of-way needed could impact the schedule. Longer schedule due to multiple phases need to construct roundabout.
Right-of-Way Needs	Requires approximately 3,325 SF of new right-of-way. Minor parking loss in northeast parcel. Landscape impacts on northwest and southwest parcels.	Requires approximately 11,750 SF of new right-of-way. More substantial parking loss in northeast parcel. Landscape impacts on northwest and southwest parcels.
Life-Cycle Cost Analysis	15-year life-cycle cost: $8,270,000 (2025 dollars)	15-year life-cycle cost: $7,660,000 (2025 dollars)

References

1. Federal Highway Administration. Intersection Control Evaluation. https://safety.fhwa.dot.gov/intersection/ice/
2. City of Wilsonville Transportation System Plan. 2013.
3. ODOT. *Traffic Signal Policy and Guidelines.* April 2022.
4. NCHRP. *Report 672 Roundabouts: An Informational Guide, 2nd Edition*. 2010.
5. Transportation Research Board. *Highway Capacity Manual, Seventh Edition.* 2021.
6. Federal Highway Administration. Manual of Uniform Traffic Control Devices. 2009 Edition with Revisions 1, 2, and 3. July 2022
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Appendix A
Crash Data

CITY OF WILSONVILLE, CLACKAMAS COUNTY   Intersectional Crashes at SW Canyon Creek Rd & SW Boeckman Rd in Wilsonville, OR. Includes Crashes within 200 Ft of the intersection.
                                                                      January 1, 2011 through December 31, 2020

```
             D
             R
         S   U
         P   G S W
         E A / C O   DATE                 CITY STREET                        INT-TYP                              SPCL
SER#     E A / C O   DATE                 FIRST STREET       RD CHAR  (MEDIAN) INT-REL OFF-RD WTHR  CRASH TYP      USE        MOVE                        A S
INVEST   E L M H R   DAY/TIME    FC       SECOND STREET      DIRECT   LEGS    TRAF-  RNDBT  SURF  COLL TYP         TRLR QTY   FROM         PRTC INJ       G E LICNS PED
UNLOC?   D C J L K   LAT/LONG    DISTNC   INTERSECTION SEQ # LOCTN    (#LANES) CONTL  DRVWY  LIGHT SVRTY       V#  OWNER      TO      P#  TYPE SVRTY     E X RES     LOC ERROR      ACTN EVENT    CAUSE
```

```
00594  N N N N N  02/15/2015  16   BOECKMAN RD         INTER   CROSS   N           N  CLR  PED        01 NONE    0 STRGHT                                                                       02
COUNTY       N    Sun    5P    0   CANYON CREEK RD     E               STOP SIGN   N  DRY  PED           PRVTE      E  W                                                          015            00
No     45 19  2.94  -122 45 27.82  1                   06      0                   N  DAY  INJ           PSNGR CAR           01  DRVR NONE 45 F OR-Y        029            029    000            02
                                                                                                                                                OR<25
                                                                                                             STRGHT 01  CONV INJC 21 M            03  000    034            00
                                                                                                             S  N
```

```
04893  N N N      11/18/2015  16   BOECKMAN RD         INTER   CROSS   N           N  UNK  O-1STOP    01 NONE    0 BACK                                                                         10
NONE         N    Wed    3P    0   CANYON CREEK RD     E               STOP SIGN   N  WET  BACK          PRVTE      W  E                                                          000            00
No     45 19  2.94  -122 45 27.82  1                   06      0                   N  DAY  PDO           PSNGR CAR           01  DRVR NONE 00 F UNK          011    011    000            10
                                                                                                                                                OR<25
                                                                                                     02 NONE    0 STOP
                                                                                                        PRVTE      E  W                                                          011            00
                                                                                                        PSNGR CAR           01  DRVR NONE 17 F OR-Y         000    000    000            00
                                                                                                                                                OR<25
```

```
04854  N N N      11/17/2017  16   BOECKMAN RD         INTER   CROSS   N           N  UNK  S-1STOP    01 NONE    9 STRGHT                                                                       29
NO RPT       N    Fri    7P    0   CANYON CREEK RD     W               STOP SIGN   N  WET  REAR          N/A        W  E                                                          000            00
No     45 19  2.94  -122 45 27.82  1                   06      0                   N  DLIT PDO           PSNGR CAR           01  DRVR NONE 00 U UNK          000    000   -000            00
                                                                                                                                                UNK
                                                                                                     02 NONE    9 STOP
                                                                                                        N/A        W  E                                                         011            00
                                                                                                        PSNGR CAR           01  DRVR NONE 00 U UNK          000    000    000            00
                                                                                                                                                UNK
```

```
02871  N N N N N  06/25/2016  16   BOECKMAN RD         INTER   CROSS   N           N  CLR  ANGL-OTH   01 NONE    0 STRGHT                                                                       03
COUNTY       N    Sat    6P    0   CANYON CREEK RD     CN              STOP SIGN   N  DRY  ANGL          PRVTE      E  W                                                          015            00
No     45 19  2.94  -122 45 27.82  1                   01      0                   N  DAY  INJ           PSNGR CAR           01  DRVR INJC 17 F OR-Y         000    000    000            00
                                                                                                                                                OR<25
                                                                                                        02  PSNG INJC 19 F                       000    000    000            00
                                                                                                     02 NONE    0 STRGHT
                                                                                                        PRVTE      N  S                                                          000            00
                                                                                                        PSNGR CAR           01  DRVR NONE 61 M OR-Y         021    000    000            03
                                                                                                                                                OR<25
```

```
02365  N N N N N  06/20/2014  16   BOECKMAN RD         INTER   3-LEG   N           N  CLR  O-1 L-TURN 01 NONE    0 STRGHT                                                                       02
COUNTY       N    Fri   12P    0   CANYON CREEK RD     CN              STOP SIGN   N  DRY  TURN          PRVTE      E  W                                                          000            00
No     45 19  2.94  -122 45 27.82  1                   02      0                   N  DAY  INJ           PSNGR CAR           01  DRVR INJC 35 M OR-Y         000    000    000            00
                                                                                                                                                OR<25
                                                                                                     02 NONE    0 TURN-L
                                                                                                        PRVTE      W  N                                                          000            00
                                                                                                        PSNGR CAR           01  DRVR NONE 41 F OR-Y     028,004    000    000            02
                                                                                                                                                OR<25
                                                                                                        02  PSNG INJC 07 F                       000    000    000            00
                                                                                                        03  PSNG INJC 05 M                       000    000    000            00
                                                                                                        04  PSNG NO<5 02 M                       000    000    000            00
```

CITY OF WILSONVILLE, CLACKAMAS COUNTY   Intersectional Crashes at SW Canyon Creek Rd & SW Boeckman Rd in Wilsonville, OR. Includes Crashes within 200 Ft of the intersection.
                                                              January 1, 2011 through December 31, 2020

```
            D
            R
          S U
          P   G S W
          E A / C O   DATE              CITY STREET        INT-TYP                              SPCL
SER#      E L M H R   DAY/TIME    FC    FIRST STREET       (MEDIAN) INT-REL OFF-RD WTHR  CRASH TYP   USE       MOVE            A S
INVEST    E L M H R   DAY/TIME    FC    SECOND STREET      LEGS     TRAF-   RNDBT  SURF  COLL TYP    TRLR QTY  FROM      PRTC INJ  G E LICNS PED
UNLOC?    D C J L K   LAT/LONG    DISTNC INTERSECTION SEQ # LOCTN   (#LANES) CONTL  DRVWY LIGHT SVRTY   V# OWNER     TO      P# TYPE SVRTY E X RES  LOC ERROR    ACTN EVENT   CAUSE
```

```
04307  N N N   11/27/2019  16  BOECKMAN RD        INTER   CROSS   N       N CLR  ANGL-OTH   01 NONE   9 STRGHT                                        02
NONE     N     Wed   12P    0  CANYON CREEK RD    CN              STOP SIGN  N DRY  ANGL        N/A       S  N                                  015      00
No    45 19  2.94  -122 45 27.82   1              02      0         N DAY  PDO       PSNGR CAR       01 DRVR NONE 00 U UNK    000      000      00
                                                                                                                 UNK

                                                                            02 NONE   9 STRGHT
                                                                               N/A       E  W                                  015      00
                                                                               PSNGR CAR       01 DRVR NONE 00 U UNK    000      000      00
                                                                                                                 UNK

04327  N N N   11/27/2018  16  BOECKMAN RD        INTER   CROSS   N       N CLD  ANGL-OTH   01 NONE   0 STRGHT                                        03
CITY     N     Tue   2P     0  CANYON CREEK RD    CN              TRF SIGNAL N WET  ANGL        PRVTE     W  E                                  000      00
No    45 19  2.94  -122 45 27.82   1              03      0         N DAY  INJ       PSNGR CAR       01 DRVR NONE 24 F OTH-Y  021      000      03
                                                                                                                 N-RES

                                                                            02 NONE   0 STRGHT
                                                                               PUBLC     N  S                                  015      00
                                                                               SCHL BUS       01 DRVR INJC 54 F OR-Y   000      000      00
                                                                                                                 OR<25

01939  N N N N N  06/12/2019  16  BOECKMAN RD     INTER   CROSS   N       N CLR  ANGL-OTH   01 NONE   9 STRGHT                                        03
CITY     N     Wed   4P     0  CANYON CREEK RD    CN              STOP SIGN  N DRY  ANGL        N/A       N  S                                  000      00
No    45 19  2.95  -122 45 27.82   1              03      0         N DAY  PDO       PSNGR CAR       01 DRVR NONE 00 U UNK    000      000      00
                                                                                                                 UNK

                                                                            02 NONE   9 STRGHT
                                                                               N/A       W  E                                  015      00
                                                                               PSNGR CAR       01 DRVR NONE 00 U UNK    000      000      00
                                                                                                                 UNK

03431  N N N N N  09/15/2012  16  BOECKMAN RD     INTER   CROSS   N       N CLR  ANGL-OTH   01 NONE   0 STRGHT                                        03
COUNTY   N     Sat   8A     0  CANYON CREEK RD    CN              STOP SIGN  N DRY  ANGL        PRVTE     W  E                                  000      00
No    45 19  2.94  -122 45 27.82   1              04      0         N DAY  INJ       PSNGR CAR       01 DRVR INJB 18 F OR-Y   021      000      03
                                                                                                                 OR<25

                                                                            02 NONE   0 STRGHT
                                                                               PRVTE     S  N                                  015      00
                                                                               PSNGR CAR       01 DRVR NONE 46 M OR-Y   000      000      00
                                                                                                                 OR<25

01417  N Y N    04/19/2015  16  BOECKMAN RD       INTER   3-LEG   N       N CLR  ANGL-OTH   01 NONE   0 STRGHT                                        03,33
COUNTY   N     Sun   8P     0  CANYON CREEK RD    CN              STOP SIGN  N DRY  TURN       PRVTE     W  E                                  000      00
No    45 19  2.94  -122 45 27.82   1              04      0         N DLIT INJ       PSNGR CAR       01 DRVR INJA 32 M SUSP   021,051  000      03,33
                                                                                                                 OR<25

                                                                            02 NONE   0 TURN-L
                                                                               PRVTE     S  W                                  015      00
                                                                               PSNGR CAR       01 DRVR NONE 28 M OR-Y   000      000      00
                                                                                                                 OR<25
```

CDS380   8/24/2022

OREGON DEPARTMENT OF TRANSPORTATION - POLICY, DATA AND ANALYSIS DIVISION
TRANSPORTATION DATA SECTION - CRASH ANALYSIS AND REPORTING UNIT
URBAN NON-SYSTEM CRASH LISTING

PAGE: 3

CITY OF WILSONVILLE, CLACKAMAS COUNTY   Intersectional Crashes at SW Canyon Creek Rd & SW Boeckman Rd in Wilsonville, OR. Includes Crashes within 200 Ft of the intersection.
January 1, 2011 through December 31, 2020

```
            D
            R
        S   U
        P   G S W                                       INT-TYP                              SPCL
        E A / C O   DATE            CITY STREET         (MEDIAN) INT-REL OFF-RD WTHR  CRASH TYP   USE          MOVE              A S
SER#    E A / C O   DATE          FIRST STREET   FC   RD CHAR  (MEDIAN) INT-REL OFF-RD WTHR  CRASH TYP   USE      MOVE          A S
INVEST  E L M H R   DAY/TIME   FC  SECOND STREET       DIRECT   LEGS    TRAF-  RNDBT  SURF  COLL TYP    TRLR QTY  FROM     PRTC INJ  G E LICNS PED
UNLOC?  D C J L K   LAT/LONG  DISTNC INTERSECTION SEQ # LOCTN  (#LANES) CONTL  DRVWY  LIGHT SVRTY   V#  OWNER     TO    P# TYPE SVRTY E X RES  LOC ERROR   ACTN EVENT   CAUSE
```

SER# INVEST UNLOC?	SPA EALC/ GCO SM WHRO DCJLK	DATE DAY/TIME LAT/LONG	FC DISTNC	CITY STREET FIRST STREET SECOND STREET INTERSECTION SEQ #	RD CHAR DIRECT LOCTN	INT-TYP (MEDIAN) LEGS (#LANES)	INT-REL TRAF-CONTL	OFF-RD RNDBT DRVWY	WTHR SURF LIGHT	CRASH TYP COLL TYP SVRTY	V#	SPCL USE TRLR QTY OWNER	MOVE FROM TO	P#	PRTC TYPE	INJ SVRTY	AGE	SEX	LICNS RES	PED LOC	ERROR	ACTN	EVENT	CAUSE
00988 NO RPT No	N N N N	03/15/2017 Wed 7A 45 19 2.94	16 0 -122 45 27.82	BOECKMAN RD CANYON CREEK RD 1	INTER CN 04	CROSS 0	N STOP SIGN	N N	CLD WET DAWN	ANGL-OTH ANGL INJ	01	NONE 0 PRVTE PSNGR CAR	STRGHT W E	01	DRVR	INJA	22	F	OR-Y OR>25		021	013 000 000		03 00 03
											02	NONE 0 PRVTE PSNGR CAR	STRGHT S N	01	DRVR	INJC	41	F	OR-Y OR<25		000	000 013 000		00 00 00
											03	NONE 0 PRVTE PSNGR CAR	STOP E W	01	DRVR	INJC	27	F	OR-Y OR<25		000	022 000		00 00
00600 CITY No	N N N N N	02/14/2020 Fri 3P 45 19 2.95	16 0 -122 45 27.83	BOECKMAN RD CANYON CREEK RD 1	INTER CN 04	CROSS 0	N STOP SIGN	N N	CLD DRY DAY	ANGL-OTH ANGL INJ	01	NONE 0 PRVTE PSNGR CAR	STRGHT S N	01	DRVR	INJC	58	F	OR-Y OR<25		021	000 038		27,03 00 27,03
											02	NONE 0 PRVTE PSNGR CAR	STRGHT W E	01	DRVR	NONE	59	M	OTH-Y OR<25		000	015 000		00 00
03456 NONE No	N N N	09/17/2019 Tue 12A 45 19 4.39	17 150 -122 45 27.86	CANYON CREEK RD BOECKMAN RD 1	STRGHT N 07	(NONE) 0	N NONE	Y N	RAIN WET DLIT	FIX OBJ FIX PDO	01	NONE 9 N/A PSNGR CAR	STRGHT N S	01	DRVR	NONE	00	U	UNK UNK		000	072 000 000		05 00 00

