



# SE 15<sup>th</sup> Street and Ferguson Road Intersection Project Evaluation Report

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## Executive Summary

The SE 15<sup>th</sup> Street / Ferguson Road intersection is identified for improvement through the voter approved 2020 Bend General Obligation Bond (GO Bond). The purpose of this Project Evaluation Report is to analyze possible changes to the intersection form at this location to guide the forthcoming GO Bond improvement project. This executive summary presents key findings and recommendations revealed through this evaluation.

- The Bend Transportation System Plan (TSP) and Southeast Area Plan (SEAP) identify the need for modifications to the SE 15<sup>th</sup> Street / Ferguson Road intersection to improve intersection operations and area connectivity in support of the growing southeast region of the city.
- Sherwood Forest Drive and the south leg of SE 15<sup>th</sup> Street have slight uphill grades, while Ferguson Road has a slight downhill grade, creating a grade differential between the east leg of the intersection and the south and west legs. This grade differential, along with the skewed east and west legs of the intersection, impact sight distance. The south leg of SE 15<sup>th</sup> Street cuts through rock with rock outcroppings remaining to the east and west of the roadway. Mature trees are also present in the northwest, southeast, and southwest intersection corners. Most of the intersection's immediate topography is generally flat.
- Utilities and communication services surround the study area (including power lines along Ferguson Road and SE 15<sup>th</sup> Street, north of the intersection). The nearest driveway is approximately 290 feet to the south on SE 15<sup>th</sup> Street.
- A shared use path is provided along the west side and bike lanes are provided along both sides of SE 15<sup>th</sup> Street. Sidewalk is available along the south side of Ferguson Road in the study area. Curb ramps are available between the shared use path and sidewalk for crossing Sherwood Forest Drive and the south leg of SE 15<sup>th</sup> Street. No other walking or biking facilities are available in the study area, including marked crosswalks.
- The current intersection is two-way stop-control, and all streets are two-lane roads with shared movements (i.e., no turn lanes).
- The current intersection meets City operating standards under existing AM and PM peak hour conditions but is forecast to not meet operating standards and exceed capacity by

## SE 15th Street and Ferguson Road Intersection Project Evaluation Report

2040. Queue storage is adequate through 2040 for 95<sup>th</sup> percentile queues in all scenarios, but the westbound queue is expected to grow significantly between existing and future no-build traffic conditions.

- ODOT reports 6 crashes have occurred at the study intersection between 2015 and 2020. Angle and turning movement crashes account for 4 of the 6 reported crashes. No fatal or serious injury crashes were reported. The observed intersection crash rate does not exceed the applicable statewide 90<sup>th</sup> percentile crash rate.
- The recommended intersection modification includes a single-lane roundabout, in support of the Bend TSP and SEAP, with a 130-foot inscribed diameter to minimize impacts to right-of-way and existing structures and accommodate WB-50 trucks. The roundabout would meet City operating standards under existing and future AM and PM peak hour conditions and reduce intersection queuing. The roundabout supports walking and biking connections with marked crossings on all approaches and space for the existing multi-use path. The roundabout cost is expected to reflect the cost of other single-lane roundabouts constructed in the City at \$2.5 to 3.5 million. Considering the state of the economy and the impacts of inflation on construction projects, the City may need to reevaluate the cost of final design and construction. A concept of the roundabout is provided later in this report.
- Intersection modifications to SE 15<sup>th</sup> Street / Ferguson Road support a Key Walking and Biking Route along SE 15<sup>th</sup> Street, identified in the Bend TSP. The intersection recommendations presented in this report are intended to be forward compatible with implementing that future route.

## Project Assumptions and Background

This section documents key project assumptions, relevant plans and policies, and other applicable background information for the SE 15<sup>th</sup> Street / Ferguson Road intersection evaluation.

### Study Area

The project evaluation study area is confined to the SE 15<sup>th</sup> Street / Ferguson Road intersection. Improvements at this intersection are an element of the 2020 Transportation General Obligation Bond (GO Bond) under project 1GRMC (Reed Market Corridor). This is a suite of projects that includes:

- The Reed Market Road railroad overcrossing
- A widened roundabout at SE 15<sup>th</sup> Street / Reed Market Road (two lanes)
- Capacity improvements at the Reed Market Road interchange with the Parkway and the Reed Market Road intersections at 3<sup>rd</sup> Street and Bond Street
- A key route project to construct a shared use path on SE 15<sup>th</sup> Street (Reed Market Road to 300 feet south of King Hezekiah Way)
- Improved pedestrian safety at the 3<sup>rd</sup> Street crossing of the Central Oregon Canal

This project suite is illustrated in **Figure 1.<sup>1</sup>**

SE 15<sup>th</sup> Street and Ferguson Road are minor arterials that connect the growing residential areas in southeast Bend to the Old Mill District and downtown (via SE Reed Market Rd or SE Wilson Ave) as well as regional roadways, US 20 and US 97.

The study intersection and key community destinations are shown in **Figure 2** and **Figure 3**.

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<sup>1</sup> <https://bendoregon.maps.arcgis.com/apps/MapJournal/index.html?appid=4c3a33373f364895be5fd0ad84da0013#>

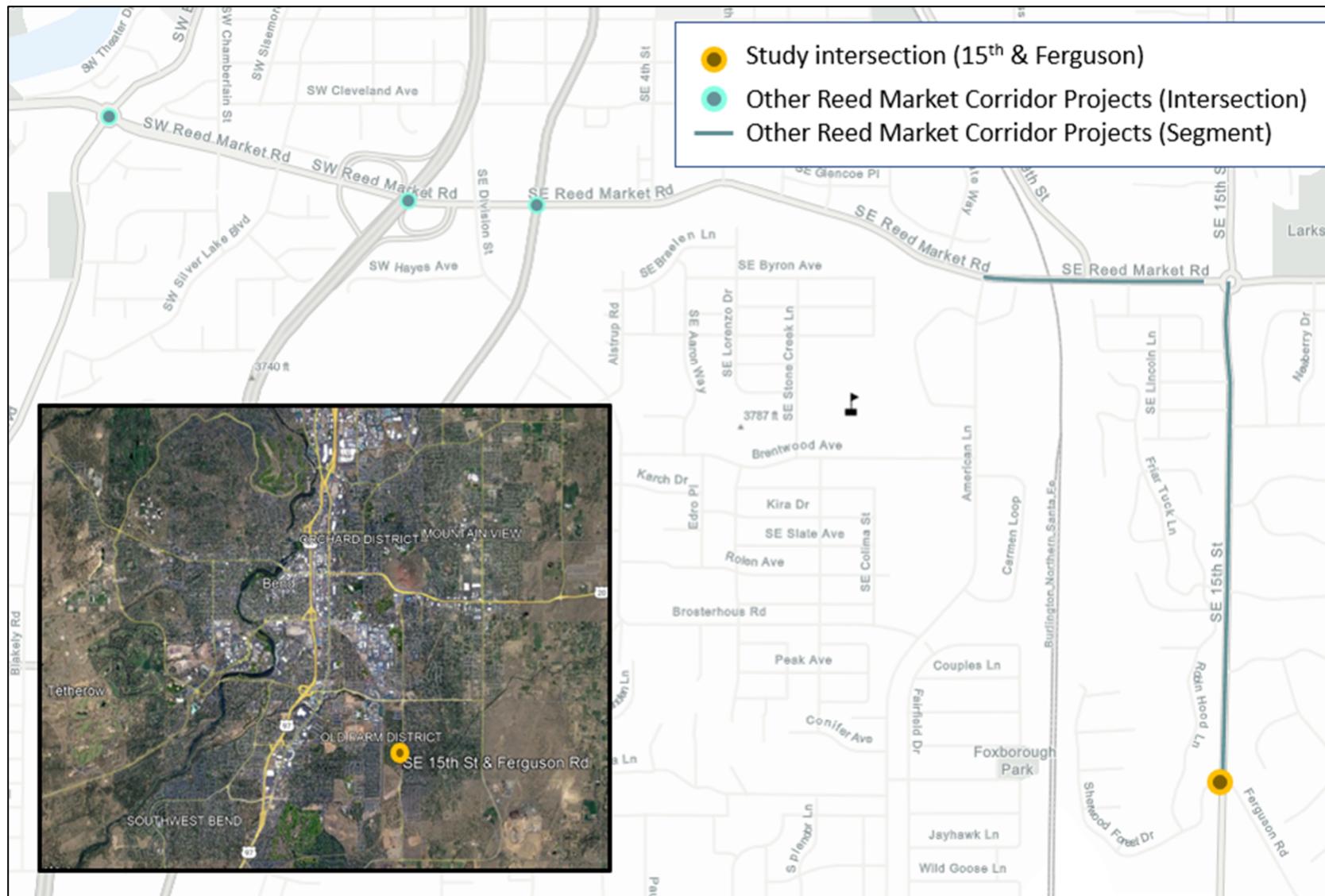


Figure 1: Reed Market Corridor Projects

SE 15th Street and Ferguson Road Intersection Project Evaluation Report



Figure 2: Study Area (SE 15<sup>th</sup> Street / Ferguson Road)



Figure 3: Community Amenities Near Study Intersection

## Relevant Planning Document Review

This section summarizes information contained in relevant planning documents that pertains to the study area. Incorporating transportation infrastructure and services that are planned for the study area establishes consistency among planning documents and works toward achieving their goals.

### **Bend Transportation System Plan (TSP, 2020)**

The Bend TSP establishes transportation system changes needed to support current and future land uses and anticipated population and employment growth through the year 2040.

Within the Urban Growth Boundary (UGB), the TSP identifies the following projects that are relevant to this study:

- R1-D: SE 15<sup>th</sup> Street just north of the study area – shared use path adjacent to roadway: convert an existing curb-tight sidewalk to a separated shared use path.
  - This project is categorized as a Key Walking and Bicycling Route
  - These routes are connected segments of low-stress bicycle facilities and shared pathways that allow travel across the city.
- C-34: improve capacity and safety at SE 15<sup>th</sup> Street / Ferguson Road intersection; improves connectivity.
  - This project is categorized as a mid-term investment priority, which supports economic and community health as they relate to anticipated growth.
  - The study intersection will facilitate travel between the developing southeast area and the rest of Bend and is assumed to be a roundabout.
  - This project is an element of Reed Market Road Corridor operational and safety improvements. These corridor improvements will require Reed Market Road closures that are expected to increase traffic congestion along SE 15<sup>th</sup> Street. Implementing an intersection improvement at the SE 15<sup>th</sup> Street / Ferguson Road intersection prior to these road closures will better facilitate the diverted traffic and enhance safety during the long-term detours.

*This report recommends specific modifications to the study intersection that consider forward compatibility with the future design and implementation of the Key Walking and Biking Route along SE 15<sup>th</sup> Street.*

### **Bend Transportation Safety Action Plan (TSAP, 2019)**

The Bend TSAP provides long-term goals, policies, and strategies and near-term actions to eliminate deaths and life-changing injuries on the transportation system within Bend's UGB. The TSAP does not identify the study intersection as one of its top sites for safety improvements.

### **Cascades East Transit (CET) 2040 Transit Master Plan (TMP, 2020)**

CET's 2040 TMP outlines a framework for providing transit and related services to Central Oregon for the next 20 years. This plan identifies new fixed-route service to southeast Bend (Route 9) in the mid- to long-term (10 to 20 years). The new route connects downtown to Knott Road via SE 15<sup>th</sup> Street, north of Reed Market Road, and Brosterhous Road, south of Reed Market Road. Although this new route does not pass through the study intersection, it provides service near the study area. The TMP also identifies a Local Neighborhood mobility hub south of the study intersection at SE 15<sup>th</sup> Street / Murphy Road. Modifications to the study intersection should support walking and biking connections to transit.

## Southeast Area Plan (SEAP, 2021)

Southeast Bend was identified as an UGB expansion area, after which the City initiated the creation of a comprehensive area plan for the 479-acre future community. The goal of the SEAP is to encourage development of a complete community (a place where people can live, work, shop, and play). While the study intersection is not directly within the SEAP, SE 15<sup>th</sup> Street and Ferguson Road bound the community to the north and west, providing key roadway connections to the rest of Bend. The plan identifies the following projects and design standards relevant to this project evaluation report:

- Existing active transportation facilities on SE 15<sup>th</sup> Street connect to an existing multiuse pathway in the corridor and will be expanded along the Central Oregon Canal.
- Implement rolled curbs, especially within roundabouts, to enable mobility for emergency service vehicles.

