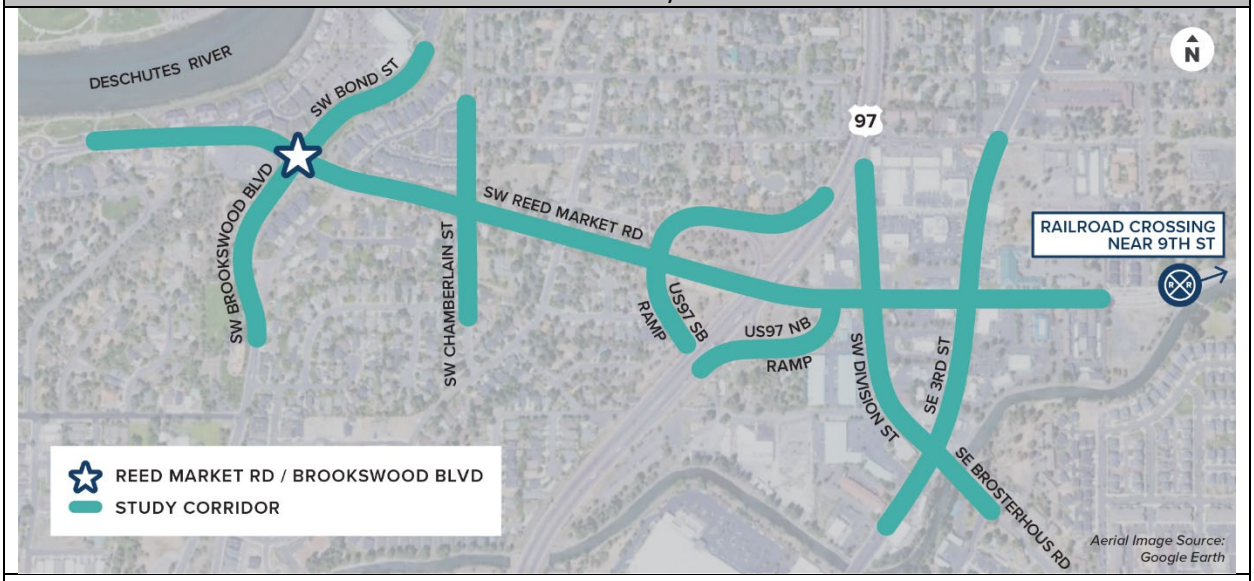
# ATTACHMENT A. PROSPECTUS SHEETS

# Prospectus Sheets

**Intersection:** Reed Market and Brookswood Boulevard/Bond Street




**Problem Statement:** The existing single-lane roundabout at SW Brookswood Boulevard/SW Bond Street/SW Reed Market Road experiences capacity deficiencies during the average weekday morning, midday, and evening peak hours, resulting in queues and delays. These deficiencies are due, in part, to the highly directional flow of traffic during these time periods. Vehicle queues resulting from these deficiencies impact adjacent roadways (e.g. SW Columbia Street and US 97 Southbound Ramps). In the future (year 2040), assuming the existing single-lane configuration, the intersection fails to meet mobility targets and vehicle queues are forecast to grow exponentially longer.

As an example of the existing capacity deficiencies, the yellow line in the following figure shows the heavy and relatively unimpeded movement from northbound SW Brookswood Boulevard during the morning peak period, which makes it challenging for drivers entering the roundabout from westbound SW Reed Market Road to find an adequate gap in conflicting traffic.

**Preferred Alternative Description**

**Widen roundabout (with option to meter in the future):**

- Alternative 1 (Short-Term): Converting existing single-lane roundabout to a multilane roundabout by adding left-turn lanes on the northbound and southbound approaches and right-turn lanes on the eastbound and westbound approaches.
- Alternative 2 (Long-Term): Converting to the multilane geometry in Alternative 1 plus the addition of metering signals. The metering signals are placed upstream of the lane additions and are intended to operate independently from the roundabout