ACTION CODE TRANSLATION LIST

ACTION CODE	SHORT DESCRIPTION	LONG DESCRIPTION
000	NONE	NO ACTION OR NON-WARRANTED
001	SKIDDED	SKIDDED
002	ON/OFF V	GETTING ON OR OFF STOPPED OR PARKED VEHICLE
003	LOAD OVR	OVERHANGING LOAD STRUCK ANOTHER VEHICLE, ETC.
006	SLOW DN	SLOWED DOWN
007	AVOIDING	AVOIDING MANEUVER
008	PAR PARK	PARALLEL PARKING
009	ANG PARK	ANGLE PARKING
010	INTERFERE	PASSENGER INTERFERING WITH DRIVER
011	STOPPED	STOPPED IN TRAFFIC NOT WAITING TO MAKE A LEFT TURN
012	STP/L TRN	STOPPED BECAUSE OF LEFT TURN SIGNAL OR WAITING, ETC.
013	STP TURN	STOPPED WHILE EXECUTING A TURN
014	EMR V PKD	EMERGENCY VEHICLE LEGALLY PARKED IN THE ROADWAY
015	GO A/STOP	PROCEED AFTER STOPPING FOR A STOP SIGN/FLASHING RED.
016	TRN A/RED	TURNED ON RED AFTER STOPPING
017	LOSTCTRL	LOST CONTROL OF VEHICLE
018	EXIT DWY	ENTERING STREET OR HIGHWAY FROM ALLEY OR DRIVEWAY
019	ENTR DWY	ENTERING ALLEY OR DRIVEWAY FROM STREET OR HIGHWAY
020	STR ENTR	BEFORE ENTERING ROADWAY, STRUCK PEDESTRIAN, ETC. ON SIDEWALK OR SHOULDER
021	NO DRVR	CAR RAN AWAY - NO DRIVER
022	PREV COL	STRUCK, OR WAS STRUCK BY, VEHICLE OR PEDESTRIAN IN PRIOR COLLISION BEFORE ACC. STABILIZED
023	STALLED	VEHICLE STALLED OR DISABLED
024	DRVR DEAD	DEAD BY UNASSOCIATED CAUSE
025	FATIGUE	FATIGUED, SLEEPY, ASLEEP
026	SUN	DRIVER BLINDED BY SUN
027	HDLGHTS	DRIVER BLINDED BY HEADLIGHTS
028	ILLNESS	PHYSICALLY ILL
029	THRU MED	VEHICLE CROSSED, PLUNGED OVER, OR THROUGH MEDIAN BARRIER
030	PURSUIT	PURSUING OR ATTEMPTING TO STOP A VEHICLE
031	PASSING	PASSING SITUATION
032	PRKOFFRD	VEHICLE PARKED BEYOND CURB OR SHOULDER
033	CROS MED	VEHICLE CROSSED EARTH OR GRASS MEDIAN
034	X N/SGNL	CROSSING AT INTERSECTION - NO TRAFFIC SIGNAL PRESENT
035	X W/ SGNL	CROSSING AT INTERSECTION - TRAFFIC SIGNAL PRESENT
036	DIAGONAL	CROSSING AT INTERSECTION - DIAGONALLY
037	BTWN INT	CROSSING BETWEEN INTERSECTIONS
038	DISTRACT	DRIVER'S ATTENTION DISTRACTED
039	W/TRAF-S	WALKING, RUNNING, RIDING, ETC., ON SHOULDER WITH TRAFFIC
040	A/TRAF-S	WALKING, RUNNING, RIDING, ETC., ON SHOULDER FACING TRAFFIC
041	W/TRAF-P	WALKING, RUNNING, RIDING, ETC., ON PAVEMENT WITH TRAFFIC
042	A/TRAF-P	WALKING, RUNNING, RIDING, ETC., ON PAVEMENT FACING TRAFFIC
043	PLAYINRD	PLAYING IN STREET OR ROAD
044	PUSH MV	PUSHING OR WORKING ON VEHICLE IN ROAD OR ON SHOULDER
045	WORK ON	WORKING IN ROADWAY OR ALONG SHOULDER
046	W/ TRAFIC	NON-MOTORIST WALKING, RUNNING, RIDING, ETC. WITH TRAFFIC
047	A/ TRAFIC	NON-MOTORIST WALKING, RUNNING, RIDING, ETC. FACING TRAFFIC
050	LAY ON RD	STANDING OR LYING IN ROADWAY
051	ENT OFFRD	ENTERING / STARTING IN TRAFFIC LANE FROM OFF ROAD
052	MERGING	MERGING

ACTION CODE TRANSLATION LIST

ACTION CODE	SHORT DESCRIPTION	LONG DESCRIPTION
055	SPRAY	BLINDED BY WATER SPRAY
088	OTHER	OTHER ACTION
099	UNK	UNKNOWN ACTION

CAUSE CODE TRANSLATION LIST

CAUSE CODE	SHORT DESCRIPTION	LONG DESCRIPTION
00	NO CODE	NO CAUSE ASSOCIATED AT THIS LEVEL
01	TOO-FAST	TOO FAST FOR CONDITIONS (NOT EXCEED POSTED SPEED
02	NO-YIELD	DID NOT YIELD RIGHT-OF-WAY
03	PAS-STOP	PASSED STOP SIGN OR RED FLASHER
04	DIS SIG	DISREGARDED TRAFFIC SIGNAL
05	LEFT-CTR	DROVE LEFT OF CENTER ON TWO-WAY ROAD; STRADDLING
06	IMP-OVER	IMPROPER OVERTAKING
07	TOO-CLOS	FOLLOWED TOO CLOSELY
08	IMP-TURN	MADE IMPROPER TURN
09	DRINKING	ALCOHOL OR DRUG INVOLVED
10	OTHR-IMP	OTHER IMPROPER DRIVING
11	MECH-DEF	MECHANICAL DEFECT
12	OTHER	OTHER (NOT IMPROPER DRIVING)
13	IMP LN C	IMPROPER CHANGE OF TRAFFIC LANES
14	DIS TCD	DISREGARDED OTHER TRAFFIC CONTROL DEVICE
15	WRNG WAY	WRONG WAY ON ONE-WAY ROAD; WRONG SIDE DIVIDED RO/
16	FATIGUE	DRIVER DROWSY/FATIGUED/SLEEPY
17	ILLNESS	PHYSICAL ILLNESS
18	IN RDWY	NON-MOTORIST ILLEGALLY IN ROADWAY
19	NT VISBL	NON-MOTORIST NOT VISIBLE; NON-REFLECTIVE CLOTHIN(
20	IMP PKNG	VEHICLE IMPROPERLY PARKED
21	DEF STER	DEFECTIVE STEERING MECHANISM
22	DEF BRKE	INADEQUATE OR NO BRAKES
24	LOADSHFT	VEHICLE LOST LOAD OR LOAD SHIFTED
25	TIREFAIL	TIRE FAILURE
26	PHANTOM	PHANTOM / NON-CONTACT VEHICLE
27	INATTENT	INATTENTION
28	NM INATT	NON-MOTORIST INATTENTION
29	F AVOID	FAILED TO AVOID VEHICLE AHEAD
30	SPEED	DRIVING IN EXCESS OF POSTED SPEED
31	RACING	SPEED RACING (PER PAR)
32	CARELESS	CARELESS DRIVING (PER PAR)
33	RECKLESS	RECKLESS DRIVING (PER PAR)
34	AGGRESV	AGGRESSIVE DRIVING (PER PAR)
35	RD RAGE	ROAD RAGE (PER PAR)
40	VIEW OBS	VIEW OBSCURED
50	USED MDN	IMPROPER USE OF MEDIAN OR SHOULDER
51	FAIL LN	FAILED TO MAINTAIN LANE
52	OFF RD	RAN OFF ROAD

COLLISION TYPE CODE TRANSLATION LIST

COLL CODE	SHORT DESCRIPTION	LONG DESCRIPTION
&	OTH	MISCELLANEOUS
-	BACK	BACKING
0	PED	PEDESTRIAN
1	ANGL	ANGLE
2	HEAD	HEAD-ON
3	REAR	REAR-END
4	SS-M	SIDESWIPE - MEETING
5	SS-O	SIDESWIPE - OVERTAKING
6	TURN	TURNING MOVEMENT
7	PARK	PARKING MANEUVER
8	NCOL	NON-COLLISION
9	FIX	FIXED OBJECT OR OTHER OBJECT

CRASH TYPE CODE TRANSLATION LIST

CRASH TYPE	SHORT DESCRIPTION	LONG DESCRIPTION
&	OVERTURN	OVERTURNED
0	NON-COLL	OTHER NON-COLLISION
1	OTH RDWY	MOTOR VEHICLE ON OTHER ROADWAY
2	PRKD MV	PARKED MOTOR VEHICLE
3	PED	PEDESTRIAN
4	TRAIN	RAILWAY TRAIN
6	BIKE	PEDALCYCLIST
7	ANIMAL	ANIMAL
8	FIX OBJ	FIXED OBJECT
9	OTH OBJ	OTHER OBJECT
A	ANGL-STP	ENTERING AT ANGLE - ONE VEHICLE STOPPED
B	ANGL-OTH	ENTERING AT ANGLE - ALL OTHERS
C	S-STRGHT	FROM SAME DIRECTION - BOTH GOING STRAIGHT
D	S-1TURN	FROM SAME DIRECTION - ONE TURN, ONE STRAIGHT
E	S-1STOP	FROM SAME DIRECTION - ONE STOPPED
F	S-OTHER	FROM SAME DIRECTION-ALL OTHERS, INCLUDING PARKING
G	O-STRGHT	FROM OPPOSITE DIRECTION - BOTH GOING STRAIGHT
H	O-1 L-TURN	FROM OPPOSITE DIRECTION-ONE LEFT TURN,ONE STRAIGHT
I	O-1STOP	FROM OPPOSITE DIRECTION - ONE STOPPED
J	O-OTHER	FROM OPPOSITE DIRECTION-ALL OTHERS INCL. PARKING

DRIVER LICENSE CODE TRANSLATION LIST

LIC CODE	SHORT DESC	LONG DESCRIPTION
0	NONE	NOT LICENSED (HAD NEVER BEEN LICENSED)
1	OR-Y	VALID OREGON LICENSE
2	OTH-Y	VALID LICENSE, OTHER STATE OR COUNTRY
3	SUSP	SUSPENDED/REVOKED
4	EXP	EXPIRED
8	N-VAL	OTHER NON-VALID LICENSE
9	UNK	UNKNOWN IF DRIVER WAS LICENSED AT TIME OF CRASH

DRIVER RESIDENCE CODE TRANSLATION LIST

RES CODE	SHORT DESC	LONG DESCRIPTION
1	OR<25	OREGON RESIDENT WITHIN 25 MILE OF HOME
2	OR>25	OREGON RESIDENT 25 OR MORE MILES FROM HOME
3	OR-?	OREGON RESIDENT - UNKNOWN DISTANCE FROM HOME
4	N-RES	NON-RESIDENT
9	UNK	UNKNOWN IF OREGON RESIDENT

ERROR CODE TRANSLATION LIST

ERROR CODE	SHORT DESCRIPTION	FULL DESCRIPTION
000	NONE	NO ERROR
001	WIDE TRN	WIDE TURN
002	CUT CORN	CUT CORNER ON TURN
003	FAIL TRN	FAILED TO OBEY MANDATORY TRAFFIC TURN SIGNAL, SIGN OR LANE MARKINGS
004	L IN TRF	LEFT TURN IN FRONT OF ONCOMING TRAFFIC
005	L PROHIB	LEFT TURN WHERE PROHIBITED
006	FRM WRNG	TURNED FROM WRONG LANE
007	TO WRONG	TURNED INTO WRONG LANE
008	ILLEG U	U-TURNED ILLEGALLY
009	IMP STOP	IMPROPERLY STOPPED IN TRAFFIC LANE
010	IMP SIG	IMPROPER SIGNAL OR FAILURE TO SIGNAL
011	IMP BACK	BACKING IMPROPERLY (NOT PARKING)
012	IMP PARK	IMPROPERLY PARKED
013	UNPARK	IMPROPER START LEAVING PARKED POSITION
014	IMP STRT	IMPROPER START FROM STOPPED POSITION
015	IMP LGHT	IMPROPER OR NO LIGHTS (VEHICLE IN TRAFFIC)
016	INATTENT	INATTENTION (FAILURE TO DIM LIGHTS PRIOR TO 4/1/97)
017	UNSF VEH	DRIVING UNSAFE VEHICLE (NO OTHER ERROR APPARENT)
018	OTH PARK	ENTERING/EXITING PARKED POSITION W/ INSUFFICIENT CLEARANCE; OTHER IMPROPER PARKING MANEUVER
019	DIS DRIV	DISREGARDED OTHER DRIVER'S SIGNAL
020	DIS SGNL	DISREGARDED TRAFFIC SIGNAL
021	RAN STOP	DISREGARDED STOP SIGN OR FLASHING RED
022	DIS SIGN	DISREGARDED WARNING SIGN, FLARES OR FLASHING AMBER
023	DIS OFCR	DISREGARDED POLICE OFFICER OR FLAGMAN
024	DIS EMER	DISREGARDED SIREN OR WARNING OF EMERGENCY VEHICLE
025	DIS RR	DISREGARDED RR SIGNAL, RR SIGN, OR RR FLAGMAN
026	REAR-END	FAILED TO AVOID STOPPED OR PARKED VEHICLE AHEAD OTHER THAN SCHOOL BUS
027	BIKE ROW	DID NOT HAVE RIGHT-OF-WAY OVER PEDALCYCLIST
028	NO ROW	DID NOT HAVE RIGHT-OF-WAY
029	PED ROW	FAILED TO YIELD RIGHT-OF-WAY TO PEDESTRIAN
030	PAS CURV	PASSING ON A CURVE
031	PAS WRNG	PASSING ON THE WRONG SIDE
032	PAS TANG	PASSING ON STRAIGHT ROAD UNDER UNSAFE CONDITIONS
033	PAS X-WK	PASSED VEHICLE STOPPED AT CROSSWALK FOR PEDESTRIAN
034	PAS INTR	PASSING AT INTERSECTION
035	PAS HILL	PASSING ON CREST OF HILL
036	N/PAS ZN	PASSING IN "NO PASSING" ZONE
037	PAS TRAF	PASSING IN FRONT OF ONCOMING TRAFFIC
038	CUT-IN	CUTTING IN (TWO LANES - TWO WAY ONLY)
039	WRNGSIDE	DRIVING ON WRONG SIDE OF THE ROAD (2-WAY UNDIVIDED ROADWAYS)

ERROR CODE TRANSLATION LIST

ERROR CODE	SHORT DESCRIPTION	FULL DESCRIPTION
040	THRU MED	DRIVING THROUGH SAFETY ZONE OR OVER ISLAND
041	F/ST BUS	FAILED TO STOP FOR SCHOOL BUS
042	F/SLO MV	FAILED TO DECREASE SPEED FOR SLOWER MOVING VEHICLE
043	TOO CLOSE	FOLLOWING TOO CLOSELY (MUST BE ON OFFICER'S REPORT)
044	STRDL LN	STRADDLING OR DRIVING ON WRONG LANES
045	IMP CHG	IMPROPER CHANGE OF TRAFFIC LANES
046	WRNG WAY	WRONG WAY ON ONE-WAY ROADWAY; WRONG SIDE DIVIDED ROAD
047	BASCRULE	DRIVING TOO FAST FOR CONDITIONS (NOT EXCEEDING POSTED SPEED)
048	OPN DOOR	OPENED DOOR INTO ADJACENT TRAFFIC LANE
049	IMPEDING	IMPEDING TRAFFIC
050	SPEED	DRIVING IN EXCESS OF POSTED SPEED
051	RECKLESS	RECKLESS DRIVING (PER PAR)
052	CARELESS	CARELESS DRIVING (PER PAR)
053	RACING	SPEED RACING (PER PAR)
054	X N/SGNL	CROSSING AT INTERSECTION, NO TRAFFIC SIGNAL PRESENT
055	X W/SGNL	CROSSING AT INTERSECTION, TRAFFIC SIGNAL PRESENT
056	DIAGONAL	CROSSING AT INTERSECTION - DIAGONALLY
057	BTWN INT	CROSSING BETWEEN INTERSECTIONS
059	W/TRAF-S	WALKING, RUNNING, RIDING, ETC., ON SHOULDER WITH TRAFFIC
060	A/TRAF-S	WALKING, RUNNING, RIDING, ETC., ON SHOULDER FACING TRAFFIC
061	W/TRAF-P	WALKING, RUNNING, RIDING, ETC., ON PAVEMENT WITH TRAFFIC
062	A/TRAF-P	WALKING, RUNNING, RIDING, ETC., ON PAVEMENT FACING TRAFFIC
063	PLAYINRD	PLAYING IN STREET OR ROAD
064	PUSH MV	PUSHING OR WORKING ON VEHICLE IN ROAD OR ON SHOULDER
065	WORK IN RD	WORKING IN ROADWAY OR ALONG SHOULDER
070	LAY ON RD	STANDING OR LYING IN ROADWAY
071	NM IMP USE	IMPROPER USE OF TRAFFIC LANE BY NON-MOTORIST
073	ELUDING	ELUDING / ATTEMPT TO ELUDE
079	F NEG CURV	FAILED TO NEGOTIATE A CURVE
080	FAIL LN	FAILED TO MAINTAIN LANE
081	OFF RD	RAN OFF ROAD
082	NO CLEAR	DRIVER MISJUDGED CLEARANCE
083	OVRSTEER	OVER-CORRECTING
084	NOT USED	CODE NOT IN USE
085	OVRLOAD	OVERLOADING OR IMPROPER LOADING OF VEHICLE WITH CARGO OR PASSENGERS
097	UNA DIS TC	UNABLE TO DETERMINE WHICH DRIVER DISREGARDED TRAFFIC CONTROL DEVICE