*The plan notes that the Bend TSP should identify a roundabout at the study intersection.*

## Analysis Methodology

All analyses summarized in this project evaluation report follow the methodology and assumptions detailed in the *Methodology Memorandum*. The *Methodology Memorandum* addresses data collection, traffic, crash, and multimodal analysis procedures, concept design and design vehicle, cost estimates, and phasing and sensitivity analysis for GO Bond project evaluation reports. Relevant elements of that memorandum have been applied to this report. *Appendix A includes the Methodology Memorandum*

## Additional Assumptions

The findings and recommendations enclosed in this project evaluation report are based on the following assumptions:

- Traffic operations analyses reflect both the AM and PM peak hour as the total entering volumes at the study intersection are similar during both periods, but there is an observed directional split along SE 15<sup>th</sup> Street that future modifications to the intersection should accommodate.
  - Counts were collected in September 2022 and therefore reflect changes in travel patterns associated with the opening of the Murphy Extension (Brosterhous Road to SE 15th Street, south of Ferguson Road) in November 2021.
  - Counts include the total number of pedestrian, bicycles, motor vehicles, and percentage of heavy vehicles that entered the intersection at 5-minute intervals.
- Future design efforts should further explore the specific heavy vehicle that should be accommodated at the study intersection based on anticipated use of SE 15<sup>th</sup> Street and Ferguson Road.
- The concept design does not fully evaluate the function of existing driveways within the intersection influence area. Future design efforts should further consider the appropriate function of each driveway as part of the project development process.
- The concept design was developed based on a field review of existing conditions, including utilities that could be seen above ground.
- Cost estimates are based on previous costs for the design and construction of similar facilities but may require additional input by the City of Bend due to the state of the economy and inflation impacts.

## Infrastructure Review

This section summarizes existing conditions within the study area based on field review and aerial imagery.

### Field Review

Kittelson conducted a field review on the morning of Thursday, September 1, 2022, under clear conditions. Traffic at the intersection was steady but light and relatively distributed across SE 15<sup>th</sup> Street and Ferguson Road approaches. Very light traffic was observed along Sherwood Forest Drive. **Figure 4** through **Figure 7** exhibit many of the existing field conditions.

Key conditions observed:

1. Most of the intersection's immediate topography is generally flat, but key items of note include:
  - a. Sherwood Forest Drive and the south leg of SE 15<sup>th</sup> Street have slight uphill grades, while Ferguson Road has a slight downhill grade, creating a grade differential between the east leg of the intersection and the south and west legs (**Figure 4**). This grade differential, along with the skewed east and west legs of the intersection, impact sight distance.
  - b. The south leg of SE 15<sup>th</sup> Street cuts through rock with rock outcroppings remaining to the east and west of the roadway. Mature trees are also present in the northwest, southeast, and southwest intersection corners.
2. Infrastructure for several utilities and communication services surround the intersection including: power lines located along Ferguson Road that continue through the northeast corner and up SE 15<sup>th</sup> Street; a fire hydrant in the southwest corner (adjacent to SE 15<sup>th</sup> Street), storm drains in the southwest and southeast corners, a street light pole in the northeast corner (30 feet from the curb), and a power box in the southeast corner (**Figure 4**).

Utilities include gas, water, power, irrigation, communication services, and fire services

The presence and location of all utilities and communication services should be identified and verified through final design.

3. The closest property accesses to the intersection include:
  - a. A backyard fence for the property at 61308 Robin Hood Lane, which fronts Robin Hood, and backs up to Sherwood Forest Drive, is roughly 100 feet west of the intersection.
  - b. Two driveways to a private residence at 61270 SE 15<sup>th</sup> Street south of the intersection, the closest of which is roughly 290 feet (**Figure 5**).
  - c. An aerial inspection of the study area revealed a paved roadway in the backyard of 61285 King Saul Ave, roughly 350 feet from the study intersection on Ferguson Road. The property is fenced in, but the paved roadway may indicate that the resident occasionally uses the backyard for ingress/egress (**Figure 5**).

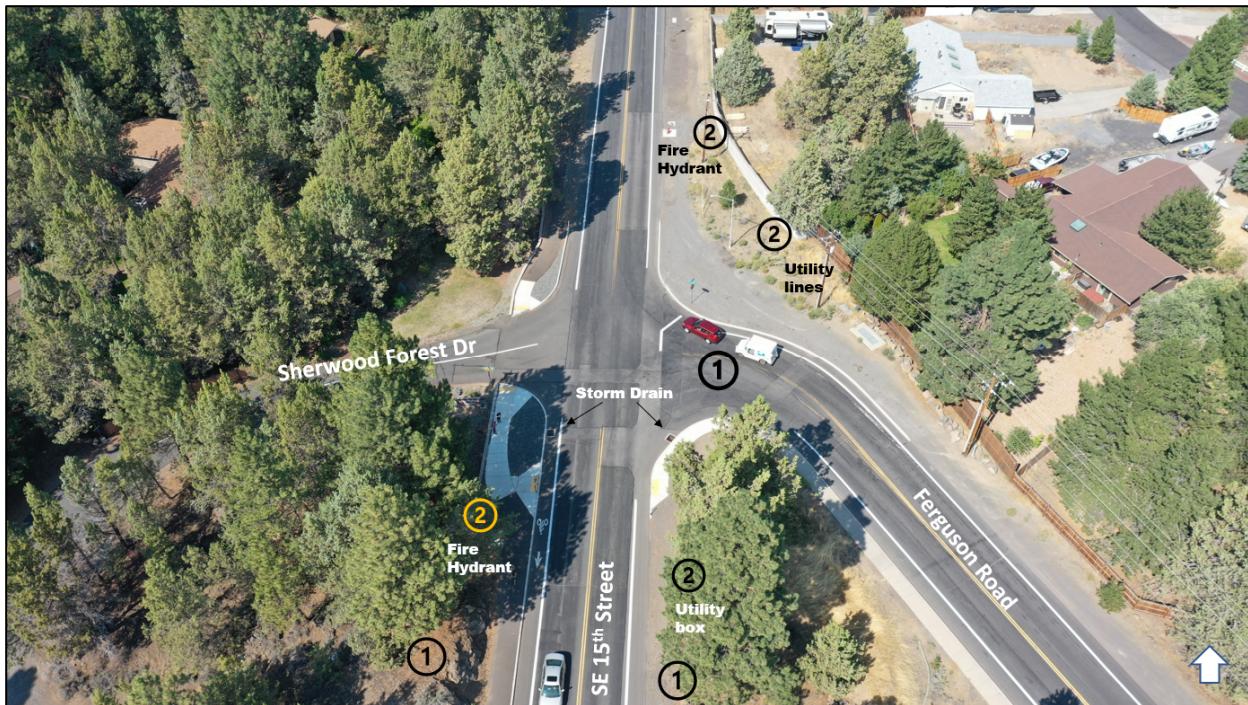


Figure 4: Utilities and Communication Infrastructure in Study Area



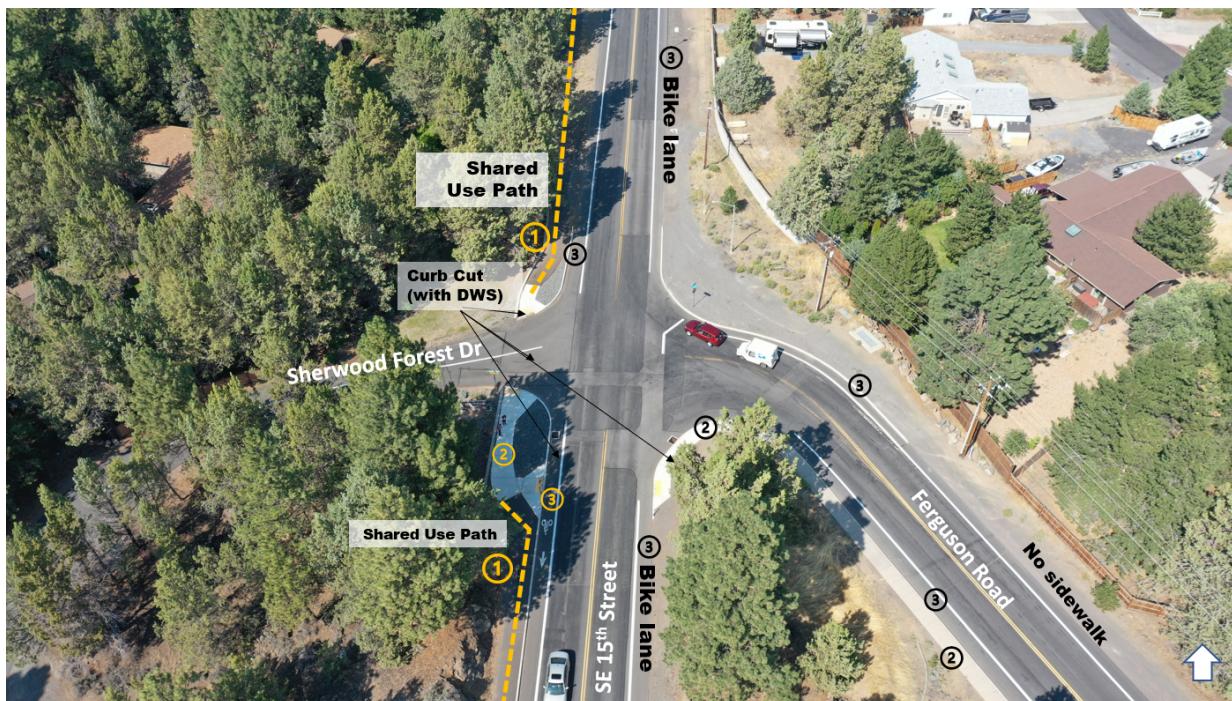
Figure 5: Existing Driveways Near Study Site

## Pedestrian and Bicycle Facilities

As noted earlier in **Figure 2**, the study intersection is within reasonable walking and/or biking distance of several community destinations including Alpenglow Park and Caldera High School, which are just over a half mile and mile downstream on SE 15<sup>th</sup> Street, respectively.

1. An 8-foot shared used path is available on the west side of SE 15<sup>th</sup> Street that ties into existing sidewalk approximately 500 feet to the north and into the new roundabout at Murphy Road to the south. The northern section of this path will be extended further north (see Bend TSP Project R1-D). At the study intersection, the path includes curb ramps with curb cuts and raised detectable warning system panels for crossing Sherwood Forest Drive as well as the south leg of SE 15<sup>th</sup> Street.
2. Sidewalk is available along the south side of Ferguson Road in the study area, and between the curb ramps in the southwest intersection corner, but nowhere else surrounding the intersection.
3. Five-foot on-street bike lanes are available on SE 15<sup>th</sup> Street and Ferguson Road in the study area. Bike lanes are not provided along Sherman Forest Drive, so motorists and bicyclists must share the road, which is appropriate for its local street context.
4. No marked crosswalks are present at the intersection.

**Figure 6** depicts existing active transportation facilities.



**Figure 6: Current Active Transportation Facilities**

## Transit Facilities

CET does not currently operate fixed-route transit service in the immediate vicinity of the study area. The closest routes are Routes 5 and 6, which serve the same loop with stops, but in opposite directions, along Reed Market Road, 15<sup>th</sup> Street (north of Reed Market Road), 27<sup>th</sup> Street, and Wells Acres Road / Butler Market Road. The nearest stop to the study intersection is over three-quarters of a mile away in front of the Bend Senior Center on Reed Market Road.

As described in previous sections, CET identifies new fixed-route service to southeast Bend in the next 10 to 20 years, near the study area vicinity, as well as a Local Neighborhood mobility hub near the SE 15<sup>th</sup> Street / Murphy Road intersection.

## Roadway Facilities

SE 15<sup>th</sup> Street / Ferguson Road is a four-leg intersection with two-way stop-controlled east and west approaches (Ferguson Road and Sherwood Drive). All approaches have shared movements and do not include turn lanes. All streets are two-lane roads; Ferguson Road and SE 15<sup>th</sup> Street have centerline and edge line striping, but Sherwood Forest Drive does not. Sherwood Forest Drive is privately owned by a Homeowners Association (HOA). The speed limit on SE 15<sup>th</sup> Street in the study area is 35 miles per hour (MPH) and the speed limit on Ferguson Road is 40MPH.

**Figure 7** depicts the current roadway facilities.



**Figure 7: Current Roadway Facilities**

## Irrigation Facilities

The Central Oregon Canal is operated by the Central Oregon Irrigation District (COID) and runs between east and west Bend, crossing underneath Ferguson Road, approximately 2,300 feet east of SE 15<sup>th</sup> Street, and underneath SE 15<sup>th</sup> Street, approximately 1,200 feet south of Ferguson Road.

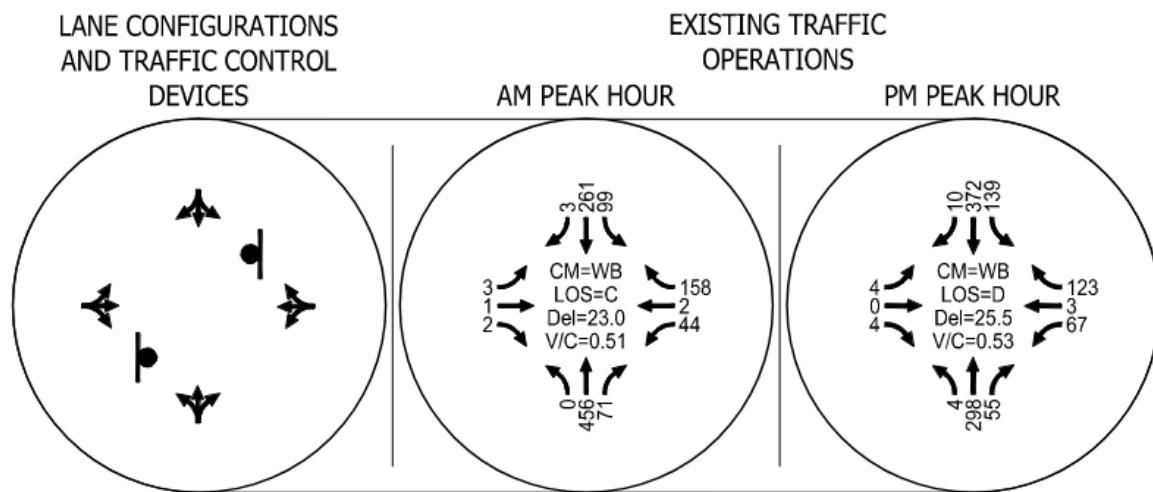
## Analysis and Operations Review

This section summarizes the key findings from analyzing existing and future no-build conditions at SE 15<sup>th</sup> Street / Ferguson Road, including traffic operations, crash history, and existing accesses. The purpose of the analysis is to identify and confirm needs that should be addressed by the preferred alternative.