**Rough Cost Estimate Summary (2023 Dollars)[1]**

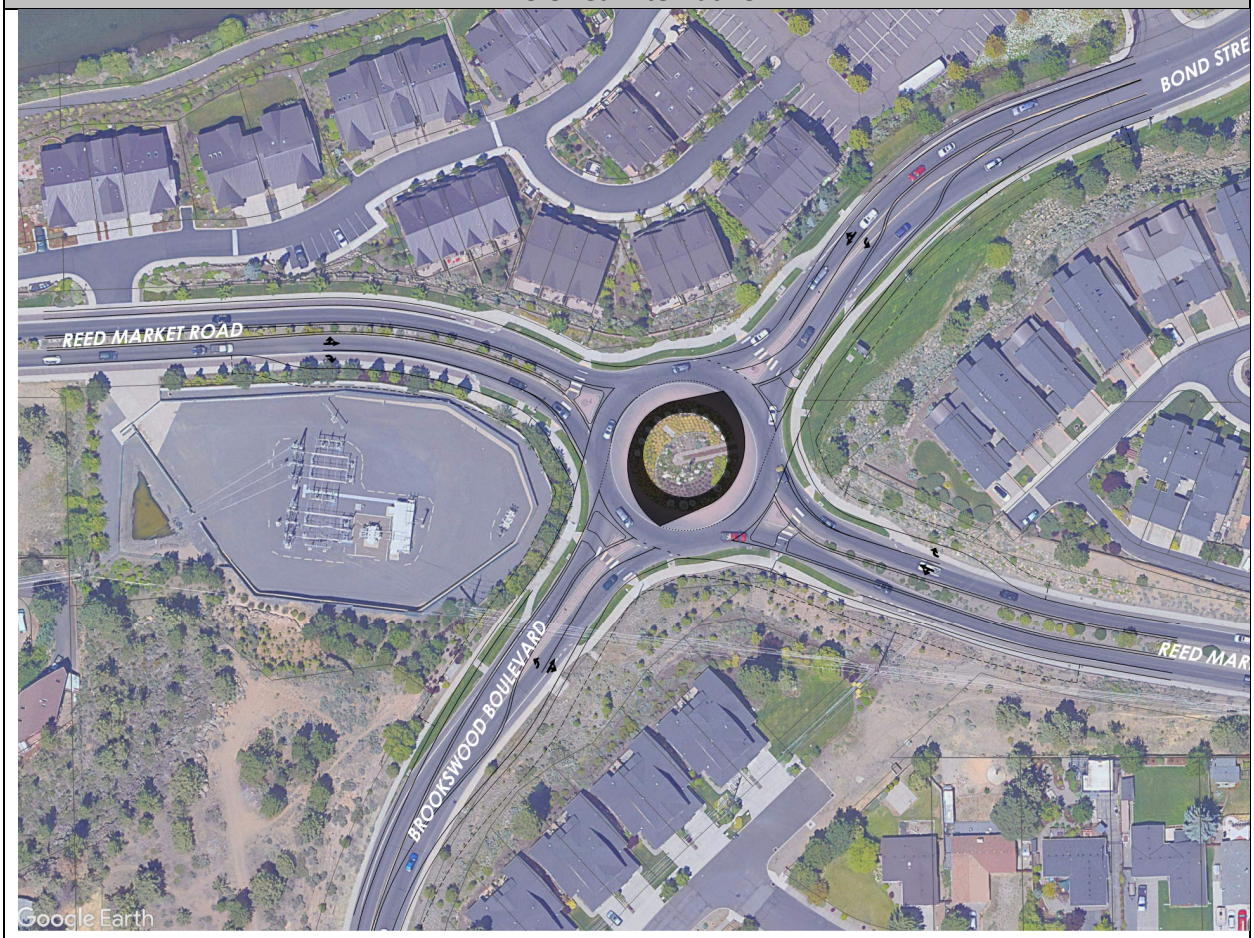
**Alternative 1: 4.0 Million**
**Alternative 2: 4.7 Million** *(inclusive of costs associated with Alternative 1)*

[1]Cost estimate includes design and construction management, mobilization, and contingency. Cost does not include right-of-way costs.

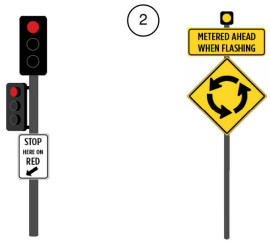
**Summary of Benefits or Tradeoffs of Preferred Alt**

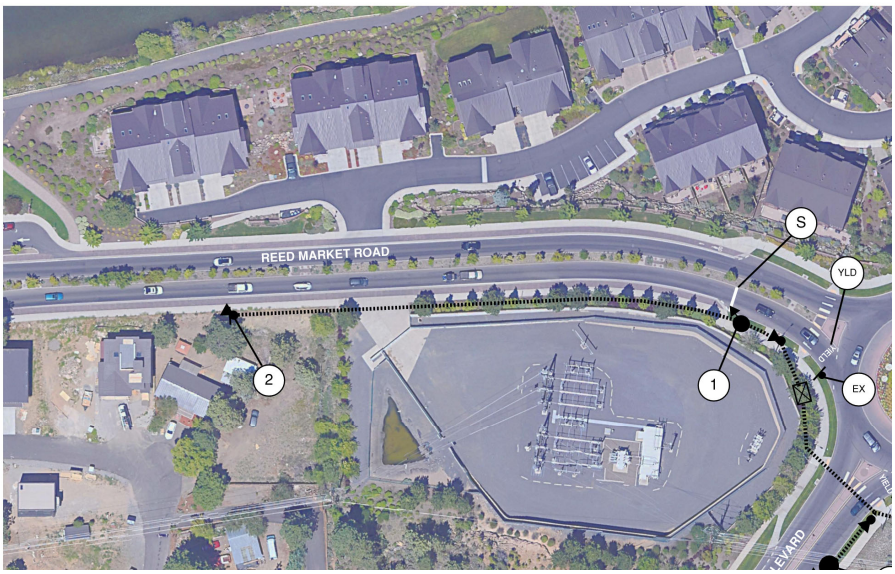
- While it does not address all congestion at the intersection, this alternative significantly reduces delay and queuing through intersection widening.
- This alternative was selected to maintain single lane exits at the roundabout, reducing conflicts for people crossing the intersection while limiting right-of-way impacts.
- The alternatives summarized in this analysis allow for phasing with the option to construct the multilane alternative and then add metering when the incremental operational benefits justify the additional cost.