EVENT CODE	SHORT DESCRIPTION	LONG DESCRIPTION
001	FEL/JUMP	OCCUPANT FELL, JUMPED OR WAS EJECTED FROM MOVING VEHICLE
002	INTERFER	PASSENGER INTERFERED WITH DRIVER
003	BUG INTF	ANIMAL OR INSECT IN VEHICLE INTERFERED WITH DRIVER
004	INDRCT PED	PEDESTRIAN INDIRECTLY INVOLVED (NOT STRUCK)
005	SUB-PED	"SUB-PED": PEDESTRIAN INJURED SUBSEQUENT TO COLLISION, ETC.
006	INDRCT BIK	PEDALCYCLIST INDIRECTLY INVOLVED (NOT STRUCK)
007	HITCHIKR	HITCHHIKER (SOLICITING A RIDE)
008	PSNGR TOW	PASSENGER OR NON-MOTORIST BEING TOWED OR PUSHED ON CONVEYANCE
009	ON/OFF V	GETTING ON/OFF STOPPED/PARKED VEHICLE (OCCUPANTS ONLY; MUST HAVE PHYSICAL CONTACT W/ VEHIC
010	SUB OTRN	OVERTURNED AFTER FIRST HARMFUL EVENT
011	MV PUSHD	VEHICLE BEING PUSHED
012	MV TOWED	VEHICLE TOWED OR HAD BEEN TOWING ANOTHER VEHICLE
013	FORCED	VEHICLE FORCED BY IMPACT INTO ANOTHER VEHICLE, PEDALCYCLIST OR PEDESTRIAN
014	SET MOTN	VEHICLE SET IN MOTION BY NON-DRIVER (CHILD RELEASED BRAKES, ETC.)
015	RR ROW	AT OR ON RAILROAD RIGHT-OF-WAY (NOT LIGHT RAIL)
016	LT RL ROW	AT OR ON LIGHT-RAIL RIGHT-OF-WAY
017	RR HIT V	TRAIN STRUCK VEHICLE
018	V HIT RR	VEHICLE STRUCK TRAIN
019	HIT RR CAR	VEHICLE STRUCK RAILROAD CAR ON ROADWAY
020	JACKNIFE	JACKKNIFE; TRAILER OR TOWED VEHICLE STRUCK TOWING VEHICLE
021	TRL OTRN	TRAILER OR TOWED VEHICLE OVERTURNED
022	CN BROKE	TRAILER CONNECTION BROKE
023	DETACH TRL	DETACHED TRAILING OBJECT STRUCK OTHER VEHICLE, NON-MOTORIST, OR OBJECT
024	V DOOR OPN	VEHICLE DOOR OPENED INTO ADJACENT TRAFFIC LANE
025	WHEELOFF	WHEEL CAME OFF
026	HOOD UP	HOOD FLEW UP
028	LOAD SHIFT	LOST LOAD, LOAD MOVED OR SHIFTED
029	TIREFAIL	TIRE FAILURE
030	PET	PET: CAT, DOG AND SIMILAR
031	LVSTOCK	STOCK: COW, CALF, BULL, STEER, SHEEP, ETC.
032	HORSE	HORSE, MULE, OR DONKEY
033	HRSE&RID	HORSE AND RIDER
034	GAME	WILD ANIMAL, GAME (INCLUDES BIRDS; NOT DEER OR ELK)
035	DEER ELK	DEER OR ELK, WAPITI
036	ANML VEH	ANIMAL-DRAWN VEHICLE
037	CULVERT	CULVERT, OPEN LOW OR HIGH MANHOLE
038	ATENUATN	IMPACT ATTENUATOR
039	PK METER	PARKING METER
040	CURB	CURB (ALSO NARROW SIDEWALKS ON BRIDGES)
041	JIGGLE	JIGGLE BAR OR TRAFFIC SNAKE FOR CHANNELIZATION
042	GDRL END	LEADING EDGE OF GUARDRAIL
043	GARDRAIL	GUARD RAIL (NOT METAL MEDIAN BARRIER)
044	BARRIER	MEDIAN BARRIER (RAISED OR METAL)
045	WALL	RETAINING WALL OR TUNNEL WALL
046	BR RAIL	BRIDGE RAILING OR PARAPET (ON BRIDGE OR APPROACH)
047	BR ABUTMNT	BRIDGE ABUTMENT (INCLUDED "APPROACH END" THRU 2013)
048	BR COLMN	BRIDGE PILLAR OR COLUMN
049	BR GIRDR	BRIDGE GIRDER (HORIZONTAL BRIDGE STRUCTURE OVERHEAD)
050	ISLAND	TRAFFIC RAISED ISLAND
051	GORE	GORE
052	POLE UNK	POLE – TYPE UNKNOWN
053	POLE UTL	POLE – POWER OR TELEPHONE
054	ST LIGHT	POLE – STREET LIGHT ONLY
055	TRF SGNL	POLE – TRAFFIC SIGNAL AND PED SIGNAL ONLY
056	SGN BRDG	POLE – SIGN BRIDGE
057	STOPSIGN	STOP OR YIELD SIGN

EVENT CODE	SHORT DESCRIPTION	LONG DESCRIPTION
058	OTH SIGN	OTHER SIGN, INCLUDING STREET SIGNS
059	HYDRANT	HYDRANT
060	MARKER	DELINEATOR OR MARKER (REFLECTOR POSTS)
061	MAILBOX	MAILBOX
062	TREE	TREE, STUMP OR SHRUBS
063	VEG OHED	TREE BRANCH OR OTHER VEGETATION OVERHEAD, ETC.
064	WIRE/CBL	WIRE OR CABLE ACROSS OR OVER THE ROAD
065	TEMP SGN	TEMPORARY SIGN OR BARRICADE IN ROAD, ETC.
066	PERM SGN	PERMANENT SIGN OR BARRICADE IN/OFF ROAD
067	SLIDE	SLIDES, FALLEN OR FALLING ROCKS
068	FRGN OBJ	FOREIGN OBSTRUCTION/DEBRIS IN ROAD (NOT GRAVEL)
069	EQP WORK	EQUIPMENT WORKING IN/OFF ROAD
070	OTH EQP	OTHER EQUIPMENT IN OR OFF ROAD (INCLUDES PARKED TRAILER, BOAT)
071	MAIN EQP	WRECKER, STREET SWEEPER, SNOW PLOW OR SANDING EQUIPMENT
072	OTHER WALL	ROCK, BRICK OR OTHER SOLID WALL
073	IRRGL PVMT	OTHER BUMP (NOT SPEED BUMP), POTHOLE OR PAVEMENT IRREGULARITY (PER PAR)
074	OVERHD OBJ	OTHER OVERHEAD OBJECT (HIGHWAY SIGN, SIGNAL HEAD, ETC.); NOT BRIDGE
075	CAVE IN	BRIDGE OR ROAD CAVE IN
076	HI WATER	HIGH WATER
077	SNO BANK	SNOW BANK
078	LO-HI EDGE	LOW OR HIGH SHOULDER AT PAVEMENT EDGE
079	DITCH	CUT SLOPE OR DITCH EMBANKMENT
080	OBJ FRM MV	STRUCK BY ROCK OR OTHER OBJECT SET IN MOTION BY OTHER VEHICLE (INCL. LOST LOADS)
081	FLY-OBJ	STRUCK BY ROCK OR OTHER MOVING OR FLYING OBJECT (NOT SET IN MOTION BY VEHICLE)
082	VEH HID	VEHICLE OBSCURED VIEW
083	VEG HID	VEGETATION OBSCURED VIEW
084	BLDG HID	VIEW OBSCURED BY FENCE, SIGN, PHONE BOOTH, ETC.
085	WIND GUST	WIND GUST
086	IMMERSED	VEHICLE IMMERSED IN BODY OF WATER
087	FIRE/EXP	FIRE OR EXPLOSION
088	FENC/BLD	FENCE OR BUILDING, ETC.
089	OTHR CRASH	CRASH RELATED TO ANOTHER SEPARATE CRASH
090	TO 1 SIDE	TWO-WAY TRAFFIC ON DIVIDED ROADWAY ALL ROUTED TO ONE SIDE
091	BUILDING	BUILDING OR OTHER STRUCTURE
092	PHANTOM	OTHER (PHANTOM) NON-CONTACT VEHICLE
093	CELL PHONE	CELL PHONE (ON PAR OR DRIVER IN USE)
094	VIOL GDL	TEENAGE DRIVER IN VIOLATION OF GRADUATED LICENSE PGM
095	GUY WIRE	GUY WIRE
096	BERM	BERM (EARTHEN OR GRAVEL MOUND)
097	GRAVEL	GRAVEL IN ROADWAY
098	ABR EDGE	ABRUPT EDGE
099	CELL WTNSD	CELL PHONE USE WITNESSED BY OTHER PARTICIPANT
100	UNK FIXD	FIXED OBJECT, UNKNOWN TYPE.
101	OTHER OBJ	NON-FIXED OBJECT, OTHER OR UNKNOWN TYPE
102	TEXTING	TEXTING
103	WZ WORKER	WORK ZONE WORKER
104	ON VEHICLE	PASSENGER RIDING ON VEHICLE EXTERIOR
105	PEDAL PSGR	PASSENGER RIDING ON PEDALCYCLE
106	MAN WHLCHR	PEDESTRIAN IN NON-MOTORIZED WHEELCHAIR
107	MTR WHLCHR	PEDESTRIAN IN MOTORIZED WHELCHAIR
108	OFFICER	LAW ENFORCEMENT / POLICE OFFICER
109	SUB-BIKE	"SUB-BIKE": PEDALCYCLIST INJURED SUBSEQUENT TO COLLISION, ETC.
110	N-MTR	NON-MOTORIST STRUCK VEHICLE
111	S CAR VS V	STREET CAR/TROLLEY (ON RAILS OR OVERHEAD WIRE SYSTEM) STRUCK VEHICLE
112	V VS S CAR	VEHICLE STRUCK STREET CAR/TROLLEY (ON RAILS OR OVERHEAD WIRE SYSTEM)
113	S CAR ROW	AT OR ON STREET CAR OR TROLLEY RIGHT-OF-WAY

EVENT CODE	SHORT DESCRIPTION	LONG DESCRIPTION
114	RR EQUIP	VEHICLE STRUCK RAILROAD EQUIPMENT (NOT TRAIN) ON TRACKS
115	DSTRCT GPS	DISTRACTED BY NAVIGATION SYSTEM OR GPS DEVICE
116	DSTRCT OTH	DISTRACTED BY OTHER ELECTRONIC DEVICE
117	RR GATE	RAIL CROSSING DROP-ARM GATE
118	EXPNSN JNT	EXPANSION JOINT
119	JERSEY BAR	JERSEY BARRIER
120	WIRE BAR	WIRE OR CABLE MEDIAN BARRIER
121	FENCE	FENCE
123	OBJ IN VEH	LOOSE OBJECT IN VEHICLE STRUCK OCCUPANT
124	SLIPPERY	SLIDING OR SWERVING DUE TO WET, ICY, SLIPPERY OR LOOSE SURFACE (NOT GRAVEL)
125	SHLDR	SHOULDER GAVE WAY
126	BOULDER	ROCK(S), BOULDER (NOT GRAVEL; NOT ROCK SLIDE)
127	LAND SLIDE	ROCK SLIDE OR LAND SLIDE
128	CURVE INV	CURVE PRESENT AT CRASH LOCATION
129	HILL INV	VERTICAL GRADE / HILL PRESENT AT CRASH LOCATION
130	CURVE HID	VIEW OBSCURED BY CURVE
131	HILL HID	VIEW OBSCURED BY VERTICAL GRADE / HILL
132	WINDOW HID	VIEW OBSCURED BY VEHICLE WINDOW CONDITIONS
133	SPRAY HID	VIEW OBSCURED BY WATER SPRAY
134	TORRENTIAL	TORRENTIAL RAIN (EXCEPTIONALLY HEAVY RAIN)
135	RAIL OCC	INJURED OCCUPANT OF RAILWAY TRAIN, LIGHT RAIL, STREET CAR OR CABLE CAR

FUNCTIONAL CLASSIFICATION TRANSLATION LIST

FUNC CLASS	DESCRIPTION
01	RURAL PRINCIPAL ARTERIAL - INTERSTATE
02	RURAL PRINCIPAL ARTERIAL - OTHER
06	RURAL MINOR ARTERIAL
07	RURAL MAJOR COLLECTOR
08	RURAL MINOR COLLECTOR
09	RURAL LOCAL
11	URBAN PRINCIPAL ARTERIAL - INTERSTATE
12	URBAN PRINCIPAL ARTERIAL - OTHER FREEWAYS AND EXP
14	URBAN PRINCIPAL ARTERIAL - OTHER
16	URBAN MINOR ARTERIAL
17	URBAN MAJOR COLLECTOR
18	URBAN MINOR COLLECTOR
19	URBAN LOCAL
78	UNKNOWN RURAL SYSTEM
79	UNKNOWN RURAL NON-SYSTEM
98	UNKNOWN URBAN SYSTEM
99	UNKNOWN URBAN NON-SYSTEM

HIGHWAY COMPONENT TRANSLATION LIST

CODE	DESCRIPTION
0	MAINLINE STATE HIGHWAY
1	COUPLET
3	FRONTAGE ROAD
6	CONNECTION
8	HIGHWAY - OTHER

INJURY SEVERITY CODE TRANSLATION LIST

CODE	SHORT DESC	LONG DESCRIPTION
1	KILL	FATAL INJURY (K)
2	INJA	SUSPECTED SERIOUS INJURY (A)
3	INJB	SUSPECTED MINOR INJURY (B)
4	INJC	POSSIBLE INJURY (C)
5	PRI	DIED PRIOR TO CRASH
7	NO<5	NO INJURY - 0 TO 4 YEARS OF AGE
9	NONE	NO APPARENT INJURY (O)

LIGHT CONDITION CODE TRANSLATION LIST

CODE	SHORT DESC	LONG DESCRIPTION
0	UNK	UNKNOWN
1	DAY	DAYLIGHT
2	DLIT	DARKNESS - WITH STREET LIGHTS
3	DARK	DARKNESS - NO STREET LIGHTS
4	DAWN	DAWN (TWILIGHT)
5	DUSK	DUSK (TWILIGHT)

MEDIAN TYPE CODE TRANSLATION LIST

CODE	SHORT DESC	LONG DESCRIPTION
0	NONE	NO MEDIAN
1	RSDMD	SOLID MEDIAN BARRIER
2	DIVMD	EARTH, GRASS OR PAVED MEDIAN

MILEAGE TYPE CODE TRANSLATION LIST

CODE	LONG DESCRIPTION
0	REGULAR MILEAGE
T	TEMPORARY
Y	SPUR
Z	OVERLAPPING

MOVEMENT TYPE CODE TRANSLATION LIST

CODE	SHORT DESC	LONG DESCRIPTION
0	UNK	UNKNOWN
1	STRGHT	STRAIGHT AHEAD
2	TURN-R	TURNING RIGHT
3	TURN-L	TURNING LEFT
4	U-TURN	MAKING A U-TURN
5	BACK	BACKING
6	STOP	STOPPED IN TRAFFIC
7	PRKD-P	PARKED - PROPERLY
8	PRKD-I	PARKED - IMPROPERLY
9	PARKNG	PARKING MANEUVER

NON-MOTORIST LOCATION CODE TRANSLATION LIST

CODE	LONG DESCRIPTION
00	AT INTERSECTION - NOT IN ROADWAY
01	AT INTERSECTION - INSIDE CROSSWALK
02	AT INTERSECTION - IN ROADWAY, OUTSIDE CROSSWALK
03	AT INTERSECTION - IN ROADWAY, XWALK AVAIL UNKNWN
04	NOT AT INTERSECTION - IN ROADWAY
05	NOT AT INTERSECTION - ON SHOULDER
06	NOT AT INTERSECTION - ON MEDIAN
07	NOT AT INTERSECTION - WITHIN TRAFFIC RIGHT-OF-WAY
08	NOT AT INTERSECTION - IN BIKE PATH OR PARKING LANE
09	NOT-AT INTERSECTION - ON SIDEWALK
10	OUTSIDE TRAFFICWAY BOUNDARIES
13	AT INTERSECTION - IN BIKE LANE
14	NOT AT INTERSECTION - IN BIKE LANE
15	NOT AT INTERSECTION - INSIDE MID-BLOCK CROSSWALK
16	NOT AT INTERSECTION - IN PARKING LANE
18	OTHER, NOT IN ROADWAY
99	UNKNOWN LOCATION

ROAD CHARACTER CODE TRANSLATION LIST

CODE	SHORT DESC	LONG DESCRIPTION
0	UNK	UNKNOWN
1	INTER	INTERSECTION
2	ALLEY	DRIVEWAY OR ALLEY
3	STRGHT	STRAIGHT ROADWAY
4	TRANS	TRANSITION
5	CURVE	CURVE (HORIZONTAL CURVE)
6	OPENAC	OPEN ACCESS OR TURNOUT
7	GRADE	GRADE (VERTICAL CURVE)
8	BRIDGE	BRIDGE STRUCTURE
9	TUNNEL	TUNNEL

PARTICIPANT TYPE CODE TRANSLATION LIST

CODE	SHORT DESC	LONG DESCRIPTION
0	OCC	UNKNOWN OCCUPANT TYPE
1	DRVR	DRIVER
2	PSNG	PASSENGER
3	PED	PEDESTRIAN
4	CONV	PEDESTRIAN USING A PEDESTRIAN CONVEYAI
5	PTOW	PEDESTRIAN TOWING OR TRAILERING AN OB
6	BIKE	PEDALCYCLIST
7	BTOW	PEDALCYCLIST TOWING OR TRAILERING AN
8	PRKD	OCCUPANT OF A PARKED MOTOR VEHICLE
9	OTHR	OTHER TYPE OF NON-MOTORIST