## Existing Intersection Operational Analysis Results

Traffic counts were collected at the study intersection during the AM peak period (7-9 AM) and PM peak period (4-6 PM) in September 2022 while school was in session. All counts include the total number of pedestrians, bicyclists, motor vehicles, and percentage of heavy vehicles that entered the intersection in 5-minute intervals. *Appendix B includes the traffic count worksheets.*

Traffic operations analyses reflect both AM and PM peak hour conditions as the total entering volumes at the study intersection are similar during both periods, but there is an observed directional split along SE 15<sup>th</sup> Street that future modifications to the intersection should accommodate. The traffic counts show that the AM peak hour occurs from 7:50 to 8:50 AM and the PM peak hour occurs from 4:55 to 5:55 PM. Peak hour conditions were analyzed at the study intersection according to *Highway Capacity Manual (HCM) 6<sup>th</sup> Edition* methodologies using Vistro software. **Figure 8** shows the intersection's lane configurations and traffic control devices, AM and PM peak hour volumes, and resultant traffic operations, including the level-of-service (LOS) and delay for the intersection and the volume-to-capacity ratio (v/c) for the intersection critical movement. As shown, the intersection meets the City's two-way stop-control operational standard of a 50-second critical movement delay.



**Figure 8: Existing AM and PM Peak Hour Traffic Conditions**

**Table 1** summarizes the 95<sup>th</sup> percentile queue lengths at the study intersection. All approaches have adequate storage for 95<sup>th</sup> percentile queue lengths under AM and PM peak hour traffic conditions. *Appendix C includes the existing traffic analysis worksheets.*

**Table 1: Existing AM and PM Peak Hour 95<sup>th</sup> Percentile Queue Lengths**

Movement	Available Storage (Feet) <sup>1</sup>	95 <sup>th</sup> Percentile Queue (Feet) <sup>2</sup>		Fits within Storage	
		AM	PM	AM	PM
NBLTR	290	<25	25	Yes	Yes
SBLTR	780	25	25	Yes	Yes
EBLTR	515	25	25	Yes	Yes
WBLTR	1,470	75	100	Yes	Yes

<sup>1</sup>Measured from approach stop bar to nearest upstream driveway or side street.

<sup>2</sup>Rounded to the nearest 25 feet.

These operational conditions could worsen during the Reed Market Road closure, increasing side-street delay and queueing for vehicles, and potentially having safety implications if drivers choose to take shorter gaps in traffic along SE 15<sup>th</sup> Street.

## Safety Evaluation

The safety evaluation summarized in this section is based on the most recent available six years of reported crash data (January 1, 2015 through December 31, 2020) obtained from the Oregon Department of Transportation's (ODOT) Crash Analysis and Reporting Unit. The data include the location, type, and severity of all crashes reported at the intersection during the study period. A total of 6 crashes were reported between 2015 and 2020. No crashes were reported in year 2020 likely due in part to changes in travel patterns related to stay-at-home orders during the COVID-19 pandemic. **Table 2** summarizes these crashes by their type and general severity.

**Table 2: Intersection Crashes by Type and General Severity (2015-2020)**

Collision Type	Type		Total
	Injury	Property Damage Only	
Fixed-Object	-	-	0
Rear-End	2	-	2
Angle	-	3	3
Turning Movement	1	-	1
<b>Total</b>	<b>3</b>	<b>3</b>	<b>6</b>

**Table 3** summarizes the crash types by their resulting number of injuries and corresponding severities. As there may be multiple injured parties or injury types per crash, the total number of injuries may exceed the total number of crashes for a particular collision type. As shown, no fatal or serious injuries were reported during the study period, nor were crashes involving bicyclists or pedestrians. Angle and turning movement crashes account for approximately 67 percent of the reported crashes. *Appendix D* includes the crash data worksheets.

**Table 3: Number of Crash Injuries by Type and Severity (2015-2020)**

Collision Type	Severity				Total
	Fatal	Incapacitating Injury	Non-Incapacitating Injury	Possible Injury	
Fixed-Object	-	-	-	-	0
Rear-End	-	-	2	1	3
Angle	-	-	-	-	
Turning Movement	-	-	1	1	2
<b>Total</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>2</b>	<b>5</b>

Given that there were no crashes reported in 2020, we used the crash data reported between 2015 and 2019 to compare the intersection's crash rate against the applicable statewide 90<sup>th</sup> percentile crash rate. The 90<sup>th</sup> percentile crash rate performance standard is used to identify intersections exhibiting more crashes than expected based on traffic volume and intersection

## SE 15th Street and Ferguson Road Intersection Project Evaluation Report

type. **Table 4** shows the observed crash rate at the intersection and how it compares to the applicable statewide 90<sup>th</sup> percentile crash rate.

**Table 4: 90<sup>th</sup> Percentile Crash Rate Comparison (2015-2019)**

Total Crashes	90 <sup>th</sup> Percentile Crash Rate	Observed Crash Rate	Observed > 90 <sup>th</sup> Rate?
6	0.408	0.305	No

As shown, the observed intersection crash rate does not exceed the applicable statewide 90<sup>th</sup> percentile crash rate. *Appendix D includes the crash analysis worksheet.*

As stated previously, the Bend TSAP recognizes that roundabouts have a significantly lower incidence of fatal and incapacitating crashes when compared to stop-controlled intersections. As noted previously, the 2020 TSP identifies a need for safety and capacity improvements at the intersection to accommodate future growth from the developing area and facilitate connections from the southeast of the city to the rest of Bend.

### Access Analysis

As described in previous sections, the driveway nearest to the study intersection is roughly 290 feet to the south on SE 15<sup>th</sup> Street. This is one of two driveways providing access to the same private residence. The second driveway is approximately an additional 135 feet to the south, and thus over 400 feet from the study intersection.

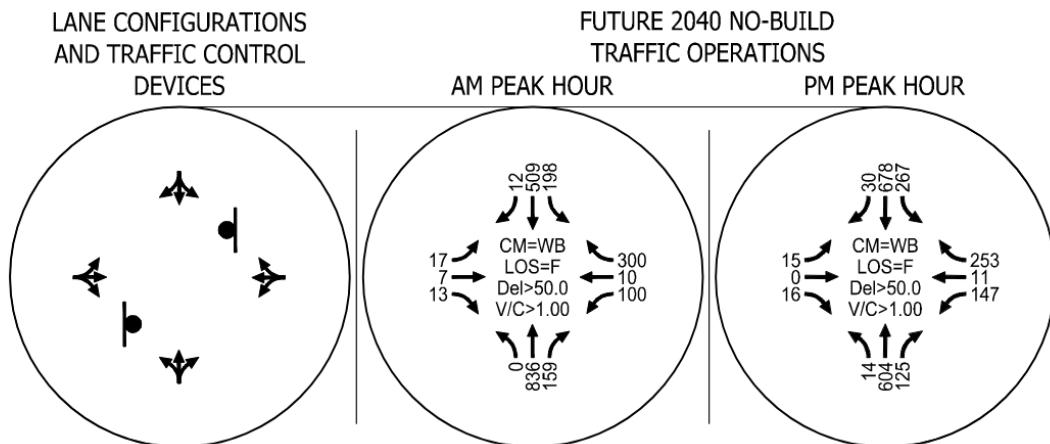
According to Bend Development Code Section 3.1.400.F, lots and parcels in all zones and all uses may have one access point and if a property has more than one permitted access, the City may require that existing accesses be closed.

The future design process should further evaluate these access points and determine if any modifications are necessary.

### Future Volume Evaluation [2040 No Build Conditions]

Per the *Methodology Memorandum*, the Bend Redmond Travel Demand Model (BRM) was used to develop year 2040 turn movement volumes at the study intersection. The raw link level volumes from the BRM were post-processed using methodologies outlined in the National Cooperative Highway Research Program (NCHRP) *Report 765 Highway Traffic Data for Urbanized Area Project Planning and Design*, consistent with the ODOT Analysis Procedures Manual (APM).

Like the existing intersection operational analysis, year 2040 AM and PM peak hour traffic volumes were evaluated at the study intersection according to *HCM 6<sup>th</sup> Edition* methodologies using Vistro software. **Figure 9** shows the intersection's no-build lane configurations, traffic control devices, forecast 2040 AM and PM peak hour volumes, and resultant traffic operations. As shown, the intersection does not meet the City's two-way stop-control operational standard of a 50-second critical movement delay.



**Figure 9: Future 2040 AM and PM Peak Hour No-Build Traffic Conditions**

**Table 5** summarizes the 95<sup>th</sup> percentile queue lengths at the study intersection. All approaches have adequate storage for 95<sup>th</sup> percentile queue lengths under AM and PM peak hour traffic conditions. However, queuing on the westbound approach is expected to grow significantly as compared to conditions observed today. *Appendix E includes the future traffic analysis worksheets.*

**Table 5: Future 2040 AM and PM Peak Hour No-Build 95<sup>th</sup> Percentile Queue Length**

Movement	Available Storage (Feet) <sup>1</sup>	95 <sup>th</sup> Percentile Queue (Feet) <sup>2</sup>		Fits within Storage	
		AM	PM	AM	PM
NBLTR	290	0	25	Yes	Yes
SBLTR	780	50	50	Yes	Yes
EBLTR	515	175	125	Yes	Yes
WBLTR	1,470	1,100	1,175	Yes	Yes

<sup>1</sup>Measured from approach stop bar to nearest upstream driveway.

<sup>2</sup>Rounded to the nearest 25 feet.

## Equity Evaluation

The Bend Transportation Bond Oversight Committee (TBOC) has Project Evaluation Criteria<sup>2</sup>, including an evaluation for equity. The following scores listed in **Table 5** were provided for the equity evaluation criteria for the entire Reed Market Corridor project package as described in previous sections and depicted in **Figure 1**. This evaluation report considers the intersection modification only.

<sup>2</sup> [https://bend.granicus.com/MetaViewer.php?view\\_id=18&event\\_id=676&meta\\_id=51774](https://bend.granicus.com/MetaViewer.php?view_id=18&event_id=676&meta_id=51774)

**Table 6: Equity Evaluation Results**

Equity Evaluation Criteria	Score	Notes
Transportation Access for Underserved Populations	●	Scored by TBOC
Transportation impacts on the community	●	Scored by TBOC
Reduce pollution of Bend's air and water, with a focus on the impacts to vulnerable populations	●	Reduces diversion, improving VMT
Access to key destinations	●	Minor improvements to connectivity for pedestrians to/from Larkspur Park

- The project clearly supports the criterion and/or makes substantial improvements in the criteria category
- The project partially supports the criterion and/or makes moderate improvements in the criteria category.
- The project does not support the intent of, provides minor or incidental benefit and/or negatively impacts the criteria category.

## Summary of Needs

The following summarizes key needs from the field review of multimodal facilities as well as the safety and operations analyses:

- Future year 2040 intersection operations do not meet the City's two-way stop-control operational standard.
- ODOT has reported 6 crashes at the intersection between 2015 and 2020.
  - 67 percent were angle and turning movement crashes.
  - No reported crash resulted in fatal or serious injuries
  - No reported crash involved a cyclist or pedestrian.
- The Bend TSP and SEAP identified the need for a capacity and connectivity improvement at the study intersection.
- The Bend TSP established SE 15<sup>th</sup> Street as a Key Walking and Biking Route and identified the need to implement a shared use path along the corridor. Part of this route appears complete through the study area, but intersection modifications should accommodate this route.

## Alternative Evaluation

This section evaluates the implementation of a single-lane roundabout at the SE 15<sup>th</sup> Street / Ferguson Road intersection in support of recommendations within the Bend TSP. Presented herein is a concept design, safety and operational evaluation, multimodal accommodations, environmental impacts, and cost estimate for a single-lane roundabout at this location.

### Concept Design

The single-lane roundabout shown in **Figure 10** is a concept design that balances environmental impacts with operational and geometric needs.



SE 15th Street / Ferguson Road  
Single-Lane Roundabout Concept  
Bend, Oregon

Figure  
10

## SE 15th Street and Ferguson Road Intersection Project Evaluation Report

The roundabout shown has a 130-foot inscribed circular diameter intended to minimize impacts to right-of-way and existing structures while accommodate WB-50 trucks. The center of the intersection is shifted south of the existing intersection – along SE 15th Street’s roadway centerline – by approximately 120 feet in order to tie the east and west legs into the existing skewed Sherwood Forest Drive and Ferguson Road streets. The splitter islands are intended to be at least 100 feet but should be evaluated during future design efforts to minimize impacts to adjacent driveways.

The following aspects of this concept should be further refined through the future design process:

- The location of the roundabout shown would require rock and tree removal along both sides of SE 15<sup>th</sup> Street, immediately south of the existing intersection. Shifting the intersection further south or to the north may have implications for existing properties and structures.
- Speed control for vehicles approaching and traveling through the intersection along SE 15<sup>th</sup> Street could be improved by offsetting the splitter islands left of the roadway centerline.
- The west leg is a private street and may not require a full roadway build. Alternative designs could be considered, such as a striped splitter island, concrete divider between entering/exiting traffic, etc. (see examples within Bend in **Figure 11**).

Future design efforts should modify and expand on this concept as needed based on more detailed field review, design considerations, and incorporation of the preferred walking and biking route along SE 15<sup>th</sup> Street.



(SE 15th Street / Murphy Road)



(SE 15th Street / Knott Road)

**Figure 11: Local Examples of Splitter Island Treatments**

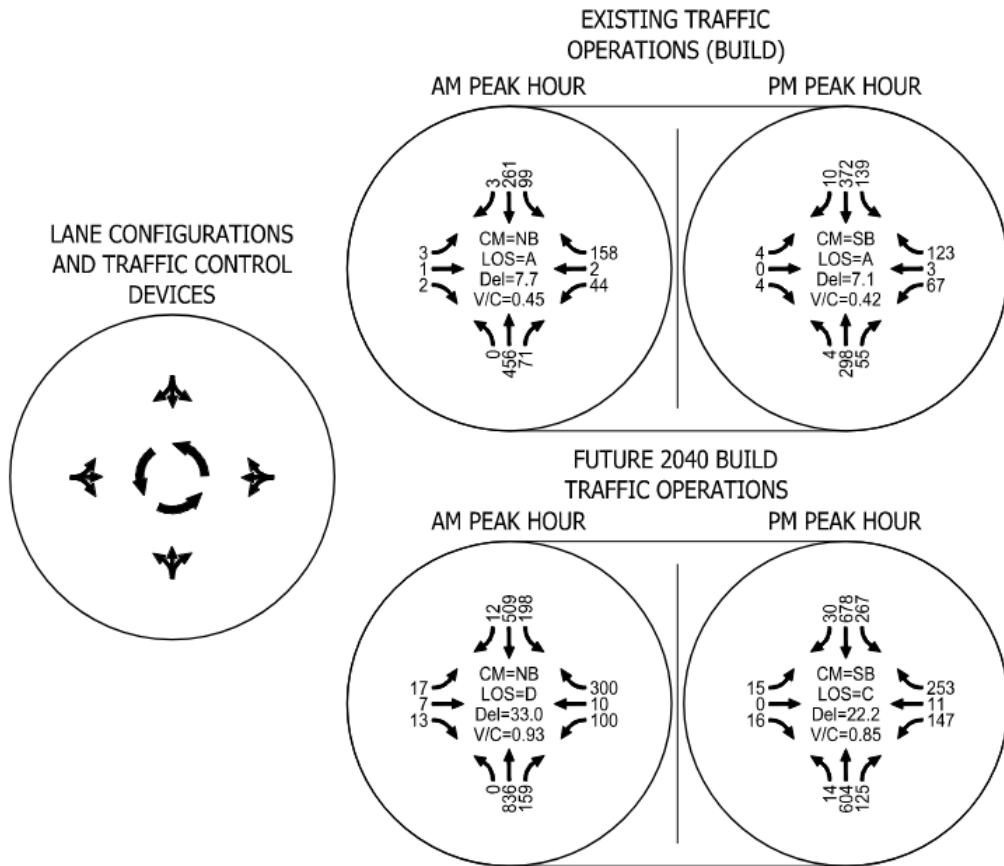
### Safety Review

As described in the safety evaluation, 6 crashes have been reported at the intersection between 2015 and 2020, none of which were reported in 2020 (67 percent were angle and turning movement crashes). The 6 reported crashes between 2015 and 2019 are below what is expected as compared with statewide 90<sup>th</sup> percentile crash rates. Converting the existing intersection into a roundabout has the potential to reduce all crash types by 19 to 82 percent, based on ODOT’s list of approved Crash Reduction Factors (CRFs) and the Highway Safety Manual (HSM), respectively.

### Operations Analysis

We analyzed a single-lane roundabout under the existing and future 2040 AM and PM traffic conditions, described in previous sections according, to *HCM 6<sup>th</sup> Edition* methodologies using Vistro software. **Figure 12** shows the roundabout lane configurations, AM and PM peak hour

volumes, and resultant traffic operations (including the LOS, delay, and v/c for the intersection critical movement) under existing and future conditions. As shown, the intersection meets the City's roundabout operational standard of a less than 1.0 critical movement v/c now and in 20 years.



**Figure 12: Existing and Future Peak Hour Traffic Conditions for a Single-Lane Roundabout**

**Table 7** summarizes the existing and future 95<sup>th</sup> percentile queue lengths for the roundabout. While queue storage is adequate for the northbound approach under future AM and PM traffic conditions, 95<sup>th</sup> percentile queues are projected to block the nearest upstream private driveway during the AM peak hour. As noted previously, this residence has two driveways. This potential impact should be taken into consideration by future design efforts. *Appendix F includes the existing and future traffic analysis worksheets for the single-lane roundabout.*

**Table 7: 95<sup>th</sup> Percentile Queue Lengths for a Single-Lane Roundabout under Existing and Future AM and PM Peak Hour Traffic Conditions**

Movement	Available Storage (Feet) <sup>1</sup>	95 <sup>th</sup> Percentile Queue Lengths (Feet) <sup>2</sup>				Fits within Storage			
		Existing		Future		Existing		Future	
		AM	PM	AM	PM	AM	PM	AM	PM
NBLTR	290	75	50	400 <sup>3</sup>	175	Yes	Yes	Yes	Yes
SBLTR	780	50	75	125	300	Yes	Yes	Yes	Yes
EBLTR	515	25	25	25	25	Yes	Yes	Yes	Yes
WBLTR	1,470	25	25	125	100	Yes	Yes	Yes	Yes

<sup>1</sup>Measured from approach stop bar to nearest upstream driveway.<sup>2</sup>Rounded to the nearest 25 feet.<sup>3</sup>Lane storage is adequate, but traffic volumes block upstream.

## Multimodal Accommodations

The concept design improves multimodal connectivity at the intersection by providing walking and biking facilities and improved crossing locations via the roundabout. The wide path that would be constructed adjacent to the roundabout will support various designs, including for the existing path along the west side of SE 15<sup>th</sup> Street, through the intersection, and the Key Walking and Biking Route planned along the corridor in the study area up to Reed Market Road. Enhanced crossing features may be necessary on the west leg of the intersection if it is not fully built out.

Although no fixed-route transit service or transit facilities are planned in the immediate vicinity of the study intersection, the concept design improves walking, rolling, and biking connections for riders accessing transit on SE Reed Market Rd.

## Environmental Impact

Although the roundabout is sized to reduce environmental impacts, it will require right-of-way acquisition, particularly on the west side of the intersection, to facilitate normal roundabout operations for vehicles and people, including walking and biking facilities, and the typical design vehicle (to be further refined through the design process). **Figure 10** generally illustrates the expected right-of-way impacts of this specific concept.

## Class 5 cost estimate

Previous single-lane roundabouts constructed in the City have cost between \$2.5 and 3.5 million, which could be expected at the study intersection. Considering the state of the economy and the impacts of inflation on construction projects, the City may need to reevaluate the cost of final design and construction.

## Findings and Recommendations

This section summarizes key findings identified through this Project Evaluation Report and the recommendations for the SE 15th Street / Ferguson Road intersection.

- The Bend Transportation System Plan (TSP) and Southeast Area Plan (SEAP) identify the need for modifications to the SE 15<sup>th</sup> Street / Ferguson Road intersection to improve intersection operations and area connectivity in support of the growing southeast region of the city.
- Sherwood Forest Drive and the south leg of SE 15<sup>th</sup> Street have slight uphill grades, while Ferguson Road has a slight downhill grade, creating a grade differential between the east leg of the intersection and the south and west legs. This grade differential, along with the skewed east and west legs of the intersection, impact sight distance. The south leg of SE 15<sup>th</sup> Street cuts through rock with rock outcroppings remaining to the east and west of the roadway. Mature trees are also present in the northwest, southeast, and southwest intersection corners. Most of the intersection's immediate topography is generally flat.
- Utilities and communication services surround the study area (including power lines along Ferguson Road and SE 15<sup>th</sup> Street, north of the intersection). The nearest driveway is approximately 290 feet to the south on SE 15<sup>th</sup> Street.
- A shared used path is provided along the west side and bike lanes are provided along both sides of SE 15<sup>th</sup> Street. Sidewalk is available along the south side of Ferguson Road in the study area. Curb ramps are available between the shared use path and sidewalk for crossing Sherwood Forest Drive and the south leg of SE 15<sup>th</sup> Street. No other walking or biking facilities are available in the study area, including marked crosswalks.
- The current intersection is two-way stop-control, and all streets are two-lane roads with shared movements (i.e., no turn lanes).
- The current intersection meets City operating standards under existing AM and PM peak hour conditions but is forecast to not meet operating standards and exceed capacity by 2040. Queue storage is adequate through 2040 for 95<sup>th</sup> percentile queues in all scenarios, but the westbound queue is expected to grow significantly between existing and future no-build traffic conditions.
- ODOT reports 6 crashes have occurred at the study intersection between 2015 and 2020. Angle and turning movement crashes account for 4 of the 6 reported crashes. No fatal or serious injury crashes were reported. The observed intersection crash rate does not exceed the applicable statewide 90<sup>th</sup> percentile crash rate.
- The recommended intersection modification includes a single-lane roundabout, in support of the Bend TSP and SEAP, with a 130-foot inscribed diameter to minimize impacts to right-of-way and existing structures and accommodate WB-50 trucks. The roundabout would meet City operating standards under existing and future AM and PM peak hour conditions and reduce intersection queuing. The roundabout supports walking and biking connections with marked crossings on all approaches and space for the existing multi-use path. The roundabout cost is expected to reflect the cost of other single-lane roundabouts constructed in the City at \$2.5 to 3.5 million. Considering the state of the economy and the impacts of inflation on construction projects, the City may need to reevaluate the cost of final design and construction. A concept of the roundabout is provided later in this report.
- Intersection modifications to SE 15<sup>th</sup> Street / Ferguson Road support a Key Walking and Biking Route along SE 15<sup>th</sup> Street, identified in the Bend TSP. The intersection recommendations presented in this report are intended to be forward compatible with implementing that future route.

## **Appendix A – Methodology Memorandum**



# Methodology Memorandum

PREPARED FOR: Sinclair Burr & Ryan Oster

PREPARED BY: Matt Kittelson & Chris Maciejewski

DATE: January 17, 2022

## Introduction

This memorandum provides details of the methodology and assumptions to perform technical analyses for General Obligation Bond (GO Bond) traffic engineering studies (Project Evaluation Reports) for the City of Bend. The methodology and assumptions include:

- Data collection and volume development;
- Traffic analysis procedure for the study intersections under existing year and planning horizon (year 2040) traffic conditions;
- Crash analysis procedure for the study intersections;
- Multimodal analysis;
- Concept design and design vehicle;
- Cost estimates; and
- Phasing and sensitivity analysis.

The following sections provide an overview of the Project Evaluation Reports and their purpose along with technical assumptions and approaches that will guide each report.

## Project Evaluation Reports

As part of the GO Bond implementation, Kittelson & Associate and DKS Associates have been retained by the City of Bend to evaluate various transportation projects identified within the GO Bond program. The purpose of these reports is to help inform intersection form, sizing, and multimodal features needed to support the long-term vision for the transportation network.

Outcomes of the Project Evaluation Reports will include conceptual designs of intersection form and key roadway features, including multimodal facilities, planning level cost estimates, and other information intended to inform a future design effort for each project. The reports are intended to be useful to City Staff, the Transportation Bond Oversight Committee (TBOC), and City Council as projects are further refined and prioritized through the GO Bond program.

Project Evaluation Reports are currently anticipated for the following projects:

- Portland Avenue Corridor improvements
- Colorado Avenue Capacity improvements

- Intersection Improvements at:
  - Olney/8th
  - Revere/8th
  - Pettigrew/Bear Creek
  - Revere/4th
  - Olney/4th
  - Ferguson/15th
  - O.B. Riley/Empire
  - Chase/Powers/Purcell

Additional projects may be evaluated if requested by the City.

## Methodology Assumptions

The following sections detail specific methodology assumptions and approaches to be included in each Project Evaluation Report.

### Volume Development

The following sections describe how traffic volumes were collected at the study intersections and how they will be used to evaluate existing and future traffic conditions for each project evaluation.

#### Traffic Counts

AM peak period (7-9 AM) and PM peak period (4-6 PM) traffic counts at the study intersections were collected by the City of Bend in October 2021, while school was in session. All counts include the total number of pedestrians, bicyclists, motor vehicles, and percentage of heavy vehicles that entered the intersections in 5-minutes intervals.