TRAFFIC CONTROL DEVICE CODE TRANSLATION LIST

CODE	SHORT DESC	LONG DESCRIPTION
000	NONE	NO CONTROL
001	TRF SIGNAL	TRAFFIC SIGNALS
002	FLASHBCN-R	FLASHING BEACON - RED (STOP)
003	FLASHBCN-A	FLASHING BEACON - AMBER (SLOW)
004	STOP SIGN	STOP SIGN
005	SLOW SIGN	SLOW SIGN
006	REG-SIGN	REGULATORY SIGN
007	YIELD	YIELD SIGN
008	WARNING	WARNING SIGN
009	CURVE	CURVE SIGN
010	SCHL X-ING	SCHOOL CROSSING SIGN OR SPECIAL SIGNAL
011	OFCR/FLAG	POLICE OFFICER, FLAGMAN - SCHOOL PATROL
012	BRDG-GATE	BRIDGE GATE - BARRIER
013	TEMP-BARR	TEMPORARY BARRIER
014	NO-PASS-ZN	NO PASSING ZONE
015	ONE-WAY	ONE-WAY STREET
016	CHANNEL	CHANNELIZATION
017	MEDIAN BAR	MEDIAN BARRIER
018	PILOT CAR	PILOT CAR
019	SP PED SIG	SPECIAL PEDESTRIAN SIGNAL
020	X-BUCK	CROSSBUCK
021	THR-GN-SIG	THROUGH GREEN ARROW OR SIGNAL
022	L-GRN-SIG	LEFT TURN GREEN ARROW, LANE MARKINGS, OR SIGNAL
023	R-GRN-SIG	RIGHT TURN GREEN ARROW, LANE MARKINGS, OR SIGNAL
024	WIGWAG	WIGWAG OR FLASHING LIGHTS W/O DROP-ARM GATE
025	X-BUCK WRN	CROSSBUCK AND ADVANCE WARNING
026	WW W/ GATE	FLASHING LIGHTS WITH DROP-ARM GATES
027	OVRHD SGNL	SUPPLEMENTAL OVERHEAD SIGNAL (RR XING ONLY)
028	SP RR STOP	SPECIAL RR STOP SIGN
029	ILUM GRD X	ILLUMINATED GRADE CROSSING
037	RAMP METER	METERED RAMPS
038	RUMBLE STR	RUMBLE STRIP
040	AUTO. FLAG	AUTOMATED FLAGGER ASSISTANCE DEVICE
090	L-TURN REF	LEFT TURN REFUGE (WHEN REFUGE IS INVOLVED)
091	R-TURN ALL	RIGHT TURN AT ALL TIMES SIGN, ETC.
092	EMR SGN/FL	EMERGENCY SIGNS OR FLARES
093	ACCEL LANE	ACCELERATION OR DECELERATION LANES
094	R-TURN PRO	RIGHT TURN PROHIBITED ON RED AFTER STOPPING
095	BUS STPSGN	BUS STOP SIGN AND RED LIGHTS

VEHICLE TYPE CODE TRANSLATION LIST

CODE	SHORT DESC	LONG DESCRIPTION
00	PDO	NOT COLLECTED FOR PDO CRASHES
01	PSNGR CAR	PASSENGER CAR, PICKUP, LIGHT DELIVERY, ETC.
02	BOBTAIL	TRUCK TRACTOR WITH NO TRAILERS (BOBTAIL)
03	FARM TRCTR	FARM TRACTOR OR SELF-PROPELLED FARM EQUIPMENT
04	SEMI TOW	TRUCK TRACTOR WITH TRAILER/MOBILE HOME IN TOW
05	TRUCK	TRUCK WITH NON-DETACHABLE BED, PANEL, ETC.
06	MOPED	MOPED, MINIBIKE, SEATED MOTOR SCOOTER, MOTOR BIKE
07	SCHL BUS	SCHOOL BUS (INCLUDES VAN)
08	OTH BUS	OTHER BUS
09	MTRCYCLE	MOTORCYCLE, DIRT BIKE
10	OTHER	OTHER: FORKLIFT, BACKHOE, ETC.
11	MOTRHOME	MOTORHOME
12	TROLLEY	MOTORIZED STREET CAR/TROLLEY (NO RAILS/WIRES)
13	ATV	ATV
14	MTRSCTR	MOTORIZED SCOOTER (STANDING)
15	SNOWMOBILE	SNOWMOBILE
99	UNKNOWN	UNKNOWN VEHICLE TYPE

WEATHER CONDITION CODE TRANSLATION LIST

CODE	SHORT DESC	LONG DESCRIPTION
0	UNK	UNKNOWN
1	CLR	CLEAR
2	CLD	CLOUDY
3	RAIN	RAIN
4	SLT	SLEET
5	FOG	FOG
6	SNOW	SNOW
7	DUST	DUST
8	SMOK	SMOKE
9	ASH	ASH

Appendix B
Traffic Data

QUALITY COUNTS REPORT

Type: Volume Data
Location: Boeckman Rd 250-700' w/o Canyon Creek Rd
Specific Location:
City/State: Wilsonville OR
QCJobNo: 15502817
Date:
Direction: EB
Comments:

Start Time	Mon	Tue	Wed	Thu	Fri	Average Weekday Hourly Traffic	Sat	Sun	Average Week Hourly Traffic
				8-Jul-21					
12:00 AM				4		4			4
1:00 AM				0		0			0
2:00 AM				3		3			3
3:00 AM				9		9			9
4:00 AM				18		18			18
5:00 AM				33		33			33
6:00 AM				92		92			92
7:00 AM				126		126			126
8:00 AM				206		206			206
9:00 AM				163		163			163
10:00 AM				152		152			152
11:00 AM				192		192			192
12:00 PM				182		182			182
1:00 PM				186		186			186
2:00 PM				203		203			203
3:00 PM				249		249			249
4:00 PM				323		323			323
5:00 PM				331		331			331
6:00 PM				245		245			245
7:00 PM				111		111			111
8:00 PM				101		101			101
9:00 PM				79		79			79
10:00 PM				44		44			44
11:00 PM				35		35			35
Day Total				3087		3087			3087
ADT				3087		3087			3087

%Weekday Average	100.00%		
%Week Average	100.00%	100.00%	
AM Peak	8:00 AM	8:00 AM	8:00 AM
Volume	206	206	206
PM Peak	5:00 PM	5:00 PM	5:00 PM
Volume	331	331	331

QUALITY COUNTS REPORT

Type: Volume Data
Location: Boeckman Rd 250-700' w/o Canyon Creek Rd
Specific Location:
City/State: Wilsonville OR
QCJobNo: 15502817
Date:
Direction: WB
Comments:

Start Time	Mon	Tue	Wed	Thu	Fri	Average Weekday Hourly Traffic	Sat	Sun	Average Week Hourly Traffic
				8-Jul-21					
12:00 AM				10		10			10
1:00 AM				2		2			2
2:00 AM				3		3			3
3:00 AM				4		4			4
4:00 AM				9		9			9
5:00 AM				12		12			12
6:00 AM				62		62			62
7:00 AM				128		128			128
8:00 AM				186		186			186
9:00 AM				142		142			142
10:00 AM				141		141			141
11:00 AM				187		187			187
12:00 PM				172		172			172
1:00 PM				179		179			179
2:00 PM				215		215			215
3:00 PM				270		270			270
4:00 PM				328		328			328
5:00 PM				366		366			366
6:00 PM				188		188			188
7:00 PM				125		125			125
8:00 PM				103		103			103
9:00 PM				61		61			61
10:00 PM				31		31			31
11:00 PM				18		18			18
Day Total				2942		2942			2942
ADT				2942		2942			2942

%Weekday Average   100.00%
%Week Average   100.00%   100.00%

AM Peak   11:00 AM   11:00 AM   11:00 AM
Volume   187   187   187

PM Peak   5:00 PM   5:00 PM   5:00 PM
Volume   366   366   366

atd
ALL TRAFFIC DATA SERVICES

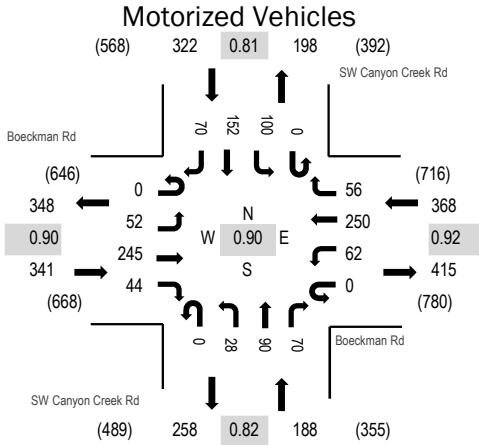(303) 216-2439
www.alltrafficdata.net

Location: 2 SW Canyon Creek Rd & Boeckman Rd PM

Date: Thursday, September 30, 2021

Peak Hour: 04:45 PM - 05:45 PM

Peak 15-Minutes: 04:50 PM - 05:05 PM

Peak Hour

Motorized Vehicles

Heavy Vehicles

Pedestrians
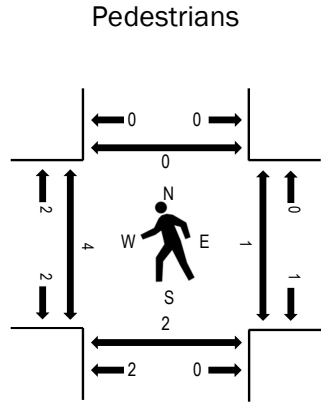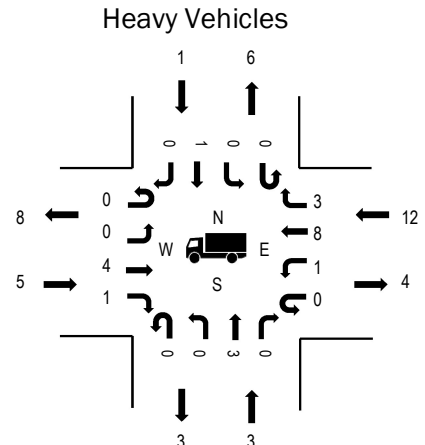
Note: Total study counts contained in parentheses.

	HV%	PHF
EB	1.5%	0.90
WB	3.3%	0.92
NB	1.6%	0.82
SB	0.3%	0.81
All	1.7%	0.90

Traffic Counts - Motorized Vehicles

Interval Start Time	Boeckman Rd Eastbound				Boeckman Rd Westbound				SW Canyon Creek Rd Northbound				SW Canyon Creek Rd Southbound				Total	Rolling Hour
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right		
4:00 PM	0	6	17	8	0	11	31	4	0	4	5	2	0	5	9	4	106	1,142
4:05 PM	0	4	22	2	0	4	18	7	0	0	8	6	0	2	9	1	83	1,148
4:10 PM	0	5	21	3	0	3	20	4	0	1	5	5	0	3	15	7	92	1,172
4:15 PM	0	5	14	3	0	2	15	5	0	2	15	6	0	8	7	3	85	1,184
4:20 PM	0	2	28	2	0	4	14	6	0	2	11	4	0	5	15	3	96	1,201
4:25 PM	0	3	19	7	0	7	22	4	0	3	7	4	0	7	9	2	94	1,201
4:30 PM	0	3	23	3	0	8	21	4	0	2	4	5	0	7	5	9	94	1,202
4:35 PM	0	4	22	5	0	2	19	5	0	3	10	1	0	3	13	3	90	1,214
4:40 PM	0	3	19	2	0	6	12	3	0	3	8	4	0	11	14	7	92	1,215
4:45 PM	0	3	18	4	0	1	20	3	0	3	5	3	0	9	9	7	85	1,219
4:50 PM	0	8	12	4	0	5	31	6	0	2	9	5	0	12	16	3	113	1,214
4:55 PM	0	7	25	2	0	6	19	3	0	3	7	8	0	9	13	10	112	1,190
5:00 PM	0	5	22	0	0	2	12	6	0	5	9	11	0	16	15	9	112	1,165
5:05 PM	0	2	27	7	0	8	24	6	0	1	7	3	0	9	10	3	107	
5:10 PM	0	3	21	6	0	8	20	5	0	1	11	4	0	6	12	7	104	
5:15 PM	0	7	19	3	0	4	20	6	0	3	10	7	0	6	14	3	102	
5:20 PM	0	5	14	5	0	7	23	7	0	3	4	5	0	6	11	6	96	
5:25 PM	0	4	19	6	0	7	18	5	0	2	3	3	0	7	16	5	95	
5:30 PM	0	2	25	5	0	3	20	3	0	1	10	7	0	10	11	9	106	
5:35 PM	0	3	21	1	0	6	17	5	0	3	8	5	0	4	17	1	91	
5:40 PM	0	3	22	1	0	5	26	1	0	1	7	9	0	6	8	7	96	
5:45 PM	0	1	21	3	0	7	20	2	0	2	8	6	0	6	2	2	80	
5:50 PM	0	2	16	4	0	5	20	6	0	0	11	2	0	10	10	3	89	
5:55 PM	0	4	19	2	0	6	16	5	0	0	5	3	0	9	14	4	87	
Count Total	0	94	486	88	0	127	478	111	0	50	187	118	0	176	274	118	2,307	
Peak Hour	0	52	245	44	0	62	250	56	0	28	90	70	0	100	152	70	1,219	

Traffic Counts - Heavy Vehicles, Bicycles on Road, and Pedestrians/Bicycles on Crosswalk

Interval Start Time	Heavy Vehicles					Interval Start Time	Bicycles on Roadway					Interval Start Time	Pedestrians/Bicycles on Crosswalk				
	EB	NB	WB	SB	Total		EB	NB	WB	SB	Total		EB	NB	WB	SB	Total
4:00 PM	0	0	3	0	3	4:00 PM	0	0	0	0	0	4:00 PM	0	0	0	0	0
4:05 PM	0	2	2	0	4	4:05 PM	0	0	0	0	0	4:05 PM	0	0	0	0	0
4:10 PM	1	0	1	0	2	4:10 PM	0	0	0	0	0	4:10 PM	0	2	0	0	2
4:15 PM	1	1	0	1	3	4:15 PM	0	0	0	0	0	4:15 PM	1	2	2	0	5
4:20 PM	0	1	1	0	2	4:20 PM	0	0	0	0	0	4:20 PM	0	0	0	0	0
4:25 PM	1	0	2	0	3	4:25 PM	0	0	0	0	0	4:25 PM	0	0	0	0	0
4:30 PM	1	0	2	0	3	4:30 PM	0	0	0	0	0	4:30 PM	0	2	0	0	2
4:35 PM	0	0	0	0	0	4:35 PM	0	0	0	0	0	4:35 PM	0	0	2	0	2
4:40 PM	0	0	0	0	0	4:40 PM	0	0	0	1	1	4:40 PM	0	0	0	0	0
4:45 PM	0	0	1	0	1	4:45 PM	0	0	0	0	0	4:45 PM	0	0	0	0	0
4:50 PM	0	0	1	0	1	4:50 PM	0	0	0	1	1	4:50 PM	0	0	0	0	0
4:55 PM	0	0	0	0	0	4:55 PM	0	0	0	0	0	4:55 PM	0	0	0	0	0
5:00 PM	1	0	0	0	1	5:00 PM	0	0	0	0	0	5:00 PM	0	1	0	0	1
5:05 PM	1	0	0	0	1	5:05 PM	0	0	0	0	0	5:05 PM	1	0	0	0	1
5:10 PM	1	0	1	0	2	5:10 PM	0	0	0	0	0	5:10 PM	0	0	0	0	0
5:15 PM	0	0	1	1	2	5:15 PM	0	0	0	0	0	5:15 PM	1	0	0	0	1
5:20 PM	2	0	2	0	4	5:20 PM	0	0	0	0	0	5:20 PM	0	1	0	0	1
5:25 PM	0	0	1	0	1	5:25 PM	0	0	0	0	0	5:25 PM	0	0	0	0	0
5:30 PM	0	1	2	0	3	5:30 PM	0	0	0	0	0	5:30 PM	0	0	0	0	0
5:35 PM	0	2	3	0	5	5:35 PM	0	0	0	0	0	5:35 PM	0	0	1	0	1
5:40 PM	0	0	0	0	0	5:40 PM	0	0	0	0	0	5:40 PM	2	0	0	0	2
5:45 PM	0	0	0	0	0	5:45 PM	0	0	0	0	0	5:45 PM	2	0	0	0	2
5:50 PM	0	0	0	0	0	5:50 PM	0	0	0	0	0	5:50 PM	0	1	0	0	1
5:55 PM	0	0	0	0	0	5:55 PM	0	0	0	0	0	5:55 PM	0	0	0	0	0
Count Total	9	7	23	2	41	Count Total	0	0	0	2	2	Count Total	7	9	5	0	21
Peak Hour	5	3	12	1	21	Peak Hour	0	0	0	1	1	Peak Hour	4	2	1	0	7

Appendix C
Traffic Signal Truck Turning Figures
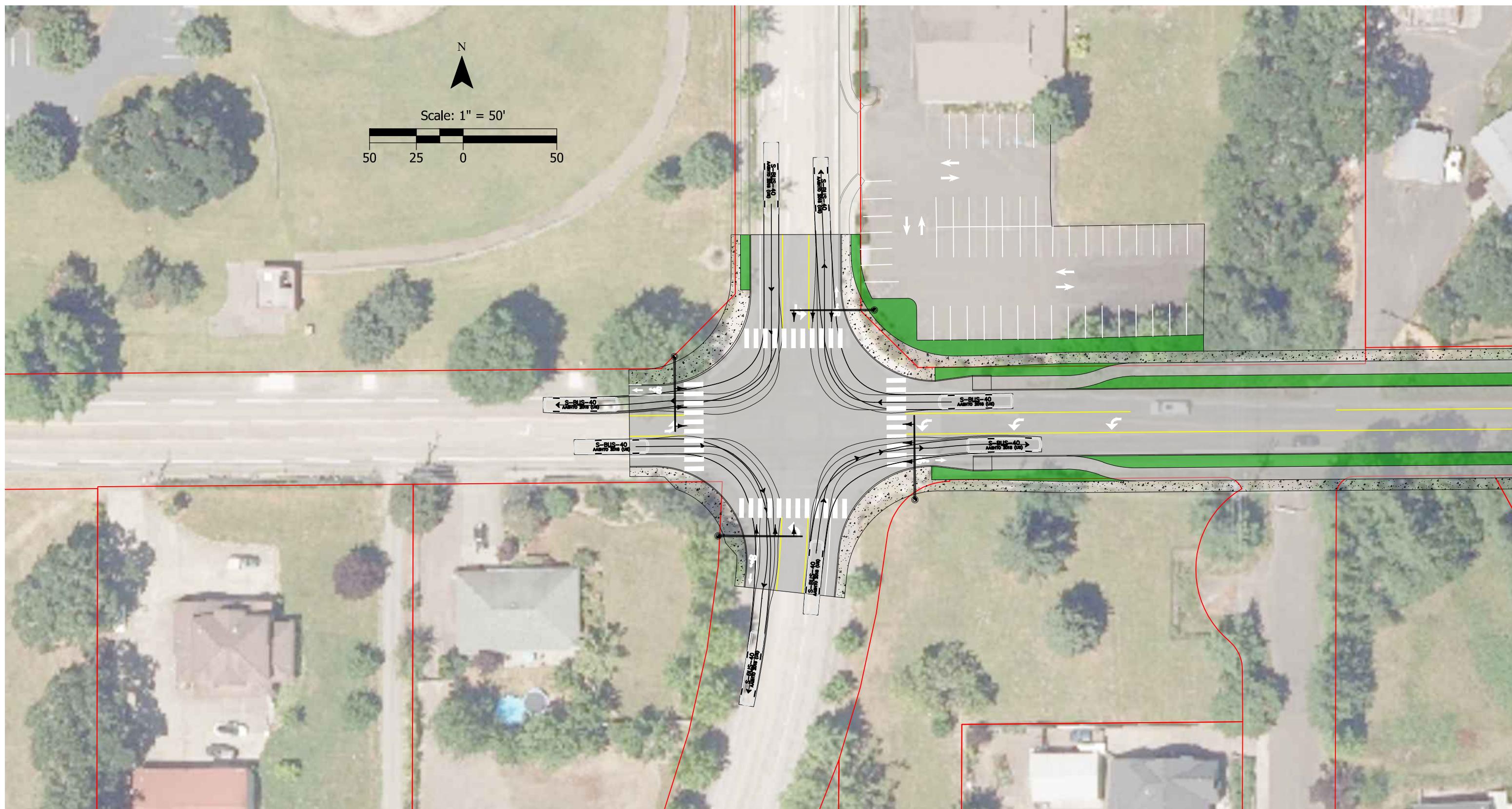
N

Scale: 1" = 50'

50 25 0 50

Scale: 1" = 50'

50   25   0   50

N

KITTELSON & ASSOCIATES
PHONE: (503) 228-5230   CONTACT: Wade Scarbrough

Boeckman Road/Canyon Creek Road Intersection
Wilsonville, Oregon
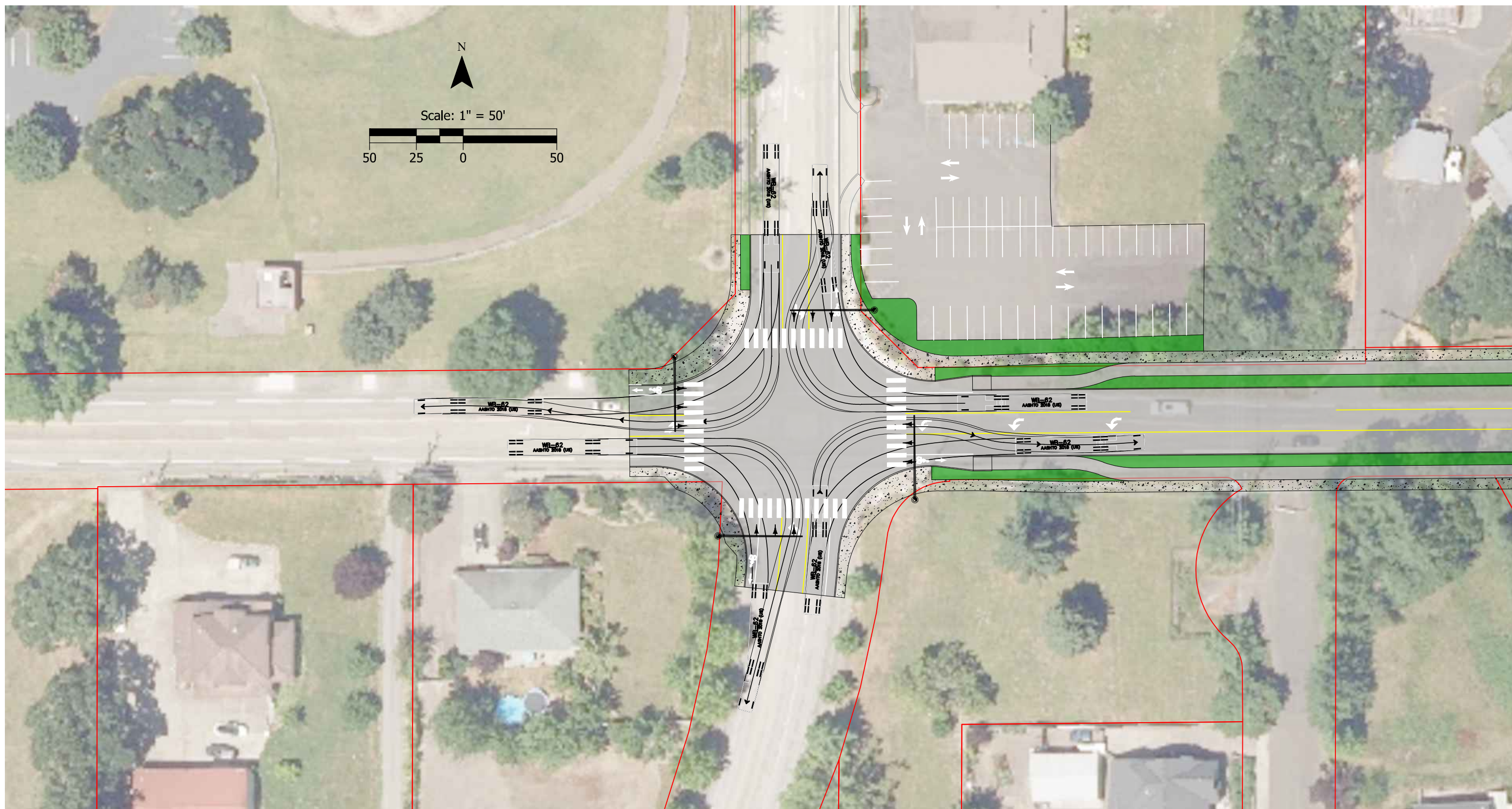
Appendix D
Roundabout Truck Turning Figures

N

Scale: 1" = 50'

50   25   0   50

Roundabout Truck Turning Paths

N

Scale: 1" = 50'

50   25   0   50

Boeckman Road/Canyon Creek Road Intersection
Wilsonville, Oregon

KITTELSON & ASSOCIATES

PHONE: (503) 228-5230   CONTACT: Wade Scarbrough

Roundabout Truck Turning Paths

N

Scale: 1" = 50'

50 25 0 50

WB-82
AASHTO 2018 (US)

WB-82
AASHTO 2018 (US)

WB-82
AASHTO 2018 (US)

KITTELSON & ASSOCIATES
PHONE: (503) 228-5230   CONTACT: Wade Scarbrough

Boeckman Road/Canyon Creek Road Intersection
Wilsonville, Oregon

Roundabout Truck Turning Paths

N

Scale: 1" = 50'

50   25   0   50

Boeckman Road/Canyon Creek Road Intersection
Wilsonville, Oregon

KITTELSON & ASSOCIATES

PHONE: (503) 228-5230   CONTACT: Wade Scarbrough
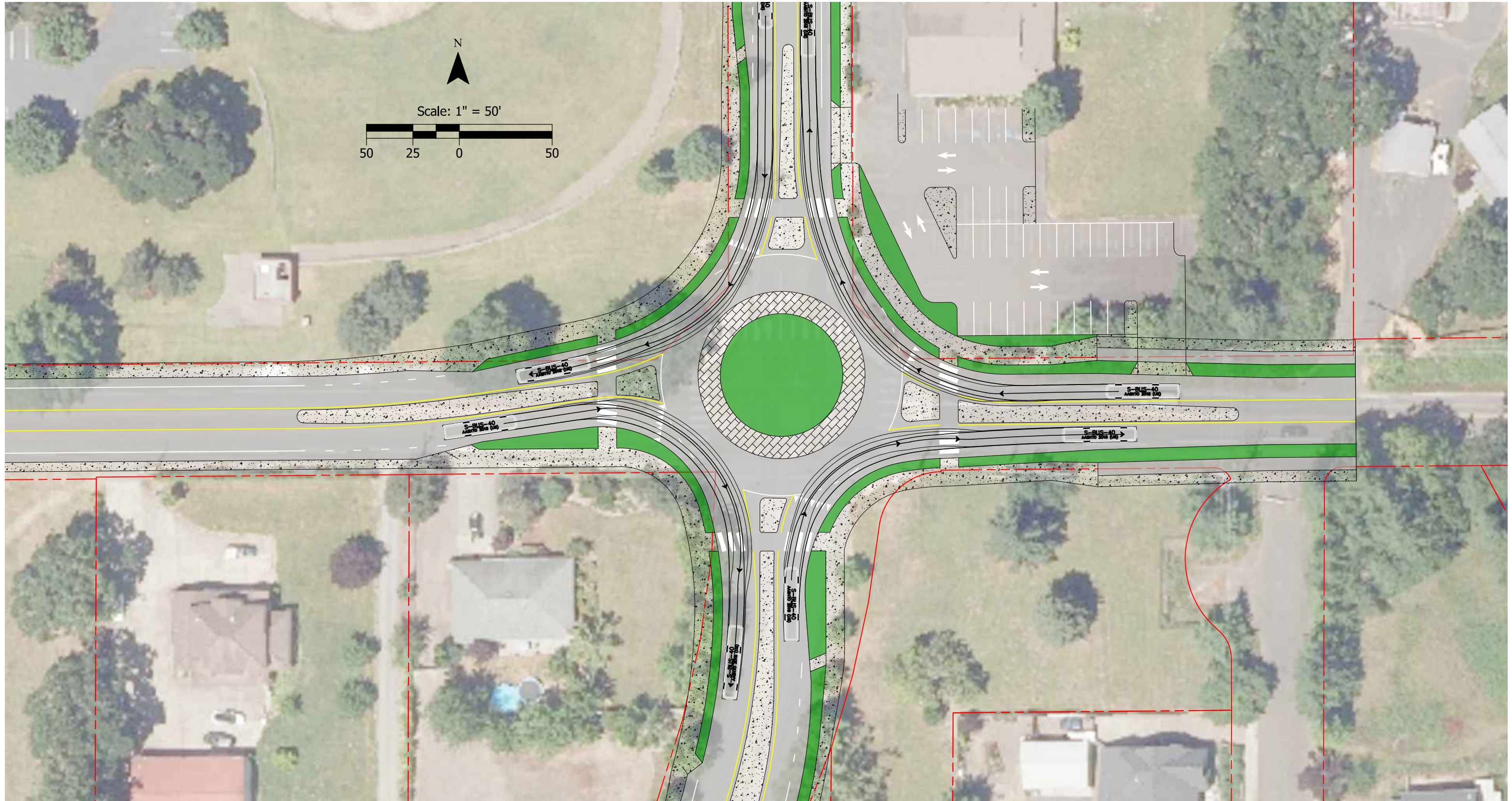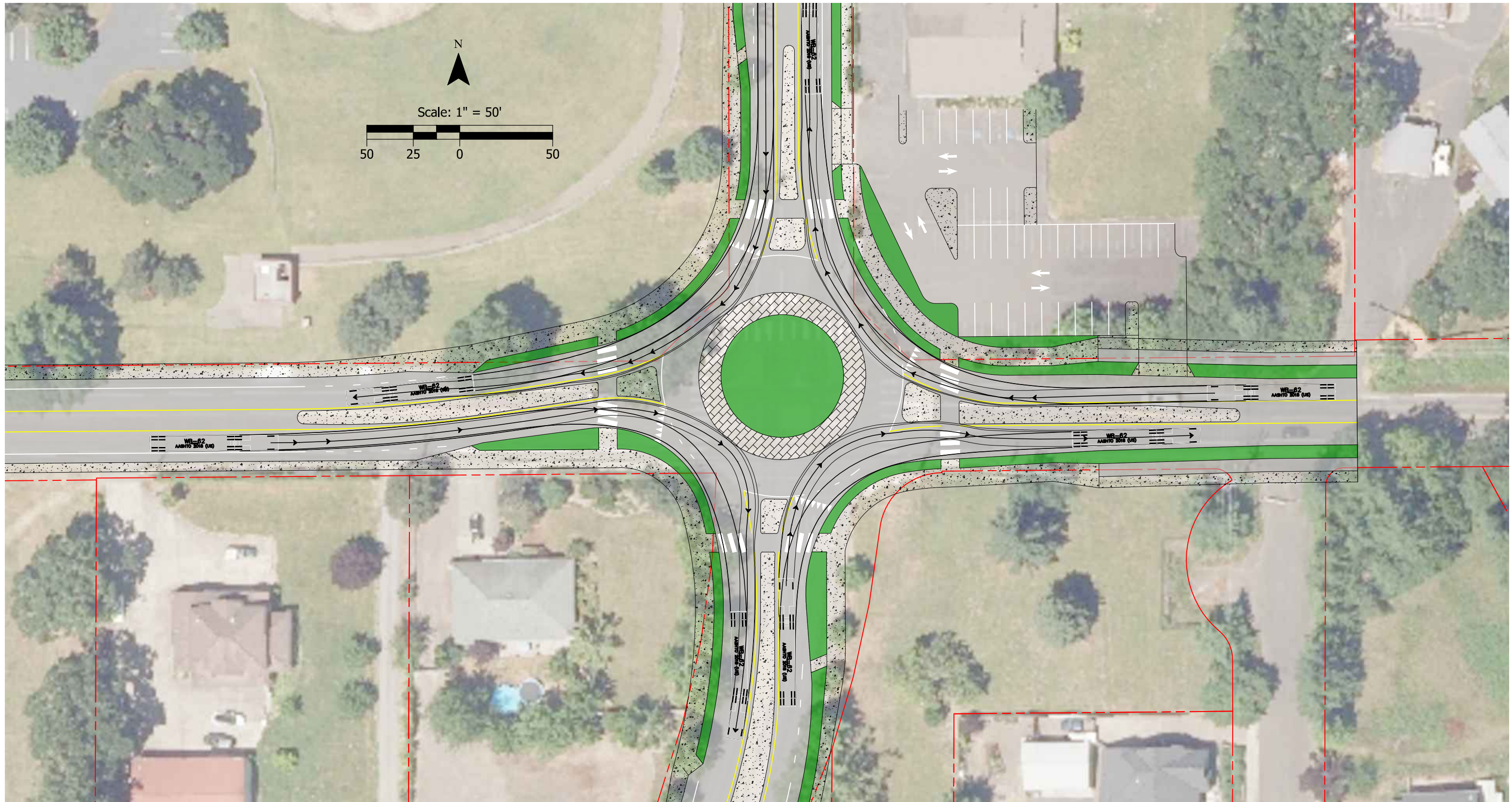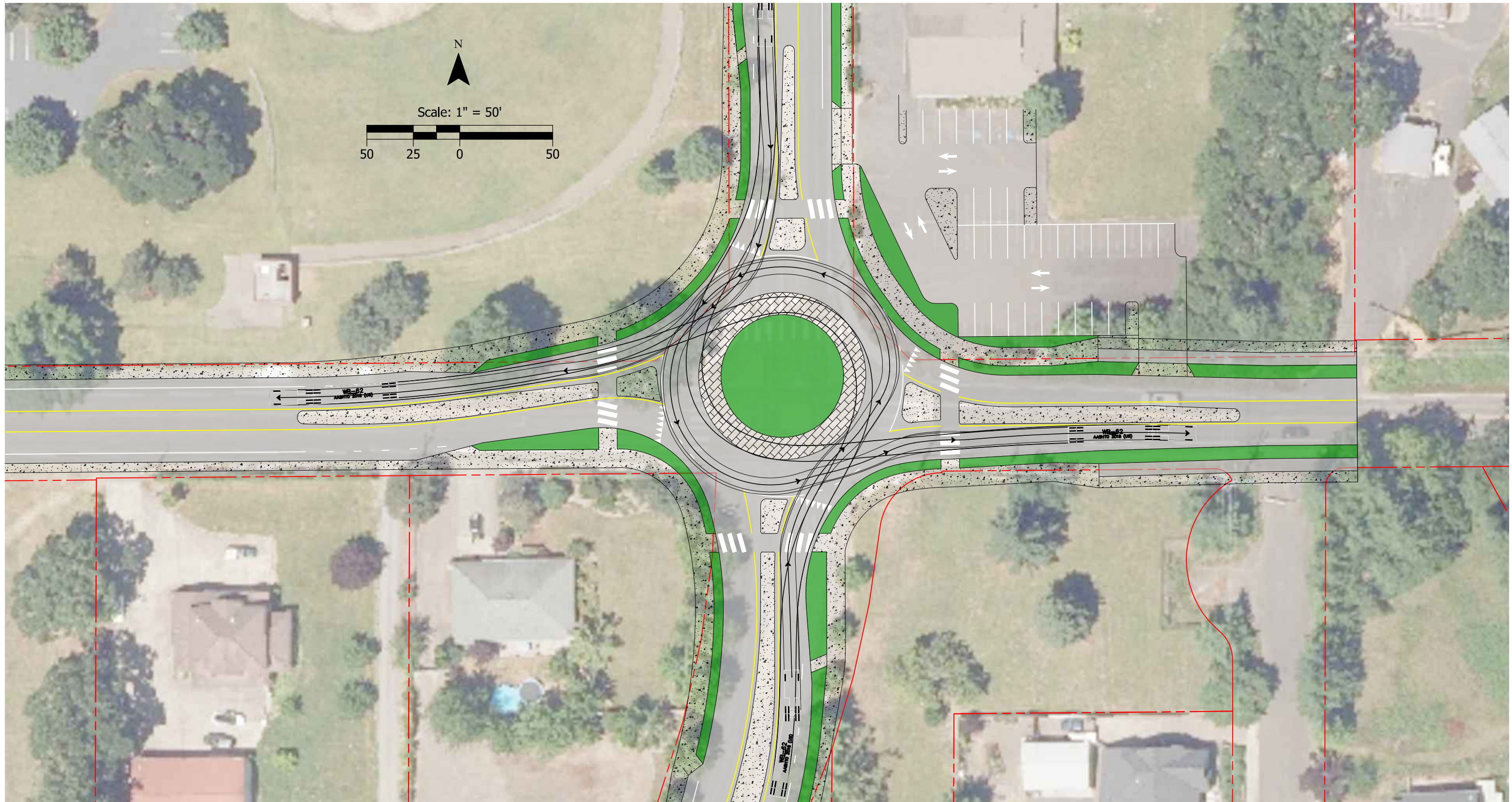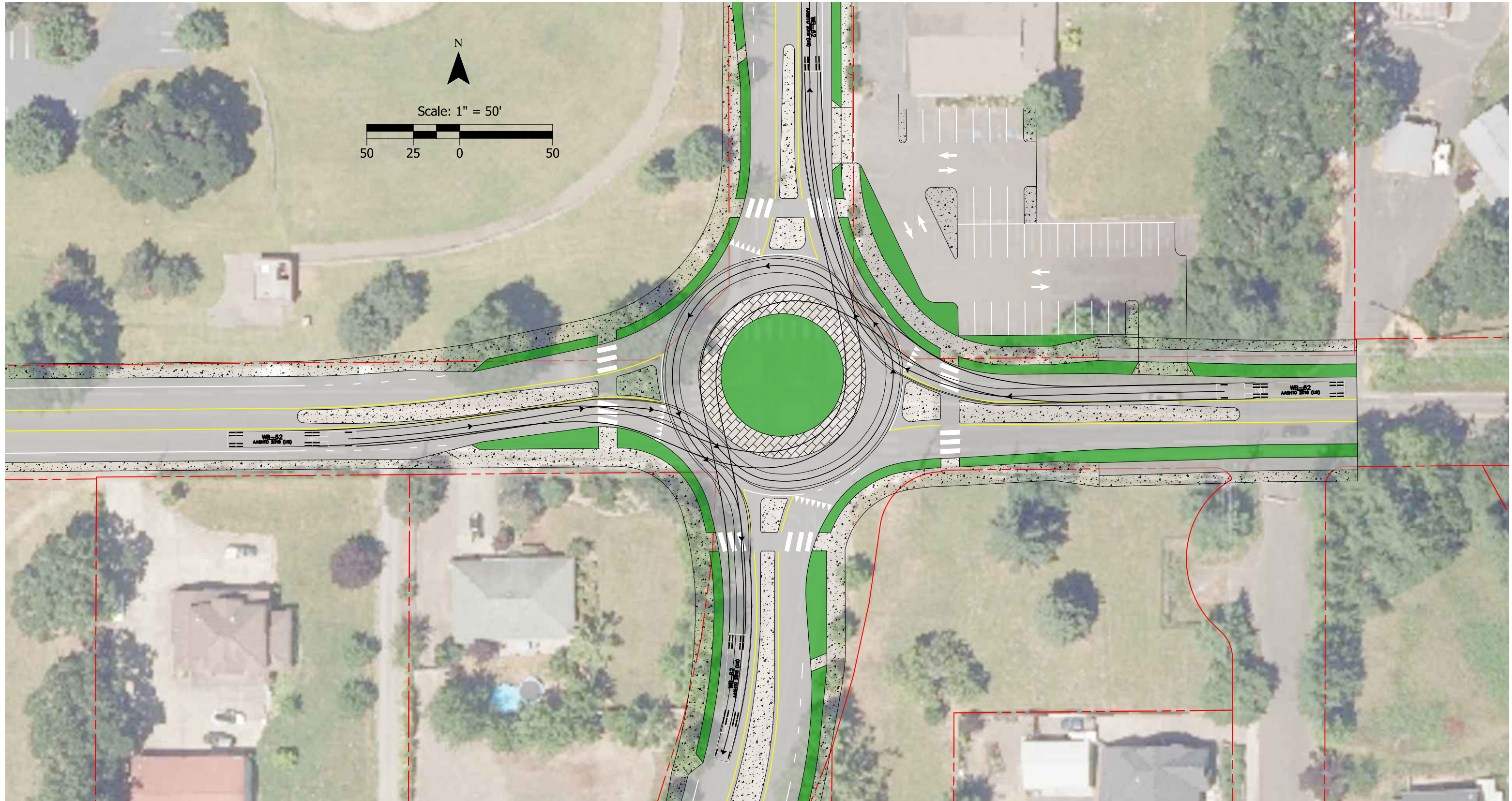
Appendix E
Operational Analysis Worksheets