At the time of the traffic counts, effects of the COVID-19 pandemic on typical travel patterns were minimal based on regular monitoring from the Bend Metropolitan Planning Organization (MPO). As such, no adjustments to account for the COVID-19 pandemic are recommended for these evaluations.

However, ongoing construction during Fall 2021 may have affected traffic conditions at one or more study locations. Notably, construction along the Newport Avenue corridor resulted in significant detours along the Portland Avenue corridor, making traffic conditions non-typical. Where this and other events are noted that could have affected typical travel patterns when traffic counts were collected, historical data will be utilized and adjusted to current conditions. If no such data are available, alternative methods will be discussed with the City to develop reasonable traffic condition estimates.

In addition, the Murphy Extension between Brosterhous Road and SE 15<sup>th</sup> Street opened in November 2021 after traffic counts were collected. Intersections where travel patterns may be affected by this new facility, such as SE 15<sup>th</sup> Street/Ferguson Road, will be reviewed to identify appropriate adjustment factors to account for this change.

Traffic data collected were AM and PM peak period turning movement counts. Daily counts, which may be necessary for pavement design, were not collected and should be coordinated as part of future design efforts.

## Peak Hour Identification

Existing and future traffic operations analyses will reflect weekday PM peak hour conditions. AM peak hour conditions may also be evaluated if traffic count data shows notably different travel patterns, such as heavy school traffic. Each Project Evaluation Report will identify an appropriate peak hour based on observed data at applicable study intersections. Per City of Bend analysis standards, a peak hour factor (PHF) of 1.0 will be used for intersection evaluation during existing and future conditions.

## Forecast Traffic Volumes

The Bend Redmond Regional Travel Demand Model (BRM) tool will be used to estimate year 2040 turn movement volumes at all study intersections. The latest approved base year and future year model scenario will be used for each Project Evaluation Report. The BRM tool links land use, demographics, travel demand management strategies (such as parking pricing), and the transportation network to forecast/predict how much people will travel, by which mode, and by which route, including sensitivity to system operational factors such as travel time due to congestion.

The land use included in the 2040 model will be consistent with the Bend Transportation System Plan (TSP) land use, which includes over 50 percent growth in housing and employment in Bend. This growth is spread throughout vacant lands, specific opportunity areas, and expansion areas identified through the 2016 Urban Growth Boundary update. This includes strategies identified through integrated transportation and land use planning to reduce vehicle miles travelled (VMT) per capita, such as increase in mixed-use, dense land uses, consistent with the land use designations shown in the adopted Bend Comprehensive Plan.

The future transportation network will include all projects and programs identified as reasonably likely to be funded in the City's TSP. These improvements include the completed key routes for low-stress walking and bicycling corridors, enhanced transit service including potential mobility hub locations, roadway extensions, and select corridor capacity/widening improvements. The combination of these improvements with the land use growth strategies listed above create area and citywide shifts in mode choice. It is important to note that these modal shifts cannot be isolated to a specific project with the regional travel model.

Raw link level volumes from the BRM will be post-processed using methods consistent with the ODOT APM V2 to develop intersection turn-movement volumes. This approach is derived from methodologies outlined in the National Cooperative Highway Research Program (NCHRP) *Report 765 Highway Traffic Data for Urbanized Area Project Planning and Design*. If needed for certain locations, network refinements be made in the travel model to help evaluate local-street level circulation patterns that are not represented in the regional model framework.

## Phasing/Sensitivity Analysis

If applicable, each Project Evaluation Report will consider if project phasing or sensitivity analysis is necessary to inform future or interim project recommendations. Examples of such analysis include:

- Possible phasing of multi-lane roundabouts
- Consideration of future UGB expansion area capacity needs
- Sensitivity analysis of possible network modifications, such as the possible closure of 9<sup>th</sup> Street at Reed Market Road.
- Policy analysis, such as the monitoring of corridors identified within the TSP for future roadway expansion (Colorado Avenue & 27<sup>th</sup> Street).

Interim analyses, if necessary, will utilize the year 2028 scenario of the Bend-Redmond Travel Demand Model.

## Traffic Analysis

The traffic analysis will evaluate peak hour traffic operations of the study intersections under existing conditions and through the planning horizon of 2040 to identify appropriate improvement alternatives. This section summarizes the traffic analysis methodology including applicable intersection operational standards and analysis parameters and assumptions.

### Intersection Operational Standards

All transportation facilities anticipated to be included in the Project Evaluation Reports are owned and operated by the City of Bend. Applicable operating standards will be identified for each intersection based on Bend Development Code (BDC) 4.7.500.B.6.d:

- Two-Way Stop Control. Average delay for the critical lane group for any major intersection with greater than 100 peak hour trips is greater than or equal to 50 seconds during the peak hour.
- All-Way Stop Control. Average delay for any major intersection as a whole is greater than or equal to 80 seconds during the peak hour.
- For signalized intersections, the volume-to-capacity ratio for the intersection as a whole is greater than or equal to 1.0 during the peak hour.
- For roundabout intersections, the volume-to-capacity ratio for the critical movement is greater than or equal to 1.0 during the peak hour.

As applicable, ODOT or Deschutes County mobility standards will be applied to facilities evaluated that are under either jurisdiction's authority.

Traffic operations at the study intersections will be evaluated as outlined above. Project alternatives will consider applicable operating standards as part of the project evaluation process for each study.

### Analysis Parameters

The following data sources and methodologies are proposed for conducting traffic analysis.

- **Intersection/Road Geometry** (e.g., number of lanes, lane configurations, cross-section elements, etc.) will be collected through aerial photography and site visits. Available as-built data may also be used to verify existing roadway geometry. The analysis models will be constructed on scaled roadway line work from GIS or aerial photography.
- **Operational Data** (e.g., posted speeds, intersection control, rail crossings, etc.) will be collected through aerial photography and confirmed through site visits.
- **Peak Hour Factors (PHF)** will be 1.0, per City of Bend analysis standards.
- **Traffic Volume Development** is described in previous sections.
- **Traffic Operations**
  - The methodologies identified in the Highway Capacity Manual 6<sup>th</sup> Edition (HCM – Reference 5) will be used to analyze traffic operations at the study intersections.
  - The team will utilize Vistro or Synchro, both software tools designed to assist with operations analyses in accordance with HCM 6<sup>th</sup> Edition methodologies; therefore, these software packages will be used to conduct the traffic operations analyses. Level-of-service (LOS), delay, v/c ratios (critical movement for unsignalized intersections) and 95<sup>th</sup> percentile queue lengths (note where queues would impact adjacent intersections or access points). Failing unsignalized intersections will be evaluated using Manual on Uniform Traffic Control Devices (MUTCD – Reference 6) traffic signal warrants.

- Roundabout operational analysis will be conducted consistent with roundabout calibration factors developed for Bend and document in the Bend Roundabout Evaluation and Design Guidelines.
- Current signal timing data will be requested from ODOT for analysis of all existing traffic signals.

## Traffic Analysis Software & Input Assumptions

Table 1 summarizes the software and input assumptions for the traffic analysis.

**Table 1: Traffic Analysis Assumptions**

Intersection Parameters	Existing Conditions Assumptions
Peak Hour Factor	From traffic counts
Conflicting Bikes and Pedestrians per Hour	From traffic counts (as available)
Area Type	Based on local conditions
Ideal Saturation Flow Rate (All Movements)	1,750 passenger cars per hour per lane
Lane Width	12 feet (unless field observations suggest otherwise)
Percent Heavy Vehicles (All Movements)	From traffic counts (as available)
Percent Grade	Estimated based on field observations
95 <sup>th</sup> -Percentile & Average Vehicle Queues	Traffic analysis summary output

## Crash Analysis

The crash analysis will review the most recent five years of reported crash data at the study intersections, obtained from ODOT's Crash Analysis & Reporting Unit. Possible crash patterns that may include location, type, characteristics, and/or severity will be identified. Intersection crash rates will be developed and compared with statewide crash rates (ODOT Analysis Procedures Manual [APM] Exhibit 4-1). Specific emphasis will be given to crashes involving people walking, biking, or rolling.

The recently completed Bend Transportation Safety Action Plan (TSAP) and City of Bend All Roads Transportation Safety (ARTS) project list will be reviewed for each study intersection and any relevant findings will be incorporated into Project Evaluation Report analysis and recommendations as appropriate.

## Multimodal Analysis

The multimodal analysis will review the following elements of the active transportation network to identify potential facility and service alternatives for people walking, rolling, biking, and taking transit within each Project Evaluation Report:

- Availability of facilities and services (including transit) within the analysis area of each Project Evaluation Report;
- Level of Traffic Stress (LTS) ratings for crossings or, if applicable, pedestrian and bicycle facilities along a corridor; and

- The context of each project within the planned walking and biking network within the City (discussed further in the following section).

The LTS analyses will be performed in accordance with the methodologies identified in Chapter 14 of the APM. Pedestrian and Bicycle LTS have unique criteria that are used to determine a facilities LTS score (e.g., number of travel lanes, bike lane widths, adjacent parking, roadway functional classification, daily volume, posted speed limits, sidewalk conditions and widths, illumination presence, etc.). LTS scores range from little traffic stress (LTS 1) to high traffic stress (LTS 4) and are based on the perceived safety issue of being in close proximity to vehicles.

### **Walking and Biking Network**

Each Project Evaluation Report will provide a description of the regional walking and biking network planned for the study area, including facilities contemplated within the Bend TSP and BPRD master plan. Particular emphasis will be given to how the project should support the identified Low Street Bicycle Network and Key Walking and Biking Routes identified within the Bend TSP.

As part of the project evaluation, each report will coordinate with the City of Bend to identify appropriate walking and biking facilities that should be provided. The purpose of this exercise will be to identify possible right-of-way needs and allocations that could be necessary to provide the necessary multimodal facilities. Recommendations documented within each Project Evaluation Report will be further refined by future design teams.

### **Concept Development**

10 percent improvement concepts will be developed for each recommended project alternative. These concepts are intended to convey recommended intersection control, lane configurations, multi-modal elements, and other geometric features that may influence future design efforts. As applicable, concepts may consider future phasing alternatives if projects require.

In coordination with the City, the appropriate design vehicle for each alternative will be identified and considered within the concept development.

As applicable, challenges that should be further explored during the design phases will be noted. In all cases, additional refinements will be required during the design phase of each project based on further investigation and project refinement.

### **Cost Estimates**

Planning level cost estimates (Class V) will be developed for each recommended project alternative in coordination with the City of Bend.

### **Equity Evaluation**

The City of Bend and TBOC conducted an equity evaluation for each project as part of the GO Bond project sequencing efforts. These efforts relied upon City of Bend equity mapping and input from the TBOC committee to assess how well each project addressed the following criteria:

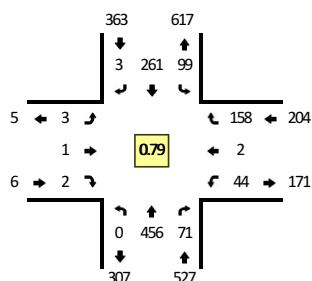
- Transportation access for underserved populations
- Transportation impacts on the community
- Reduce pollution of Bend's air and water, with a focus on impacts to vulnerable populations
- Access to key destination

Each Project Evaluation Report will incorporate the equity evaluation done for each project and include key findings in the report recommendations.