Canyon Creek & Boeckman 2021 PM Peak, All-Way Stop

Intersection Level Of Service Report
Intersection 1: SW Canyon Creek Rd/Boeckman Rd

Control Type:	All-way stop	Delay (sec / veh):	17.8
Analysis Method:	HCM 7th Edition	Level Of Service:	C
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.660

Intersection Setup

Name	SW Canyon Creek Rd			SW Canyon Creek Rd			Boeckman Road			Boeckman Rd		
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration	⌐⊦			⌐⊦			⌐⊦			⌐⊦		
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	1	0	0	1	0	0	1	0	0	1	0	0
Entry Pocket Length [ft]	200.00	100.00	100.00	150.00	100.00	100.00	100.00	100.00	100.00	50.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			40.00			40.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	Yes			Yes			Yes			Yes		

Volumes

Name	SW Canyon Creek Rd			SW Canyon Creek Rd			Boeckman Road			Boeckman Rd		
Base Volume Input [veh/h]	28	90	70	100	152	70	52	245	44	62	250	56
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	3.00	0.00	0.00	1.00	0.00	0.00	2.00	2.00	2.00	3.00	5.00
Growth Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	28	90	70	100	152	70	52	245	44	62	250	56
Peak Hour Factor	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	8	25	19	28	42	19	14	68	12	17	69	16
Total Analysis Volume [veh/h]	31	100	78	111	169	78	58	272	49	69	278	62
Pedestrian Volume [ped/h]	2			0			4			1		

Intersection Settings

Lanes

Capacity per Entry Lane [veh/h]	442	489	458	504	473	512	474	515
Degree of Utilization, x	0.07	0.36	0.24	0.49	0.12	0.63	0.15	0.66

Movement, Approach, & Intersection Results

95th-Percentile Queue Length [veh]	0.23	1.65	0.94	2.67	0.42	4.28	0.51	4.78
95th-Percentile Queue Length [ft]	5.63	41.19	23.50	66.70	10.39	106.97	12.65	119.56
Approach Delay [s/veh]	13.81		15.47		19.38		20.44	
Approach LOS	B		C		C		C	
Intersection Delay [s/veh]	17.81							
Intersection LOS	C							

Intersection Level Of Service Report
Intersection 1: SW Canyon Creek Rd/Boeckman Rd

Control Type:	Signalized	Delay (sec / veh):	8.8
Analysis Method:	HCM 7th Edition	Level Of Service:	A
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.616

Intersection Setup

Name	SW Canyon Creek Rd			SW Canyon Creek Rd			Boeckman Road			Boeckman Rd		
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	1	0	0	1	0	0	1	0	0	1	0	0
Entry Pocket Length [ft]	200.00	100.00	100.00	150.00	100.00	100.00	100.00	100.00	100.00	50.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			40.00			40.00		
Grade [%]	0.00			0.00			0.00			0.00		
Curb Present	No			No			No			No		
Crosswalk	Yes			Yes			Yes			Yes		

Volumes

Name	SW Canyon Creek Rd			SW Canyon Creek Rd			Boeckman Road			Boeckman Rd		
Base Volume Input [veh/h]	28	90	70	100	152	70	52	245	44	62	250	56
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	3.00	0.00	0.00	1.00	0.00	0.00	2.00	2.00	2.00	3.00	5.00
Proportion of CAVs [%]	0.00											
Growth Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Right Turn on Red Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	28	90	70	100	152	70	52	245	44	62	250	56
Peak Hour Factor	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	8	25	19	28	42	19	14	68	12	17	69	16
Total Analysis Volume [veh/h]	31	100	78	111	169	78	58	272	49	69	278	62
Presence of On-Street Parking	No		No	No		No	No		No	No		No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
v_do, Outbound Pedestrian Volume crossing	0			0			0			0		
v_di, Inbound Pedestrian Volume crossing m	0			0			0			0		
v_co, Outbound Pedestrian Volume crossing	0			0			0			0		
v_ci, Inbound Pedestrian Volume crossing mi	0			0			0			0		
v_ab, Corner Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Located in CBD	Yes
Signal Coordination Group	-
Cycle Length [s]	90
Coordination Type	Free Running
Actuation Type	Fully actuated
Offset [s]	0.0
Offset Reference	Lead Green - Beginning of First Green
Permissive Mode	SingleBand
Lost time [s]	12.00

Phasing & Timing

Control Type	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss
Signal Group	1	6	0	5	2	0	3	8	0	7	4	0
Auxiliary Signal Groups												
Lead / Lag	Lead	-	-	Lead	-	-	Lead	-	-	Lead	-	-
Minimum Green [s]	4	8	0	4	8	0	4	8	0	4	8	0
Maximum Green [s]	30	21	0	30	21	0	30	30	0	30	30	0
Amber [s]	3.0	4.0	0.0	3.0	4.0	0.0	3.0	4.0	0.0	3.0	4.0	0.0
All red [s]	1.0	0.5	0.0	1.0	0.5	0.0	1.0	0.5	0.0	1.0	0.5	0.0
Split [s]	0	0	0	0	0	0	0	0	0	0	0	0
Vehicle Extension [s]	3.0	3.0	0.0	3.0	3.0	0.0	3.0	3.0	0.0	3.0	3.0	0.0
Walk [s]	0	7	0	0	7	0	0	7	0	0	7	0
Pedestrian Clearance [s]	0	16	0	0	16	0	0	16	0	0	16	0
Delayed Vehicle Green [s]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rest In Walk		No			No			No			No	
I1, Start-Up Lost Time [s]	2.0	2.0	0.0	2.0	2.0	0.0	2.0	2.0	0.0	2.0	2.0	0.0
I2, Clearance Lost Time [s]	2.0	2.5	0.0	2.0	2.5	0.0	2.0	2.5	0.0	2.0	2.5	0.0
Minimum Recall		No			No			Yes			Yes	
Maximum Recall		No			No			No			No	
Pedestrian Recall		No			No			No			No	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	20.0	20.0	0.0	20.0	20.0	0.0	20.0	20.0	0.0	20.0	20.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

Lane Group Calculations

Lane Group	L	C	L	C	L	C	L	C
C, Cycle Length [s]	29	29	29	29	29	29	29	29
L, Total Lost Time per Cycle [s]	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50
l1_p, Permitted Start-Up Lost Time [s]	2.00	0.00	2.00	0.00	2.00	0.00	2.00	0.00
l2, Clearance Lost Time [s]	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
g_i, Effective Green Time [s]	9	9	9	9	11	11	11	11
g / C, Green / Cycle	0.32	0.32	0.32	0.32	0.37	0.37	0.37	0.37
(v / s)_i Volume / Saturation Flow Rate	0.03	0.11	0.10	0.15	0.06	0.20	0.07	0.21
s, saturation flow rate [veh/h]	1036	1550	1103	1607	951	1639	953	1617
c, Capacity [veh/h]	391	497	442	516	386	612	400	604
d1, Uniform Delay [s]	11.18	7.67	11.02	8.02	11.38	7.19	11.11	7.32
k, delay calibration	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	0.09	0.44	0.29	0.69	0.18	0.70	0.20	0.83
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

	L	C	L	C	L	C	L	C
X, volume / capacity	0.08	0.36	0.25	0.48	0.15	0.52	0.17	0.56
d, Delay for Lane Group [s/veh]	11.26	8.10	11.32	8.71	11.55	7.89	11.31	8.15
Lane Group LOS	B	A	B	A	B	A	B	A
Critical Lane Group	No	No	No	Yes	No	No	No	Yes
50th-Percentile Queue Length [veh/ln]	0.14	0.60	0.51	0.88	0.24	0.82	0.28	0.90
50th-Percentile Queue Length [ft/ln]	3.53	14.90	12.70	21.92	6.05	20.60	7.04	22.48
95th-Percentile Queue Length [veh/ln]	0.25	1.07	0.91	1.58	0.44	1.48	0.51	1.62
95th-Percentile Queue Length [ft/ln]	6.36	26.83	22.86	39.46	10.89	37.09	12.68	40.46

Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	11.26	8.10	8.10	11.32	8.71	8.71	11.55	7.89	7.89	11.31	8.15	8.15
Movement LOS	B	A	A	B	A	A	B	A	A	B	A	A
d_A, Approach Delay [s/veh]	8.57			9.52			8.45			8.68		
Approach LOS	A			A			A			A		
d_I, Intersection Delay [s/veh]	8.82											
Intersection LOS	A											
Intersection V/C	0.616											

Other Modes

g_Walk,mi, Effective Walk Time [s]	11.0	11.0	11.0	11.0
M_corner, Corner Circulation Area [ft²/ped]	0.00	0.00	0.00	0.00
M_CW, Crosswalk Circulation Area [ft²/ped]	0.00	0.00	0.00	0.00
d_p, Pedestrian Delay [s]	5.74	5.74	5.74	5.74
I_p,int, Pedestrian LOS Score for Intersection	2.127	2.138	2.244	2.402
Crosswalk LOS	B	B	B	B
s_b, Saturation Flow Rate of the bicycle lane	2000	2000	2000	2000
c_b, Capacity of the bicycle lane [bicycles/h]	1431	1431	2044	2044
d_b, Bicycle Delay [s]	1.19	1.19	0.01	0.01
I_b,int, Bicycle LOS Score for Intersection	1.904	2.150	2.185	2.234
Bicycle LOS	A	B	B	B

Sequence

Ring 1	-	2	-	4	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	-	6	-	8	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
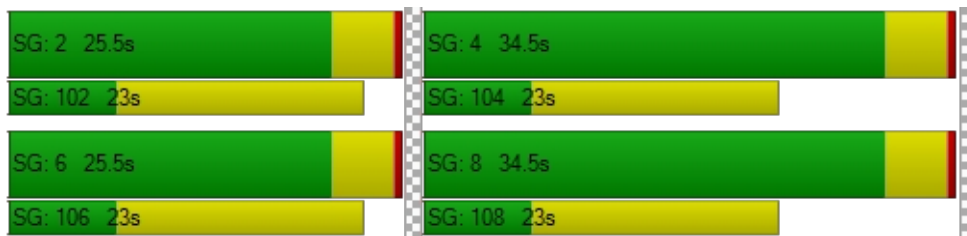
SG: 2 25.5s
SG: 102 23s
SG: 4 34.5s
SG: 104 23s
SG: 6 25.5s
SG: 106 23s
SG: 8 34.5s
SG: 108 23s