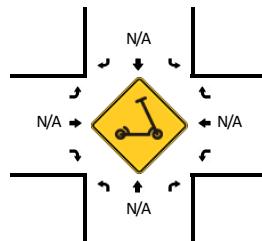
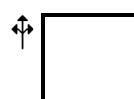
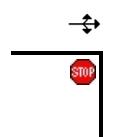
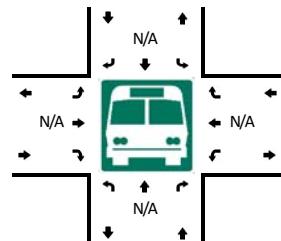
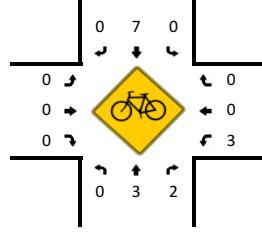
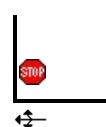
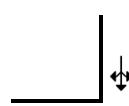
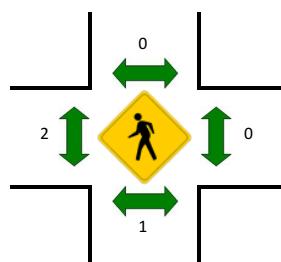
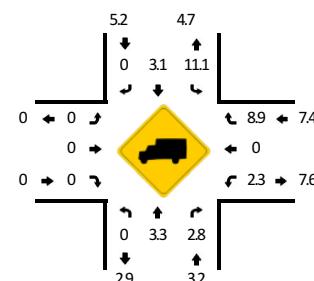
## Appendix B – Traffic Count Worksheets

**LOCATION:** SE 15th St -- Sherwood Forest Dr/Ferguson Rd  
**CITY/STATE:** Bend, OR

**QC JOB #:** 15949101  
**DATE:** Wed, Sep 14 2022



**Peak-Hour: 7:50 AM -- 8:50 AM**  
**Peak 15-Min: 8:20 AM -- 8:35 AM**

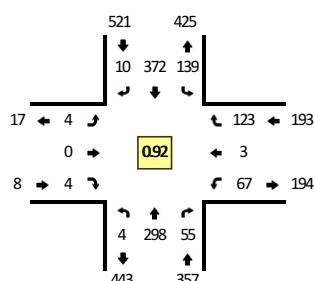


5-Min Count Period Beginning At	SE 15th St (Northbound)				SE 15th St (Southbound)				Sherwood Forest Dr/Ferguson Rd (Eastbound)				Sherwood Forest Dr/Ferguson Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
7:00 AM	0	25	0	0	2	8	0	0	1	0	0	0	1	0	7	0	44	
7:05 AM	0	28	0	0	3	14	1	0	2	0	0	0	2	0	10	0	60	
7:10 AM	0	24	2	0	6	10	0	0	1	0	0	0	1	0	3	0	47	
7:15 AM	0	33	1	0	3	10	0	0	1	0	0	0	1	0	9	0	58	
7:20 AM	0	30	2	0	2	13	0	0	1	0	0	0	2	0	11	0	61	
7:25 AM	0	40	1	0	3	16	0	0	2	0	0	0	5	0	16	0	83	
7:30 AM	0	25	1	0	5	15	0	0	1	0	0	0	6	0	11	0	64	
7:35 AM	1	34	0	0	3	13	0	0	0	0	0	0	3	0	18	0	72	
7:40 AM	0	43	2	0	7	25	1	0	0	0	0	0	3	0	11	0	92	
7:45 AM	0	30	4	0	6	19	0	0	0	0	0	0	1	0	10	0	70	
7:50 AM	0	42	4	0	8	14	0	0	0	0	1	0	1	0	9	0	79	
7:55 AM	0	32	5	0	2	22	0	0	0	0	0	0	4	0	15	0	80	810
8:00 AM	0	22	3	0	6	11	0	0	0	0	0	0	3	0	12	0	57	823
8:05 AM	0	43	3	0	2	11	1	0	1	1	0	0	1	0	15	0	78	841
8:10 AM	0	34	0	0	10	21	0	0	0	0	0	0	4	0	12	0	81	875
8:15 AM	0	35	10	0	6	27	0	0	0	0	0	0	4	2	12	0	96	913
8:20 AM	0	44	13	0	13	27	0	0	1	0	1	0	2	0	10	0	111	963
8:25 AM	0	50	8	0	20	35	0	0	0	0	0	0	1	0	9	0	123	1003
8:30 AM	0	41	11	0	8	24	0	0	0	0	0	0	5	0	26	0	115	1054
8:35 AM	0	36	7	0	11	25	0	0	0	0	0	0	10	0	13	0	102	1084
8:40 AM	0	41	6	0	6	26	2	0	1	0	0	0	1	0	9	0	92	1084
8:45 AM	0	36	1	0	7	18	0	0	0	0	0	0	8	0	16	0	86	1100
8:50 AM	1	40	2	0	7	10	0	0	2	0	0	0	5	0	9	0	76	1097
8:55 AM	0	16	2	0	6	18	0	0	1	0	0	0	1	0	10	0	54	1071
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total	
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
All Vehicles	0	540	128	0	164	344	0	0	4	0	4	0	32	0	180	0	1396	
Heavy Trucks	0	16	0	0	20	20	0	0	0	0	0	0	4	0	24	0	84	
Buses	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	
Pedestrians	0	4	0	0	0	16	0	0	0	0	0	0	0	0	0	0	20	
Bicycles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Scooters	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		

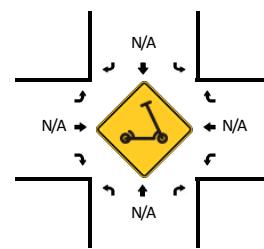
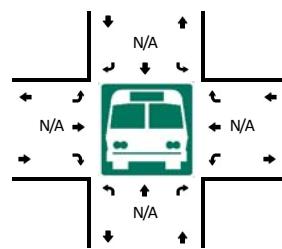
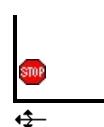
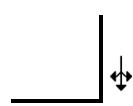
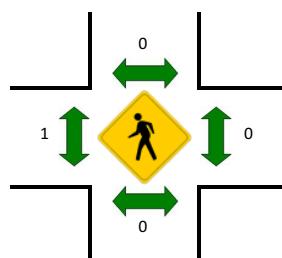
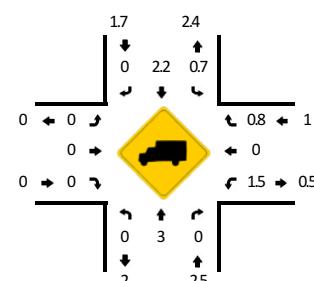
Comments:

**LOCATION:** SE 15th St -- Sherwood Forest Dr/Ferguson Rd  
**CITY/STATE:** Bend, OR

**QC JOB #:** 15949102  
**DATE:** Tue, Sep 13 2022



**Peak-Hour: 4:55 PM -- 5:55 PM**  
**Peak 15-Min: 5:05 PM -- 5:20 PM**



5-Min Count Period Beginning At	SE 15th St (Northbound)				SE 15th St (Southbound)				Sherwood Forest Dr/Ferguson Rd (Eastbound)				Sherwood Forest Dr/Ferguson Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
4:00 PM	0	31	2	0	12	22	1	0	0	0	1	0	7	0	17	0	93	
4:05 PM	0	27	4	0	11	25	0	0	0	0	0	0	5	0	12	0	84	
4:10 PM	1	25	2	0	14	35	0	0	0	0	0	0	4	0	12	0	93	
4:15 PM	0	33	6	0	12	25	2	0	0	0	0	0	2	0	10	0	90	
4:20 PM	0	19	4	0	11	38	0	0	0	0	0	0	4	1	6	0	83	
4:25 PM	0	27	4	0	17	37	0	0	0	0	0	0	1	0	3	0	89	
4:30 PM	1	22	1	0	11	26	2	0	0	0	0	0	9	0	8	0	80	
4:35 PM	0	30	2	0	15	27	1	0	0	0	0	0	3	0	7	0	85	
4:40 PM	0	30	2	0	12	26	0	0	0	0	0	0	3	0	6	0	79	
4:45 PM	0	30	4	0	21	29	0	0	0	0	0	0	8	0	6	0	98	
4:50 PM	2	28	2	0	13	20	0	0	0	0	1	0	7	0	4	0	77	
4:55 PM	1	24	3	0	10	26	1	0	1	0	1	0	4	0	13	0	84	1035
5:00 PM	0	30	4	0	8	32	1	0	0	0	2	0	4	0	9	0	90	1032
5:05 PM	1	27	6	0	14	33	1	0	0	0	0	0	5	1	12	0	100	1048
5:10 PM	0	27	5	0	11	36	1	0	1	0	0	0	6	0	11	0	98	1053
5:15 PM	0	28	6	0	11	35	0	0	0	0	0	0	6	0	8	0	94	1057
5:20 PM	1	24	7	0	14	28	2	0	0	0	0	0	6	0	10	0	92	1066
5:25 PM	1	29	3	0	15	30	0	0	1	0	0	0	4	0	12	0	95	1072
5:30 PM	0	19	4	0	9	27	1	0	0	0	0	0	7	0	6	0	73	1065
5:35 PM	0	27	10	0	13	28	1	0	0	0	1	0	3	0	7	0	90	1070
5:40 PM	0	25	2	0	7	34	1	0	0	0	0	0	4	0	13	0	86	1077
5:45 PM	0	18	1	0	15	28	1	0	0	0	0	0	9	1	10	0	83	1062
5:50 PM	0	20	4	0	12	35	0	0	1	0	0	0	9	1	12	0	94	1079
5:55 PM	0	17	7	0	9	29	2	0	1	0	0	0	2	0	4	0	71	1066
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total	
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
All Vehicles	4	328	68	0	144	416	8	0	4	0	0	0	68	4	124	0	1168	
Heavy Trucks	0	8	0	0	4	16	0	0	0	0	0	0	0	0	0	0	28	
Buses	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pedestrians	0	0	0	0	0	4	0	0	0	0	0	0	0	0	4	0	8	
Bicycles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Scooters	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

**Comments:**

## **Appendix C – Existing Traffic Analysis Worksheets**

**Intersection Level Of Service Report**  
**Intersection 1: SE 15th St and Ferguson Rd**

Control Type: Two-way stop Delay (sec / veh): 32.2  
Analysis Method: HCM 6th Edition Level Of Service: D  
Analysis Period: 15 minutes Volume to Capacity (v/c): 0.022

**Intersection Setup**

Name	SE 15th			SE 15th			Sherwood Forest Dr			Ferguson 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]	35.00			35.00			20.00			40.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	Yes			Yes			Yes			Yes		

**Volumes**

Name	SE 15th			SE 15th			Sherwood Forest Dr			Ferguson Rd		
Base Volume Input [veh/h]	0	456	71	99	261	3	3	1	2	44	2	158
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	3.00	11.00	3.00	0.00	0.00	0.00	0.00	2.00	0.00	9.00
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	3	2	0	7	0	0	0	0	3	0	0
Total Hourly Volume [veh/h]	0	459	73	99	268	3	3	1	2	47	2	158
Peak Hour 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
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]	0	115	18	25	67	1	1	0	1	12	1	40
Total Analysis Volume [veh/h]	0	459	73	99	268	3	3	1	2	47	2	158
Pedestrian Volume [ped/h]	1			0			2			0		

**Intersection Settings**

Priority Scheme	Free	Free	Stop	Stop
Flared Lane			No	Yes
Storage Area [veh]	0	0	0	0
Two-Stage Gap Acceptance			No	No
Number of Storage Spaces in Median	0	0	0	0

**Movement, Approach, & Intersection Results**

V/C, Movement V/C Ratio	0.00	0.00	0.00	0.10	0.00	0.00	0.02	0.00	0.00	0.22	0.01	0.28
d_M, Delay for Movement [s/veh]	7.77	0.00	0.00	9.03	0.00	0.00	32.18	22.25	10.22	31.04	29.97	20.45
Movement LOS	A	A	A	A	A	A	D	C	B	D	D	C
95th-Percentile Queue Length [veh/ln]	0.00	0.00	0.00	0.33	0.33	0.33	0.09	0.09	0.09	2.83	2.83	2.83
95th-Percentile Queue Length [ft/ln]	0.00	0.00	0.00	8.30	8.30	8.30	2.27	2.27	2.27	70.83	70.83	70.83
d_A, Approach Delay [s/veh]	0.00			2.42			23.21			22.95		
Approach LOS	A			A			C			C		
d_I, Intersection Delay [s/veh]							5.19					
Intersection LOS							D					

**Intersection Level Of Service Report**  
**Intersection 1: SE 15th St and Ferguson Rd**

Control Type: Two-way stop Delay (sec / veh): 34.1  
Analysis Method: HCM 6th Edition Level Of Service: D  
Analysis Period: 15 minutes Volume to Capacity (v/c): 0.343

**Intersection Setup**

Name	SE 15th			SE 15th			Sherwood Forest Dr			Ferguson 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]	35.00			35.00			20.00			40.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	Yes			Yes			Yes			Yes		

**Volumes**

Name	SE 15th			SE 15th			Sherwood Forest Dr			Ferguson Rd		
Base Volume Input [veh/h]	4	298	55	139	372	10	4	0	4	67	3	123
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	1.00	2.00	0.00	0.00	0.00	0.00	2.00	0.00	1.00
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	2	3	0	2	1	0	0	2	0	0	3
Total Hourly Volume [veh/h]	4	300	58	139	374	11	4	0	6	67	3	126
Peak Hour 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
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]	1	75	15	35	94	3	1	0	2	17	1	32
Total Analysis Volume [veh/h]	4	300	58	139	374	11	4	0	6	67	3	126
Pedestrian Volume [ped/h]	0			0			1			0		

**Intersection Settings**

Priority Scheme	Free	Free	Stop	Stop
Flared Lane			No	Yes
Storage Area [veh]	0	0	0	0
Two-Stage Gap Acceptance			No	No
Number of Storage Spaces in Median	0	0	0	0

**Movement, Approach, & Intersection Results**

V/C, Movement V/C Ratio	0.00	0.00	0.00	0.12	0.00	0.00	0.03	0.00	0.01	0.34	0.01	0.18
d_M, Delay for Movement [s/veh]	8.06	0.00	0.00	8.37	0.00	0.00	30.03	23.38	10.86	34.12	33.02	20.72
Movement LOS	A	A	A	A	A	A	D	C	B	D	D	C
95th-Percentile Queue Length [veh/ln]	0.01	0.01	0.01	0.39	0.39	0.39	0.11	0.11	0.11	3.01	3.01	3.01
95th-Percentile Queue Length [ft/ln]	0.25	0.25	0.25	9.74	9.74	9.74	2.81	2.81	2.81	75.29	75.29	75.29
d_A, Approach Delay [s/veh]		0.09			2.22			18.53			25.49	
Approach LOS		A			A			C			D	
d_I, Intersection Delay [s/veh]							5.84					
Intersection LOS							D					