Canyon Creek & Boeckman 2021 PM, Roundabout

Intersection Level Of Service Report
Intersection 1: SW Canyon Creek Rd/Boeckman Rd

Control Type:	Roundabout	Delay (sec / veh):	7.7
Analysis Method:	HCM 7th Edition	Level Of Service:	A
Analysis Period:	15 minutes		

Intersection Setup

Name	SW Canyon Creek Rd			SW Canyon Creek Rd			Boeckman Road			Boeckman Rd		
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration	✚			✚			✚			✚		
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Entry Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			40.00			40.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	Yes			Yes			Yes			Yes		

Volumes

Name	SW Canyon Creek Rd			SW Canyon Creek Rd			Boeckman Road			Boeckman Rd		
Base Volume Input [veh/h]	28	90	70	100	152	70	52	245	44	62	250	56
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	3.00	0.00	0.00	1.00	0.00	0.00	2.00	2.00	2.00	3.00	5.00
Proportion of CAVs [%]	0.00											
Growth Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	28	90	70	100	152	70	52	245	44	62	250	56
Peak Hour Factor	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	8	25	19	28	42	19	14	68	12	17	69	16
Total Analysis Volume [veh/h]	31	100	78	111	169	78	58	272	49	69	278	62
Pedestrian Volume [ped/h]	0			0			0			0		

Intersection Settings

Number of Conflicting Circulating Lanes	1			1			1			1		
Circulating Flow Rate [veh/h]	446			388			352			192		
Exiting Flow Rate [veh/h]	291			226			395			466		
Demand Flow Rate [veh/h]	28	90	70	100	152	70	52	245	44	62	250	56
Adjusted Demand Flow Rate [veh/h]	31	100	78	111	169	78	58	272	49	69	278	62

Lanes

Overwrite Calculated Critical Headway	No	No	No	No
User-Defined Critical Headway [s]	4.00	4.00	4.00	4.00
Overwrite Calculated Follow-Up Time	No	No	No	No
User-Defined Follow-Up Time [s]	3.00	3.00	3.00	3.00
A (intercept)	1380.00	1380.00	1380.00	1380.00
B (coefficient)	0.00102	0.00102	0.00102	0.00102
HV Adjustment Factor	0.99	1.00	0.98	0.97
Entry Flow Rate [veh/h]	212	360	386	422
Capacity of Entry and Bypass Lanes [veh/h]	876	930	964	1135
Pedestrian Impedance	1.00	1.00	1.00	1.00
Capacity per Entry Lane [veh/h]	864	925	948	1101
X, volume / capacity	0.24	0.39	0.40	0.37

Movement, Approach, & Intersection Results

Lane LOS	A	A	A	A
95th-Percentile Queue Length [veh]	0.95	1.85	1.95	1.74
95th-Percentile Queue Length [ft]	23.69	46.16	48.66	43.51
Approach Delay [s/veh]	6.71	8.26	8.31	7.05
Approach LOS	A	A	A	A
Intersection Delay [s/veh]	7.67			
Intersection LOS	A			

Intersection Level Of Service Report
Intersection 1: SW Canyon Creek Rd/Boeckman Rd

Control Type:	All-way stop	Delay (sec / veh):	40.0
Analysis Method:	HCM 7th Edition	Level Of Service:	E
Analysis Period:	15 minutes	Volume to Capacity (v/c):	1.009

Intersection Setup

Name	SW Canyon Creek Rd			SW Canyon Creek Rd			Boeckman Road			Boeckman Rd		
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration	⌐⼕			⌐⼕			⌐⼕			⌐⼕		
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	1	0	0	1	0	0	1	0	0	1	0	0
Entry Pocket Length [ft]	200.00	100.00	100.00	150.00	100.00	100.00	100.00	100.00	100.00	50.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			40.00			40.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	Yes			Yes			Yes			Yes		

Volumes

Name	SW Canyon Creek Rd			SW Canyon Creek Rd			Boeckman Road			Boeckman Rd		
Base Volume Input [veh/h]	40	120	120	150	185	85	55	290	45	80	330	65
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	3.00	0.00	0.00	1.00	0.00	0.00	2.00	2.00	2.00	3.00	5.00
Growth Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	40	120	120	150	185	85	55	290	45	80	330	65
Peak Hour Factor	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	11	33	33	42	51	24	15	81	13	22	92	18
Total Analysis Volume [veh/h]	44	133	133	167	206	94	61	322	50	89	367	72
Pedestrian Volume [ped/h]	0			0			0			0		

Intersection Settings

Lanes

Capacity per Entry Lane [veh/h]	390	427	400	434	406	433	406	439
Degree of Utilization, x	0.11	0.62	0.42	0.69	0.15	0.86	0.22	1.01

Movement, Approach, & Intersection Results

95th-Percentile Queue Length [veh]	0.38	4.13	2.01	5.16	0.52	8.61	0.83	13.08
95th-Percentile Queue Length [ft]	9.46	103.25	50.22	128.95	13.09	215.20	20.65	326.93
Approach Delay [s/veh]	22.60		24.23		39.95		64.16	
Approach LOS	C		C		E		F	
Intersection Delay [s/veh]	39.99							
Intersection LOS	E							

Intersection Level Of Service Report
Intersection 1: SW Canyon Creek Rd/Boeckman Rd

Control Type:	Signalized	Delay (sec / veh):	12.1
Analysis Method:	HCM 7th Edition	Level Of Service:	B
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.631

Intersection Setup

Name	SW Canyon Creek Rd			SW Canyon Creek Rd			Boeckman Road			Boeckman Rd		
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	1	0	0	1	0	0	1	0	0	1	0	0
Entry Pocket Length [ft]	200.00	100.00	100.00	150.00	100.00	100.00	100.00	100.00	100.00	50.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			40.00			40.00		
Grade [%]	0.00			0.00			0.00			0.00		
Curb Present	No			No			No			No		
Crosswalk	Yes			Yes			Yes			Yes		

Volumes

Name	SW Canyon Creek Rd			SW Canyon Creek Rd			Boeckman Road			Boeckman Rd		
Base Volume Input [veh/h]	40	120	120	150	185	85	55	290	45	80	330	65
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	3.00	0.00	0.00	1.00	0.00	0.00	2.00	2.00	2.00	3.00	5.00
Proportion of CAVs [%]	0.00											
Growth Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Right Turn on Red Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	40	120	120	150	185	85	55	290	45	80	330	65
Peak Hour Factor	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	11	33	33	42	51	24	15	81	13	22	92	18
Total Analysis Volume [veh/h]	44	133	133	167	206	94	61	322	50	89	367	72
Presence of On-Street Parking	No		No	No		No	No		No	No		No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
v_do, Outbound Pedestrian Volume crossing	0			0			0			0		
v_di, Inbound Pedestrian Volume crossing m	0			0			0			0		
v_co, Outbound Pedestrian Volume crossing	0			0			0			0		
v_ci, Inbound Pedestrian Volume crossing mi	0			0			0			0		
v_ab, Corner Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Located in CBD	Yes
Signal Coordination Group	-
Cycle Length [s]	90
Coordination Type	Free Running
Actuation Type	Fully actuated
Offset [s]	0.0
Offset Reference	Lead Green - Beginning of First Green
Permissive Mode	SingleBand
Lost time [s]	12.00

Phasing & Timing

Control Type	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss
Signal Group	1	6	0	5	2	0	3	8	0	7	4	0
Auxiliary Signal Groups												
Lead / Lag	Lead	-	-	Lead	-	-	Lead	-	-	Lead	-	-
Minimum Green [s]	4	8	0	4	8	0	4	8	0	4	8	0
Maximum Green [s]	30	21	0	30	21	0	30	30	0	30	30	0
Amber [s]	3.0	4.0	0.0	3.0	4.0	0.0	3.0	4.0	0.0	3.0	4.0	0.0
All red [s]	1.0	0.5	0.0	1.0	0.5	0.0	1.0	0.5	0.0	1.0	0.5	0.0
Split [s]	0	0	0	0	0	0	0	0	0	0	0	0
Vehicle Extension [s]	3.0	3.0	0.0	3.0	3.0	0.0	3.0	3.0	0.0	3.0	3.0	0.0
Walk [s]	0	7	0	0	7	0	0	7	0	0	7	0
Pedestrian Clearance [s]	0	16	0	0	16	0	0	16	0	0	16	0
Delayed Vehicle Green [s]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rest In Walk		No			No			No			No	
I1, Start-Up Lost Time [s]	2.0	2.0	0.0	2.0	2.0	0.0	2.0	2.0	0.0	2.0	2.0	0.0
I2, Clearance Lost Time [s]	2.0	2.5	0.0	2.0	2.5	0.0	2.0	2.5	0.0	2.0	2.5	0.0
Minimum Recall		No			No			Yes			Yes	
Maximum Recall		No			No			No			No	
Pedestrian Recall		No			No			No			No	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	20.0	20.0	0.0	20.0	20.0	0.0	20.0	20.0	0.0	20.0	20.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

Lane Group Calculations

Lane Group	L	C	L	C	L	C	L	C
C, Cycle Length [s]	44	44	44	44	44	44	44	44
L, Total Lost Time per Cycle [s]	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50
l1_p, Permitted Start-Up Lost Time [s]	2.00	0.00	2.00	0.00	2.00	0.00	2.00	0.00
l2, Clearance Lost Time [s]	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
g_i, Effective Green Time [s]	17	17	17	17	18	18	18	18
g / C, Green / Cycle	0.39	0.39	0.39	0.39	0.40	0.40	0.40	0.40
(v / s)_i Volume / Saturation Flow Rate	0.04	0.17	0.16	0.19	0.07	0.23	0.10	0.27
s, saturation flow rate [veh/h]	987	1534	1018	1608	869	1644	909	1623
c, Capacity [veh/h]	365	597	384	626	287	664	335	655
d1, Uniform Delay [s]	14.51	9.82	16.08	9.98	17.34	10.00	15.98	10.61
k, delay calibration	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	0.15	0.52	0.78	0.57	0.37	0.74	0.42	1.19
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

	L	C	L	C	L	C	L	C
X, volume / capacity	0.12	0.45	0.44	0.48	0.21	0.56	0.27	0.67
d, Delay for Lane Group [s/veh]	14.65	10.34	16.86	10.55	17.70	10.74	16.40	11.80
Lane Group LOS	B	B	B	B	B	B	B	B
Critical Lane Group	No	No	No	Yes	No	No	No	Yes
50th-Percentile Queue Length [veh/ln]	0.33	1.53	1.40	1.75	0.49	2.01	0.68	2.56
50th-Percentile Queue Length [ft/ln]	8.14	38.24	35.05	43.83	12.35	50.18	17.06	63.95
95th-Percentile Queue Length [veh/ln]	0.59	2.75	2.52	3.16	0.89	3.61	1.23	4.60
95th-Percentile Queue Length [ft/ln]	14.65	68.83	63.09	78.89	22.23	90.32	30.70	115.12

Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	14.65	10.34	10.34	16.86	10.55	10.55	17.70	10.74	10.74	16.40	11.80	11.80
Movement LOS	B	B	B	B	B	B	B	B	B	B	B	B
d_A, Approach Delay [s/veh]	10.95			12.81			11.72			12.58		
Approach LOS	B			B			B			B		
d_I, Intersection Delay [s/veh]	12.14											
Intersection LOS	B											
Intersection V/C	0.631											

Other Modes

g_Walk,mi, Effective Walk Time [s]	11.0	11.0	11.0	11.0
M_corner, Corner Circulation Area [ft²/ped]	0.00	0.00	0.00	0.00
M_CW, Crosswalk Circulation Area [ft²/ped]	0.00	0.00	0.00	0.00
d_p, Pedestrian Delay [s]	12.16	12.16	12.16	12.16
I_p,int, Pedestrian LOS Score for Intersection	2.237	2.223	2.367	2.634
Crosswalk LOS	B	B	B	B
s_b, Saturation Flow Rate of the bicycle lane	2000	2000	2000	2000
c_b, Capacity of the bicycle lane [bicycles/h]	965	965	1378	1378
d_b, Bicycle Delay [s]	5.84	5.84	2.11	2.11
I_b,int, Bicycle LOS Score for Intersection	2.071	2.330	2.274	2.431
Bicycle LOS	B	B	B	B

Sequence

Ring 1	-	2	-	4	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	-	6	-	8	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
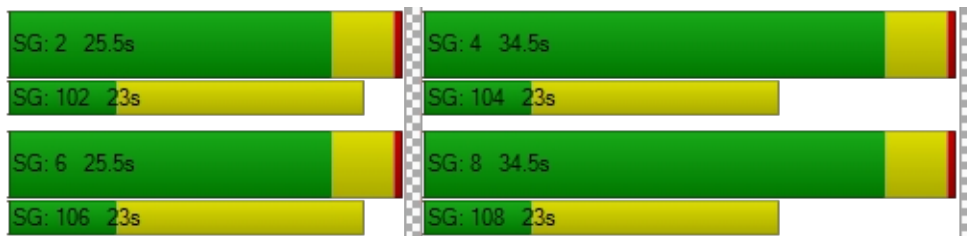
SG: 2 25.5s   SG: 4 34.5s
SG: 102 23s   SG: 104 23s
SG: 6 25.5s   SG: 8 34.5s
SG: 106 23s   SG: 108 23s

Canyon Creek & Boeckman 2040 PM, Roundabout

Intersection Level Of Service Report
Intersection 1: SW Canyon Creek Rd/Boeckman Rd

Control Type:	Roundabout	Delay (sec / veh):	10.9
Analysis Method:	HCM 7th Edition	Level Of Service:	B
Analysis Period:	15 minutes		

Intersection Setup

Name	SW Canyon Creek Rd			SW Canyon Creek Rd			Boeckman Road			Boeckman Rd		
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Entry Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			40.00			40.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	Yes			Yes			Yes			Yes		

Volumes

Name	SW Canyon Creek Rd			SW Canyon Creek Rd			Boeckman Road			Boeckman Rd		
Base Volume Input [veh/h]	40	120	120	150	185	85	55	290	45	80	330	65
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	3.00	0.00	0.00	1.00	0.00	0.00	2.00	2.00	2.00	3.00	5.00
Proportion of CAVs [%]	0.00											
Growth Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	40	120	120	150	185	85	55	290	45	80	330	65
Peak Hour Factor	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	11	33	33	42	51	24	15	81	13	22	92	18
Total Analysis Volume [veh/h]	44	133	133	167	206	94	61	322	50	89	367	72
Pedestrian Volume [ped/h]	0			0			0			0		

Intersection Settings

Number of Conflicting Circulating Lanes	1			1			1			1		
Circulating Flow Rate [veh/h]	556			513			466			242		
Exiting Flow Rate [veh/h]	350			274			516			628		
Demand Flow Rate [veh/h]	40	120	120	150	185	85	55	290	45	80	330	65
Adjusted Demand Flow Rate [veh/h]	44	133	133	167	206	94	61	322	50	89	367	72

Lanes

Overwrite Calculated Critical Headway	No	No	No	No
User-Defined Critical Headway [s]	4.00	4.00	4.00	4.00
Overwrite Calculated Follow-Up Time	No	No	No	No
User-Defined Follow-Up Time [s]	3.00	3.00	3.00	3.00
A (intercept)	1380.00	1380.00	1380.00	1380.00
B (coefficient)	0.00102	0.00102	0.00102	0.00102
HV Adjustment Factor	0.99	1.00	0.98	0.97
Entry Flow Rate [veh/h]	314	470	441	545
Capacity of Entry and Bypass Lanes [veh/h]	783	818	859	1079
Pedestrian Impedance	1.00	1.00	1.00	1.00
Capacity per Entry Lane [veh/h]	773	815	844	1046
X, volume / capacity	0.40	0.57	0.51	0.50

Movement, Approach, & Intersection Results

Lane LOS	A	B	B	A
95th-Percentile Queue Length [veh]	1.95	3.72	2.99	2.93
95th-Percentile Queue Length [ft]	48.63	92.88	74.74	73.17
Approach Delay [s/veh]	9.75	13.06	11.24	9.42
Approach LOS	A	B	B	A
Intersection Delay [s/veh]	10.91			
Intersection LOS	B			

Appendix F
Signal Warrant Worksheet

KITTELSON & ASSOCIATES

Analysis Traffic Volumes

Hour		Major Street		Minor Street	
Begin	End	EB	WB	NB	SB
5:00 PM	6:00 PM	390	475	280	420
2nd Highest Hour		364	444	262	392
3rd Highest Hour		290	354	208	313
4th Highest Hour		242	295	174	261
5th Highest Hour		234	285	168	252
6th Highest Hour		219	267	157	236
7th Highest Hour		212	258	152	228
8th Highest Hour		204	249	147	220
9th Highest Hour		198	241	142	213
10th Highest Hour		171	208	123	184
11th Highest Hour		164	200	118	177
12th Highest Hour		142	173	102	153
13th Highest Hour		132	161	95	142
14th Highest Hour		114	139	82	123
15th Highest Hour		86	105	62	93
16th Highest Hour		78	95	56	84
17th Highest Hour		42	51	30	45
18th Highest Hour		30	36	21	32
19th Highest Hour		25	31	18	27
20th Highest Hour		15	18	11	16
21st Highest Hour		8	10	6	8
22nd Highest Hour		7	9	5	8
23rd Highest Hour		3	4	2	4
24th Highest Hour		1	1	1	1

Project #: 27376
Project Name: Boeckman Rd DB
Analyst: Keisuke & Kelly
Analysis Date: 10/17/2022
File: K:\H_Projects\27\27376 - Boeckman Rd PDB Project\Task 8. Alternatives Analysis\Analysis\Signal Warrant\[Signal-Warrant-
Intersection: Boeckman & Canyon Creek
Scenario: 2040 PM
Data Date: N/A

Warrant Summary

Warrant	Name	Analyzed?	Met?
#1	Eight-Hour Vehicular Volume	Yes	Yes
#2	Four-Hour Vehicular volume	Yes	Yes
#3	Peak Hour	Yes	Yes
#4	Pedestrian Volume	No	-
#5	School Crossing	No	-
#6	Coordinated Signal System	No	-
#7	Crash Experience	No	-
#8	Roadway Network	No	-
#9	Intersection Near a Grade Crossing	No	-

Input Parameters

Volume Adjustment Factor =	1.0
North-South Approach =	Minor
East-West Approach =	Major
Major Street Thru Lanes =	1
Minor Street Thru Lanes =	1
Speed > 40 mph?	Yes
Population < 10,000?	No
Warrant Factor	70%
Peak Hour or Daily Count?	Peak Hour
Major Street: 4th-Highest Hour / Peak Hour	62%
Major Street: 8th-Highest Hour / Peak Hour	52%
Minor Street: 4th-Highest Hour / Peak Hour	62%
Minor Street: 8th-Highest Hour / Peak Hour	52%

Warrant #1 - Eight Hour

Warrant Factor	Condition	Major Street Requirement	Minor Street Requirement	Hours That Condition Is Met	Condition for Warrant Factor Met?	Signal Warrant Met?
100%	A	500	150	5	No	No
	B	750	75	2	No	
80%	A	400	120	9	Yes	Yes
	B	600	60	3	No	
70%	A	350	105	11	Yes	Yes
	B	525	53	4	No	
56%	A	280	84	13	Yes	Yes
	B	420	42	9	Yes	

Warrant #2 - Four Hour
70% Warrant Factor

Warrant #3 - Peak Hour
70% Warrant Factor
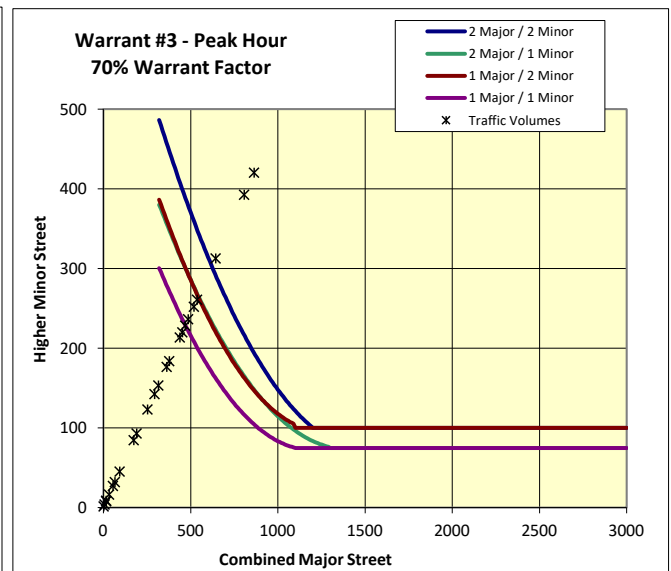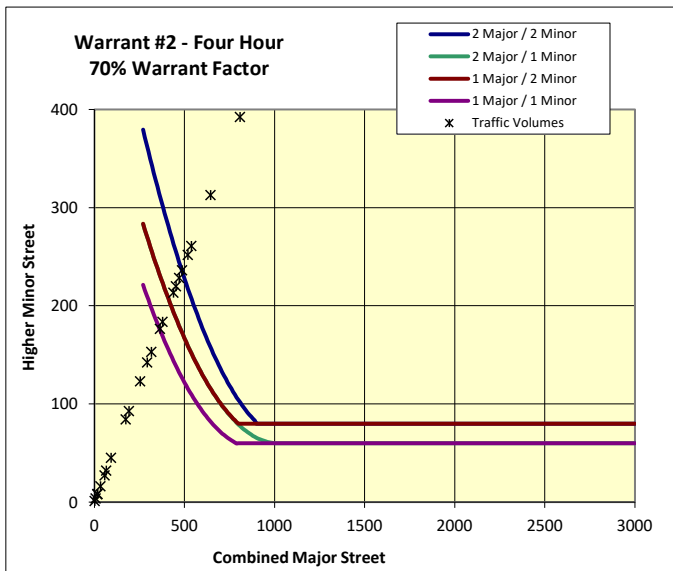
Appendix G
Conceptual Cost Estimates

TAPANI | SUNDT
IN ASSOCIATION WITH KPFF

BRCP Alternative Analysis Package 1 - #12A   10/6/2022

Bid Item	Description	Qty	Unit	Unit Price		Extended Price	
	Signalized Intersection						
1010	Asphalt Removal	6400	SF	$	1.25	$	8,000.00
1020	Concrete Road Removal including hauloff	16000	SF	$	3.00	$	48,000.00
1030	Curb Removal	650	LF	$	6.00	$	3,900.00
1040	Sidewalk Removal	5800	SF	$	1.50	$	8,700.00
1050	Clearing & Grubbing (Tree Removal)	1	LS	$	5,000.00	$	5,000.00
1060	Excavation Incl Haul	1800	CY	$	29.00	$	52,200.00
1065	Grading Costs for Asphalt	22362	SF	$	0.50	$	11,181.00
1070	Aggregate Base	1655	TN	$	35.00	$	57,925.00
1080	Asphalt 6"	845	TN	$	130.00	$	109,850.00
1090	Concrete Bike Path 6"	2150	SF	$	12.00	$	25,800.00
1100	Sidewalk & Ramps 4"	6050	SF	$	10.00	$	60,500.00
1110	Truncated Dome Installation	80	SF	$	35.00	$	2,800.00
1120	Curb & Gutter	780	LF	$	30.00	$	23,400.00
1130	Landscape Area	5379	SF	$	7.00	$	37,653.00
1140	Storm Piping - 12" - average 5' depth	600	LF	$	120.00	$	72,000.00
1150	Storm Catch Basin	8	EA	$	3,000.00	$	24,000.00
1160	48" Storm Manhole	4	EA	$	5,000.00	$	20,000.00
1170	Stormwater Planter LIDA	352	SF	$	125.00	$	44,000.00
1180	Signal Installation Incl Foundations	1	LS	$	672,500.00	$	672,500.00
1190	Illumination on Signal Poles	1	LS	$	20,300.00	$	20,300.00
1200	Signage/Striping	1	LS	$	20,000.00	$	20,000.00
1210	Traffic Control for Construction	800	HR	$	75.00	$	60,000.00
1220	Church Parking Lot Reconfiguration	1	LS	$	25,000.00	$	25,000.00
1230	Relocation of existing utilities due to ROW expansion	1	LS	$	25,000.00	$	25,000.00
				Subtotal		**$**	**1,437,709.00**
	RIGHT-OF-WAY	SF	3,325	$	17.80	$	59,185.00
	CONSTRUCTION ENGINEERING/DESIGN (Base Design Scope Task 11)					$	-
	CONSTRUCTION SURVEY WORK				1.50%	$	21,565.64
	CONTINGENCY				20.00%	$	287,541.80
				TOTAL	**$**		**1,806,001.44**
	ALTERNATE to Leave Ex. Conc Pavement at Intersection						
1020	Concrete Road Removal including hauloff	-16000	SF	$	3.00	$	(48,000.00)
1060	Excavation Incl Haul	-600	CY	$	29.00	$	(17,400.00)
1065	Grading Costs for Asphalt	-16000	SF	$	0.50	$	(8,000.00)
1070	Aggregate Base	-1025	TN	$	35.00	$	(35,875.00)
1080	Asphalt 6"	-600	TN	$	130.00	$	(78,000.00)
1140	Storm Piping - 12"	-400	LF	$	120.00	$	(48,000.00)
1150	Storm Catch Basin	-6	EA	$	3,000.00	$	(18,000.00)
1160	Storm Manhole	-3	EA	$	5,000.00	$	(15,000.00)
1210	Traffic Control for Construction	-180	HR	$	75.00	$	(13,500.00)
1990	Resurfacing Concrete Intersection	16000	SF	$	2.00	$	32,000.00
1995	Reseal Ex. Concrete Joints	16000	SF	$	0.75	$	12,000.00
						$	(237,775.00)
	ALTERNATE to treat storm from intersection						
1175	Larger Storm Facility at City Property	3375	SF	$	40.00	**$**	**135,000.00**

TAPANI | SUNDT
IN ASSOCIATION WITH KPFF

BRCP Alternative Analysis Package 1 - #12B   10/6/2022

Bid Item	Description	Qty	Unit	Unit Price	Extended Price
	RAB Intersection				
2010	Asphalt Removal	6400	SF	$ 1.25	$ 8,000.00
2020	Concrete Road Removal including hauloff	28000	SF	$ 3.00	$ 84,000.00
2030	Curb Removal	1550	LF	$ 6.00	$ 9,300.00
2040	Sidewalk Removal	8500	SF	$ 1.50	$ 12,750.00
2050	Clearing & Grubbing (Tree Removal)	1	LS	$ 20,000.00	$ 20,000.00
2060	Excavation Incl Haul	2550	CY	$ 29.00	$ 73,950.00
2065	Grading Cost for Road	31184	SF	$ 0.50	$ 15,592.00
2070	Aggregate Base	3067	TN	$ 35.00	$ 107,345.00
2080	Asphalt 6"	1184	TN	$ 130.00	$ 153,920.00
2090	Concrete Bike Path 6"	1070	SF	$ 12.00	$ 12,840.00
2100	Sidewalk & Ramps 4"	31184	SF	$ 10.00	$ 311,840.00
2110	Truncated Dome Installation	128	SF	$ 35.00	$ 4,480.00
2120	Stamped/Colored Vehicle Concrete at RAB	3050	SF	$ 30.00	$ 91,500.00
2130	Center RAB Island Feature (Concrete?)	3341	SF	$ 30.00	$ 100,230.00
2135	Median Island - concrete	5670	SF	$ 12.00	$ 68,040.00
2140	Concrete Driveway	563	SF	$ 15.00	$ 8,445.00
2150	Curb & Gutter	1396	LF	$ 30.00	$ 41,880.00
2160	Mountable Curb	490	LF	$ 30.00	$ 14,700.00
2170	Standard Curb	1294	LF	$ 30.00	$ 38,820.00
2180	Landscape Area	10683	SF	$ 7.00	$ 74,781.00
2190	Storm Piping - 12" - 5' average depth	760	LF	$ 120.00	$ 91,200.00
2200	Storm Catch Basin	8	EA	$ 3,000.00	$ 24,000.00
2210	48" Storm Manhole	4	EA	$ 5,000.00	$ 20,000.00
2220	Stormwater Planter LIDA	1455	SF	$ 125.00	$ 181,875.00
2230	Illumination - 8 illuminaires	1	LS	$ 267,500.00	$ 267,500.00
2240	Signage/Striping	1	LS	$ 30,000.00	$ 30,000.00
2250	Traffic Control for Construction	1	LS	$ 50,000.00	$ 50,000.00
2260	Church Parking Lot Reconfiguration	1	LS	$ 75,000.00	$ 75,000.00
2270	Relocation of existing utilities due to ROW expansion	1	LS	$ 100,000.00	$ 100,000.00
				Subtotal	**$ 2,091,988.00**
	Owner's Rep/Consultant				$ 50,000.00
	RIGHT-OF-WAY	SF	11,750	$ 17.80	$ 209,150.00
	CONSTRUCTION ENGINEERING/DESIGN (Task 14)				$ 157,000.00
	CONSTRUCTION SURVEY WORK			1.50%	$ 31,379.82
	CONTINGENCY			20.00%	$ 418,397.60
				TOTAL	**$ 2,957,915.42**
	ALTERNATE to build pond vs. planters				
2220	Stormwater Planter LIDA	-1455	SF	$ 125.00	$ (181,875.00)
2990	Larger Storm Facility at City Property	3375	SF	$ 40.00	$ 135,000.00
					$ (46,875.00)

Appendix H
Documentation of Cost per Crash
Calculation

APPENDIX H. DOCUMENTATION OF COST PER CRASH CALCULATION

The Intersection Control Evaluation (ICE) tool used for this analysis is a modified version of the Life-Cycle Cost Estimating Tool (LCCET) that was developed as part of NCHRP Project 03-110. The objective of NCHRP Project 3-110 was to develop a spreadsheet-based tool that can be used to compare the life-cycle costs of different intersection control strategies. This tool relies on a cost per crash value to calculate the safety benefit, or cost, of alternatives. The methodology uses a cost per fatal and injury crash, as well as a cost per property damage only (PDO) crash.

ODOT provides the economic value per crash in the *ODOT Highway Safety Improvement Program (HSIP) Guide* from February 2021. The costs are broken up into fatal and serious (injury A) crashes, moderate (injury B) and minor (injury C) crashes, and PDO crashes. The values are shown in Figure H-1.

Figure H.1 Comprehensive Economic Value Per Crash

Highway Type	Urban	Rural
Fatal and Serious (Injury A) Injury Crashes		
Interstate	$1,150,000	$2,330,000
Other state highways	$1,170,000	$1,680,000
Local Roads	$870,000	$1,670,000
Moderate (Injury B) and Minor (Injury C) Injury Crashes		
Interstate	$69,300	$79,200
Other state highways	$70,600	$81,900
Local Roads	$72,400	$83,900
Property Damage Only (PDO) Crashes		
All facilities	$19,400	$19,400

* Calculated using the cost (updated to 2012 dollars) and procedures shown in
Appendix 4A of the Highway Safety Manual
Source: Table 3-1, ODOT HSIP Guide, February 2021

Both the LCCET and ODOT's Guide separate out PDO crashes, with an economic value of $19,400 provided in ODOT's guide. However, fatal and injury crashes are split up differently between the LCCET tool and ODOT's Guide. Therefore, the economic values in ODOT's Guide were used to determine a value for fatal and injury crashes to use in the LCCET tool. In order to develop this value, a weighted average was calculated based on the crash history at Boeckman Road and Canyon Creek Road. Table H-1 summarizes the crash history at the intersection and calculates a comprehensive economic value for fatal and injury crashes as $271,800.

Table H-1: Crash Summary (January 2011 – December 2020)

Crash Severity	Reported Crashes	Comprehensive Economic Value per Crash	Total Comprehensive Economic Value
Fatal	-	$870,000	$0 (0 x $870,000)
Injury A	2	$870,000	$1,740,000 (2 x $870,000)
Injury B	1	$72,400	$72,400 (1 x $72,400)
Injury C	5	$72,400	$362,000 (5 x $72,400)
Total Fatal/Injury	**8**	**$271,800 ($2,174,400/8)**	**$2,174,400**

Although this method does not account for the change in crash severity distribution (among fatal/injury crashes) that may be associated with different alternatives, it provides a reasonable method for estimating the cost per fatal or injury crash for use in the LCCET.

Appendix I
Documentation of Cost per Crash
Calculation Life-Cycle Cost Analysis
Outputs

Agency:	City of Wilsonville
Project Name:	Boeckman Rd PDB Project
Project Reference:	27376
Intersection:	Boeckman Rd & Canyon Creek Rd
City:	Wilsonville
State:	Oregon
Performing Department or Organization:	Kittelson
Date:	12.7.2022
Analyst:	Kelly Laustsen
Analysis Type	At-Grade Intersection

Analysis Summary

Cost Categories	Net Present Value of Costs				
	All Way Stop	Traffic Signal	Roundabout		
Construction Cost	$ -	$ 1,806,001	$ 2,957,915		
Post-Construction Cost	$ -	$ 215,275	$ 12,118		
Auto Passenger Delay Cost	$ 10,651,476	$ 3,874,670	$ 3,413,145		
Truck Delay Cost	$ 550,329	$ 200,338	$ 176,441		
Crash Cost	$ 1,102,957	$ 2,171,890	$ 1,102,957		
Total cost	**$12,304,762**	**$8,268,174**	**$7,662,577**		

Select Base Case for Benefit-Cost Comparison: (Choose from list)	All Way Stop				
Benefit Categories	Net Present Value of Benefits Relative to Base Case				
	All Way Stop	Traffic Signal	Roundabout		
Auto Passenger Delay		$ 6,776,806	$ 7,238,331		
Truck Delay Cost		$ 349,991	$ 373,888		
Crash Cost		$ (1,068,933)	$ -		
Net Present Value of Benefits		$ 6,057,864	$ 7,612,218		
Net Present Value of Costs		$ 2,021,276	$ 2,970,034		
Net Present Value of Improvement		$ 4,036,587	$ 4,642,185		
Benefit-Cost (B/C) Ratio		3.00	2.56		
Delay B/C		3.53	2.56		
Safety B/C		preferred. Benefits are less than base case and cost is greater than base	0.00		