## **Appendix D – Crash Data and Analysis Worksheets**

CITY OF BEND, DESCHUTES COUNTY

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SER#	INVEST	UNLOC?	CITY STREET		RD CHAR DIRECT LOCTN	INT-TYP (MEDIAN) LEGS	INT-REL TRAFF- CONTL	OFF-RD RNDBT DRVWY	WTHR SURF LIGHT	CRASH TYP COLL TYP SVRTY	SPCL USE TRLR QTY OWNER	MOVE FROM TO	A G E X RES	S LICNS LOC PED LOC ERROR	Intersectional Crashes at SE 15th St & Ferguson Rd in Bend, OR.		ACTN EVENT	CAUSE							
			E	A	/	C	O	DATE	DAY/TIME	FC	FIRST STREET	SECOND STREET	INTERSECTION SEQ #	V#	P#	PRTC TYPE	INJ SVRTY								
00824	CITY	No	N	N	N	N	N	05/25/2016	16		FERGUSON RD	SE 15TH ST	INTER	CROSS	N	CLD	S-1STOP	01	NONE	9	STRGHT	129	07		
			N	Wed	1P	0					N	STOP SIGN	N	DRY	REAR		N/A		N S	000	00				
			44	1	35.14	-121	17	2.34	1				06	0	N	DAY	PDO		PSNGR CAR	01	DRVVR	NONE	00 U UNK	000	000
																	02	NONE	9	STOP	012	00			
																	N/A		N S	000	00				
																	PSNGR CAR	01	DRVVR	NONE	00 U UNK	000	000		
																	UNK			012	00				
																	PSNGR CAR	01	DRVVR	NONE	00 U UNK	000	000		
																	UNK			012	00				
02152	NONE	No	N	N	N	11/16/2017	16				FERGUSON RD	SE 15TH ST	INTER	CROSS	N	CLR	S-1STOP	01	NONE	9	STRGHT	29			
			N	Thu	2P	0					N	STOP SIGN	N	DRY	REAR		N/A		N S	000	00				
			44	1	35.14	-121	17	2.34	1				06	0	N	DAY	PDO		PSNGR CAR	01	DRVVR	NONE	00 U UNK	000	000
																	02	NONE	9	STOP	011	00			
																	N/A		N S	000	00				
																	PSNGR CAR	01	DRVVR	NONE	00 U UNK	000	000		
																	UNK			011	00				
																	PSNGR CAR	01	DRVVR	NONE	00 U UNK	000	000		
																	UNK			011	00				
01669	NO RPT	No	N	N	N	10/15/2018	16				FERGUSON RD	SE 15TH ST	INTER	CROSS	N	CLR	S-1STOP	01	NONE	0	STRGHT	29			
			N	Mon	5P	0					N	STOP SIGN	N	DRY	REAR		PRVTE		N S	000	00				
			44	1	35.14	-121	17	2.34	1				06	0	N	DAY	INJ		PSNGR CAR	01	DRVVR	INJB	77 F OR-Y	026	000
																	OR<25			026	29				
																	PSNGR CAR	01	DRVVR	INJB	34 F OR-Y	000	000		
																	OR<25			012	00				
																	PSNGR CAR	01	DRVVR	INJB	34 F OR-Y	000	000		
																	OR<25			012	00				
00747	CITY	No	N	N	N	04/07/2019	16				FERGUSON RD	SE 15TH ST	INTER	CROSS	N	RAIN	S-1STOP	01	NONE	0	STRGHT	07,32,27			
			N	Sun	3P	0					N	STOP SIGN	N	WET	REAR		PRVTE		SE NW	000	00				
			44	1	35.16	-121	17	2.33	1				06	0	N	DAY	INJ		PSNGR CAR	01	DRVVR	NONE	19 M OR-Y	026	000
																	OR<25			026	07,32,27				
																	PSNGR CAR	01	DRVVR	INJC	65 M OR-Y	000	000		
																	OR<25			012	00				
																	PSNGR CAR	01	DRVVR	INJC	65 M OR-Y	000	000		
																	OR<25			012	00				
00821	NO RPT	No	N	N	N	05/18/2018	17				FERGUSON RD	SE 15TH ST	INTER	CROSS	N	CLR	S-1STOP	01	NONE	9	STOP	29			
			N	Fri	8P	17					N	STOP SIGN	N	DRY	REAR		N/A		SE NW	011	00				
			44	1	34.93	-121	17	1.79	1				06	0	N	DAY	PDO		PSNGR CAR	01	DRVVR	NONE	00 U UNK	000	000
																	UNK			000	00				
																	PSNGR CAR	01	DRVVR	NONE	00 U UNK	000	000		
																	UNK			000	00				

CITY OF BEND, DESCHUTES COUNTY

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SER#	E	A	/	C	O	DATE	CITY STREET	RD CHAR	INT-TYP			CRASH TYP	SPCL		MOVE	FROM	TO	P#	PRTC	INJ	A	S	G	E	LICNS	PED	ACTN	EVENT	CAUSE	
									RD DIRECT	INT-REL (MEDIAN LEGS)	OFF-RD (TRAF- CONTL)		TRLR QTY	OWNER					PRT	INJ	E	X	RES	LOC	ERROR					
00119	N	N	N	N	N	01/26/2015	16	FERGUSON RD	INTER	CROSS	N	N	CLR	ANGL-OTH	01	NONE	0	STRGHT											02	
CITY	N					Mon	7A	SE 15TH ST	CN	STOP SIGN	N	DRY	TURN			PRVTE		S N										000	00	
No	44	1	35.14	-121	17	2.34	1		02	0		N	DAY	INJ		PSNGR	CAR		01	DRVR	INJC	55	F	OR-Y		000	000	00		
															02	NONE	0	TURN-L										015	00	
															PRVTE	SE	S													
															PSNGR	CAR		01	DRVR	NONE	45	F	OR-Y		028	000	02			
																		OR<25												
															02	PSNG	INJB	08	M									000	000	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/TRAFF-S	WALKING, RUNNING, RIDING, ETC., ON SHOULDER WITH TRAFFIC
040	A/TRAFF-S	WALKING, RUNNING, RIDING, ETC., ON SHOULDER FACING TRAFFIC
041	W/TRAFF-P	WALKING, RUNNING, RIDING, ETC., ON PAVEMENT WITH TRAFFIC
042	A/TRAFF-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 ROAD
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 CLOTHING
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	SHORT	LONG DESCRIPTION
CODE	DESC	
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	SHORT	LONG DESCRIPTION
CODE	DESC	
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	SHORT	FULL DESCRIPTION
CODE	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/TRAFF-S	WALKING, RUNNING, RIDING, ETC., ON SHOULDER WITH TRAFFIC
060	A/TRAFF-S	WALKING, RUNNING, RIDING, ETC., ON SHOULDER FACING TRAFFIC
061	W/TRAFF-P	WALKING, RUNNING, RIDING, ETC., ON PAVEMENT WITH TRAFFIC
062	A/TRAFF-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 TRANSLATION LIST

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/ VEHICLE)
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 TRANSLATION LIST

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 WHEELCHAIR
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 TRANSLATION LIST

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	COUPLER
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

**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 CONVEYANCE
5	PTOW	PEDESTRIAN TOWING OR TRAILERING AN OBJECT
6	BIKE	PEDALCYCLIST
7	BTOW	PEDALCYCLIST TOWING OR TRAILERING AN OBJECT
8	PRKD	OCCUPANT OF A PARKED MOTOR VEHICLE
9	OTHR	OTHER TYPE OF NON-MOTORIST

**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

**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	MOTRHOM	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

Location	Collision Type				Severity		Total Crashes	90th Percentile Crash Rate	Observed Crash Rate
	Fixed-Object	Rear-End	Angle	Turning Movement	PDO	Injury			
SE 15th St and Ferguson Rd	0	2	0	1	3	3	6	0.408	0.232

input required  
from ODOT report  
excel calculated

Location	PM Peak							Intersection Class	90th Percentile Rate
	Day one	Day Two	Day Three	AVG	EST AADT	EST 5Y TEV	Crash Rate		
SE 15th St and Ferguson Rd				1419	14190	25896750	0.23	Urban 4ST	0.408

PM Peak hour TEV from network tool

$$\text{Intersection Crash Rate per MEV} = \frac{\text{Annual Number of Crashes} \times 10^6}{(\text{AADT}) \times (365 \text{ days/year})}$$

The values shown in Exhibit 4-1 represent the 90<sup>th</sup> percentile crash rates from a study of 500 intersections in Oregon. The crash rates are grouped by rural/urban, signalized/unsignalized, and three-leg/four-leg intersections. Intersections with crash rates that exceed the 90<sup>th</sup> percentile values shown in the table should be flagged for further analysis. For more information on crash rates and using this table, see Section 4.3.4 Critical Crash Rate.

#### Exhibit 4-1: Intersection Crash Rates per MEV by Land Type and Traffic Control

	Rural				Urban			
	3SG	3ST	4SG	4ST	3SG	3ST	4SG	4ST
No. of Intersections	7	115	20	60	55	77	106	60
Mean Crash Rate	0.226	0.196	0.324	0.434	0.275	0.131	0.477	0.198
Median Crash Rate	0.163	0.092	0.320	0.267	0.252	0.105	0.420	0.145
Standard Deviation	0.185	0.314	0.223	0.534	0.155	0.121	0.273	0.176
Coefficient of Variation	0.819	1.602	0.688	1.230	0.564	0.924	0.572	0.889
90 <sup>th</sup> Percentile Rate	0.464	0.475	0.579	1.080	0.509	0.293	0.860	0.408

Source: *Assessment of Statewide Intersection Safety Performance*, FHWA-OR-RD-18, Portland State University and Oregon State University, June 2011, Table 4.1, p. 47.

Note: Traffic control types include  
3SG (three-leg signalized),  
3ST (three-leg minor stop-control),  
4SG (four-leg signalized),  
4ST (four-leg minor stop-control).

## **Appendix E – Future No-Build Traffic Analysis Worksheets**

**Intersection Level Of Service Report**  
**Intersection 1: SE 15th St and Ferguson Rd**

Control Type: Two-way stop      Delay (sec / veh): 8,152.3  
Analysis Method: HCM 6th Edition      Level Of Service: F  
Analysis Period: 15 minutes      Volume to Capacity (v/c): 11.324

**Intersection Setup**

Name	SE 15th			SE 15th			Sherwood Forest Dr			Ferguson 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]	35.00			35.00			20.00			40.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	Yes			Yes			Yes			Yes		

**Volumes**

Name	SE 15th			SE 15th			Sherwood Forest Dr			Ferguson Rd		
Base Volume Input [veh/h]	0	836	159	198	509	12	17	7	13	100	10	300
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	3.00	11.00	3.00	0.00	0.00	0.00	0.00	2.00	0.00	9.00
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	3	2	0	7	0	0	0	0	3	0	0
Total Hourly Volume [veh/h]	0	839	161	198	516	12	17	7	13	103	10	300
Peak Hour 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
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]	0	210	40	50	129	3	4	2	3	26	3	75
Total Analysis Volume [veh/h]	0	839	161	198	516	12	17	7	13	103	10	300
Pedestrian Volume [ped/h]	1			0			2			0		

**Intersection Settings**

Priority Scheme	Free	Free	Stop	Stop
Flared Lane			No	Yes
Storage Area [veh]	0	0	0	0
Two-Stage Gap Acceptance			No	No
Number of Storage Spaces in Median	0	0	0	0

**Movement, Approach, & Intersection Results**

V/C, Movement V/C Ratio	0.00	0.01	0.00	0.30	0.01	0.00	11.32	0.18	0.02	3.18	0.23	0.94
d_M, Delay for Movement [s/veh]	8.44	0.00	0.00	12.81	0.00	0.00	8152.32	5846.80	5760.77	1670.47	1642.61	1570.74
Movement LOS	A	A	A	B	A	A	F	F	F	F	F	F
95th-Percentile Queue Length [veh/ln]	0.00	0.00	0.00	1.26	1.26	1.26	6.39	6.39	6.39	43.33	43.33	43.33
95th-Percentile Queue Length [ft/ln]	0.00	0.00	0.00	31.59	31.59	31.59	159.85	159.85	159.85	1083.18	1083.18	1083.18
d_A, Approach Delay [s/veh]		0.00			3.49			6875.87			1597.35	
Approach LOS		A			A			F			F	
d_I, Intersection Delay [s/veh]							421.25					
Intersection LOS							F					

**Intersection Level Of Service Report**  
**Intersection 1: SE 15th St and Ferguson Rd**

Control Type: Two-way stop Delay (sec / veh): 2,516.4  
Analysis Method: HCM 6th Edition Level Of Service: F  
Analysis Period: 15 minutes Volume to Capacity (v/c): 5.249

**Intersection Setup**

Name	SE 15th			SE 15th			Sherwood Forest Dr			Ferguson 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]	35.00			35.00			20.00			40.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	Yes			Yes			Yes			Yes		

**Volumes**

Name	SE 15th			SE 15th			Sherwood Forest Dr			Ferguson Rd		
Base Volume Input [veh/h]	14	604	125	267	678	30	15	0	16	147	11	253
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	1.00	2.00	0.00	0.00	0.00	0.00	2.00	0.00	1.00
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	2	3	0	2	1	0	0	2	0	0	3
Total Hourly Volume [veh/h]	14	606	128	267	680	31	15	0	18	147	11	256
Peak Hour 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
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]	4	152	32	67	170	8	4	0	5	37	3	64
Total Analysis Volume [veh/h]	14	606	128	267	680	31	15	0	18	147	11	256
Pedestrian Volume [ped/h]	0			0			1			0		

**Intersection Settings**

Priority Scheme	Free	Free	Stop	Stop
Flared Lane			No	Yes
Storage Area [veh]	0	0	0	0
Two-Stage Gap Acceptance			No	No
Number of Storage Spaces in Median	0	0	0	0

**Movement, Approach, & Intersection Results**

V/C, Movement V/C Ratio	0.02	0.01	0.00	0.30	0.01	0.00	1.87	0.00	0.04	5.25	0.35	0.56
d_M, Delay for Movement [s/veh]	9.08	0.00	0.00	10.90	0.00	0.00	1132.40	805.10	690.61	2516.38	2502.15	2395.67
Movement LOS	A	A	A	B	A	A	F	F	F	F	F	F
95th-Percentile Queue Length [veh/ln]	0.05	0.05	0.05	1.29	1.29	1.29	4.64	4.64	4.64	46.67	46.67	46.67
95th-Percentile Queue Length [ft/ln]	1.19	1.19	1.19	32.35	32.35	32.35	115.97	115.97	115.97	1166.78	1166.78	1166.78
d_A, Approach Delay [s/veh]		0.17			2.98			891.43			2441.36	
Approach LOS		A			A			F			F	
d_I, Intersection Delay [s/veh]							480.06					
Intersection LOS								F				

## **Appendix F – Existing and Future Build Traffic Analysis Worksheets**

**Intersection Level Of Service Report**  
**Intersection 1: SE 15th St and Ferguson Rd**

Control Type: Roundabout Delay (sec / veh): 6.8  
Analysis Method: HCM 6th Edition Level Of Service: A  
Analysis Period: 15 minutes

**Intersection Setup**

Name	SE 15th			SE 15th			Sherwood Forest Dr			Ferguson 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]	35.00			35.00			20.00			40.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	Yes			Yes			Yes			Yes		

**Volumes**

Name	SE 15th			SE 15th			Sherwood Forest Dr			Ferguson Rd		
Base Volume Input [veh/h]	0	456	71	99	261	3	3	1	2	44	2	158
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	3.00	11.00	3.00	0.00	0.00	0.00	0.00	2.00	0.00	9.00
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	3	2	0	7	0	0	0	0	3	0	0
Total Hourly Volume [veh/h]	0	459	73	99	268	3	3	1	2	47	2	158
Peak Hour 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
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]	0	115	18	25	67	1	1	0	1	12	1	40
Total Analysis Volume [veh/h]	0	459	73	99	268	3	3	1	2	47	2	158
Pedestrian Volume [ped/h]	1			0			2			0		

**Intersection Settings**

Number of Conflicting Circulating Lanes	1			1			1			1		
Circulating Flow Rate [veh/h]	114			50			434			476		
Exiting Flow Rate [veh/h]	326			648			5			186		
Demand Flow Rate [veh/h]	0	459	73	99	268	3	3	1	2	47	2	158
Adjusted Demand Flow Rate [veh/h]	0	459	73	99	268	3	3	1	2	47	2	158

**Lanes**

Overwrite Calculated Critical Headway	Yes	Yes	Yes	Yes
User-Defined Critical Headway [s]	4.10	4.10	4.10	4.10
Overwrite Calculated Follow-Up Time	Yes	Yes	Yes	Yes
User-Defined Follow-Up Time [s]	2.70	2.70	2.70	2.70
A (intercept)	1333.33	1333.33	1333.33	1333.33
B (coefficient)	0.00076	0.00076	0.00076	0.00076
HV Adjustment Factor	0.97	0.95	1.00	0.93
Entry Flow Rate [veh/h]	548	389	6	222
Capacity of Entry and Bypass Lanes [veh/h]	1223	1284	958	928
Pedestrian Impedance	1.00	1.00	1.00	1.00
Capacity per Entry Lane [veh/h]	1187	1223	957	865
X, volume / capacity	0.45	0.30	0.01	0.24

**Movement, Approach, & Intersection Results**

Lane LOS	A	A	A	A
95th-Percentile Queue Length [veh]	2.37	1.29	0.02	0.93
95th-Percentile Queue Length [ft]	59.25	32.17	0.47	23.35
Approach Delay [s/veh]	7.72	5.73	3.82	6.67
Approach LOS	A	A	A	A
Intersection Delay [s/veh]	6.84			
Intersection LOS	A			

**Intersection Level Of Service Report**  
**Intersection 1: SE 15th St and Ferguson Rd**

Control Type: Roundabout  
Analysis Method: HCM 6th Edition  
Analysis Period: 15 minutes

Delay (sec / veh): 6.4  
Level Of Service: A

**Intersection Setup**

Name	SE 15th			SE 15th			Sherwood Forest Dr			Ferguson 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]	35.00			35.00			20.00			40.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	Yes			Yes			Yes			Yes		

**Volumes**

Name	SE 15th			SE 15th			Sherwood Forest Dr			Ferguson Rd		
Base Volume Input [veh/h]	4	298	55	139	372	10	4	0	4	67	3	123
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	1.00	2.00	0.00	0.00	0.00	0.00	2.00	0.00	1.00
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	2	3	0	2	1	0	0	2	0	0	3
Total Hourly Volume [veh/h]	4	300	58	139	374	11	4	0	6	67	3	126
Peak Hour 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
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]	1	75	15	35	94	3	1	0	2	17	1	32
Total Analysis Volume [veh/h]	4	300	58	139	374	11	4	0	6	67	3	126
Pedestrian Volume [ped/h]	0			0			1			0		

**Intersection Settings**

Number of Conflicting Circulating Lanes	1			1			1			1		
Circulating Flow Rate [veh/h]	144			75			590			317		
Exiting Flow Rate [veh/h]	456			440			18			198		
Demand Flow Rate [veh/h]	4	300	58	139	374	11	4	0	6	67	3	126
Adjusted Demand Flow Rate [veh/h]	4	300	58	139	374	11	4	0	6	67	3	126

**Lanes**

Overwrite Calculated Critical Headway	Yes	Yes	Yes	Yes
User-Defined Critical Headway [s]	4.10	4.10	4.10	4.10
Overwrite Calculated Follow-Up Time	Yes	Yes	Yes	Yes
User-Defined Follow-Up Time [s]	2.70	2.70	2.70	2.70
A (intercept)	1333.33	1333.33	1333.33	1333.33
B (coefficient)	0.00076	0.00076	0.00076	0.00076
HV Adjustment Factor	0.98	0.98	1.00	0.99
Entry Flow Rate [veh/h]	371	533	10	199
Capacity of Entry and Bypass Lanes [veh/h]	1195	1259	850	1047
Pedestrian Impedance	1.00	1.00	1.00	1.00
Capacity per Entry Lane [veh/h]	1166	1238	850	1033
X, volume / capacity	0.31	0.42	0.01	0.19

**Movement, Approach, & Intersection Results**

Lane LOS	A	A	A	A
95th-Percentile Queue Length [veh]	1.33	2.15	0.04	0.70
95th-Percentile Queue Length [ft]	33.36	53.76	0.89	17.45
Approach Delay [s/veh]	6.03	7.14	4.35	5.25
Approach LOS	A	A	A	A
Intersection Delay [s/veh]	6.41			
Intersection LOS	A			

**Intersection Level Of Service Report**  
**Intersection 1: SE 15th St and Ferguson Rd**

Control Type: Roundabout Delay (sec / veh): 22.6  
Analysis Method: HCM 6th Edition Level Of Service: C  
Analysis Period: 15 minutes

**Intersection Setup**

Name	SE 15th			SE 15th			Sherwood Forest Dr			Ferguson 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]	35.00			35.00			20.00			40.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	Yes			Yes			Yes			Yes		

**Volumes**

Name	SE 15th			SE 15th			Sherwood Forest Dr			Ferguson Rd		
Base Volume Input [veh/h]	0	836	159	198	509	12	17	7	13	100	10	300
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	3.00	11.00	3.00	0.00	0.00	0.00	0.00	2.00	0.00	9.00
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	3	2	0	7	0	0	0	0	3	0	0
Total Hourly Volume [veh/h]	0	839	161	198	516	12	17	7	13	103	10	300
Peak Hour 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
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]	0	210	40	50	129	3	4	2	3	26	3	75
Total Analysis Volume [veh/h]	0	839	161	198	516	12	17	7	13	103	10	300
Pedestrian Volume [ped/h]	1			0			2			0		

**Intersection Settings**

Number of Conflicting Circulating Lanes	1			1			1			1		
Circulating Flow Rate [veh/h]	244			115			856			881		
Exiting Flow Rate [veh/h]	650			1208			22			393		
Demand Flow Rate [veh/h]	0	839	161	198	516	12	17	7	13	103	10	300
Adjusted Demand Flow Rate [veh/h]	0	839	161	198	516	12	17	7	13	103	10	300

**Lanes**

Overwrite Calculated Critical Headway	Yes	Yes	Yes	Yes
User-Defined Critical Headway [s]	4.10	4.10	4.10	4.10
Overwrite Calculated Follow-Up Time	Yes	Yes	Yes	Yes
User-Defined Follow-Up Time [s]	2.70	2.70	2.70	2.70
A (intercept)	1333.33	1333.33	1333.33	1333.33
B (coefficient)	0.00076	0.00076	0.00076	0.00076
HV Adjustment Factor	0.97	0.95	1.00	0.94
Entry Flow Rate [veh/h]	1030	763	37	442
Capacity of Entry and Bypass Lanes [veh/h]	1107	1222	694	681
Pedestrian Impedance	1.00	1.00	1.00	1.00
Capacity per Entry Lane [veh/h]	1075	1163	693	637
X, volume / capacity	0.93	0.62	0.05	0.65

**Movement, Approach, & Intersection Results**

Lane LOS	D	B	A	C
95th-Percentile Queue Length [veh]	15.27	4.60	0.17	4.75
95th-Percentile Queue Length [ft]	381.63	114.96	4.22	118.67
Approach Delay [s/veh]	33.00	11.21	5.75	18.77
Approach LOS	D	B	A	C
Intersection Delay [s/veh]	22.57			
Intersection LOS	C			

**Intersection Level Of Service Report**  
**Intersection 1: SE 15th St and Ferguson Rd**

Control Type: Roundabout Delay (sec / veh): 17.5  
Analysis Method: HCM 6th Edition Level Of Service: C  
Analysis Period: 15 minutes

**Intersection Setup**

Name	SE 15th			SE 15th			Sherwood Forest Dr			Ferguson 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]	35.00			35.00			20.00			40.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	Yes			Yes			Yes			Yes		

**Volumes**

Name	SE 15th			SE 15th			Sherwood Forest Dr			Ferguson Rd		
Base Volume Input [veh/h]	14	604	125	267	678	30	15	0	16	147	11	253
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	1.00	2.00	0.00	0.00	0.00	0.00	2.00	0.00	1.00
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	2	3	0	2	1	0	0	2	0	0	3
Total Hourly Volume [veh/h]	14	606	128	267	680	31	15	0	18	147	11	256
Peak Hour 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
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]	4	152	32	67	170	8	4	0	5	37	3	64
Total Analysis Volume [veh/h]	14	606	128	267	680	31	15	0	18	147	11	256
Pedestrian Volume [ped/h]	0			0			1			0		

**Intersection Settings**

Number of Conflicting Circulating Lanes	1			1			1			1		
Circulating Flow Rate [veh/h]	285			175			1113			653		
Exiting Flow Rate [veh/h]	862			898			56			398		
Demand Flow Rate [veh/h]	14	606	128	267	680	31	15	0	18	147	11	256
Adjusted Demand Flow Rate [veh/h]	14	606	128	267	680	31	15	0	18	147	11	256

**Lanes**

Overwrite Calculated Critical Headway	Yes	Yes	Yes	Yes
User-Defined Critical Headway [s]	4.10	4.10	4.10	4.10
Overwrite Calculated Follow-Up Time	Yes	Yes	Yes	Yes
User-Defined Follow-Up Time [s]	2.70	2.70	2.70	2.70
A (intercept)	1333.33	1333.33	1333.33	1333.33
B (coefficient)	0.00076	0.00076	0.00076	0.00076
HV Adjustment Factor	0.98	0.98	1.00	0.99
Entry Flow Rate [veh/h]	767	995	33	420
Capacity of Entry and Bypass Lanes [veh/h]	1073	1167	570	810
Pedestrian Impedance	1.00	1.00	1.00	1.00
Capacity per Entry Lane [veh/h]	1048	1148	570	799
X, volume / capacity	0.71	0.85	0.06	0.52

**Movement, Approach, & Intersection Results**

Lane LOS	C	C	A	B
95th-Percentile Queue Length [veh]	6.40	11.29	0.18	3.03
95th-Percentile Queue Length [ft]	160.00	282.30	4.60	75.87
Approach Delay [s/veh]	15.09	22.20	7.00	11.84
Approach LOS	C	C	A	B
Intersection Delay [s/veh]	17.55			
Intersection LOS	C			