**Preferred Alternative**




Alternative 1




S Install stop bar

YLD Install YIELD legend

EX Maintain existing YIELD sign

Install conduit and wiring

Install signal control cabinet and controller

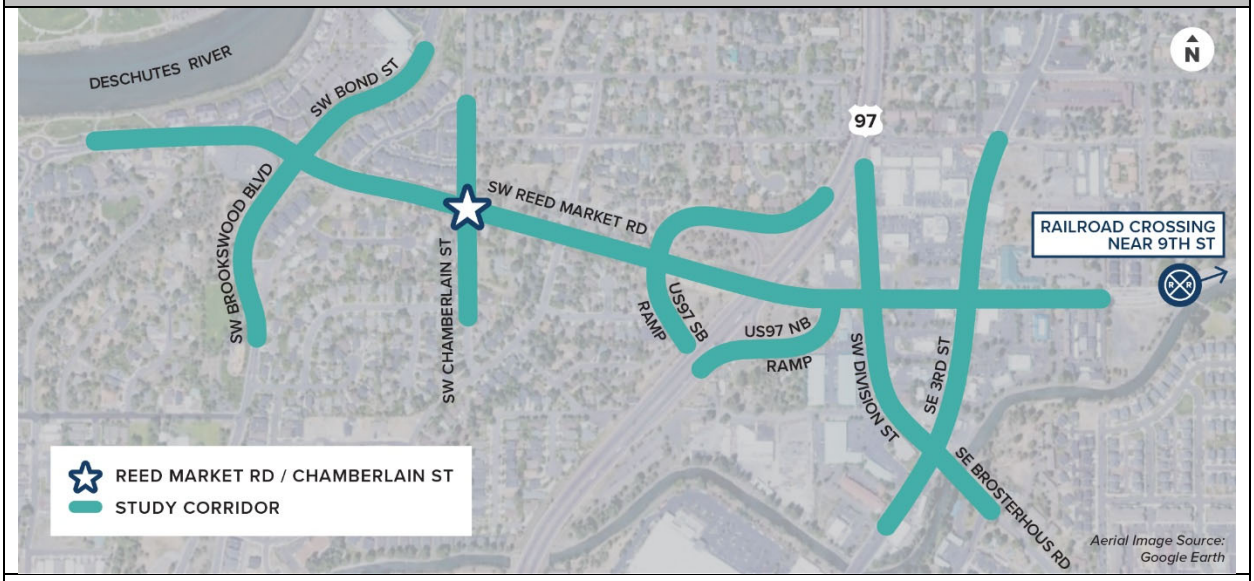
Install radar or video detection unit

Alternative 2 *(Example of potential metering concept originally developed for April 2020 evaluation. Additional development of concept needed to place queue detection and operational zones.)*

| Design/Construction Constraints and Opportunities |
| --- |
| • If the roundabout is expanded to include multilane approaches and active treatments (i.e. pedestrian signals or beacons) are added to the pedestrian crossings, consideration should be given to potential interaction with future metering signals.<br>• The metering alternative will require further development of the operational logic and queue detection strategies developed from the April 2020 pilot test.<br>• The addition of meters could incorporate emergency vehicle preemption to facilitate emergency response during queued conditions. |

# Prospectus Sheets

**Intersection:** Reed Market Road and Chamberlain Street




**Problem Statement:** Chamberlain Street has been identified as a key walking and biking route in the Bend TSP. The City has approximately $250,000 in the Neighborhood Street Safety Program to pave a portion of Chamberlain Street and install crossing enhancements at Reed Market Road. Chamberlain Street is two-way stop controlled and does not have a through movement at Reed Market Road. There is a marked pedestrian crossing on the west side of the intersection.

**Preferred Alternative Description**

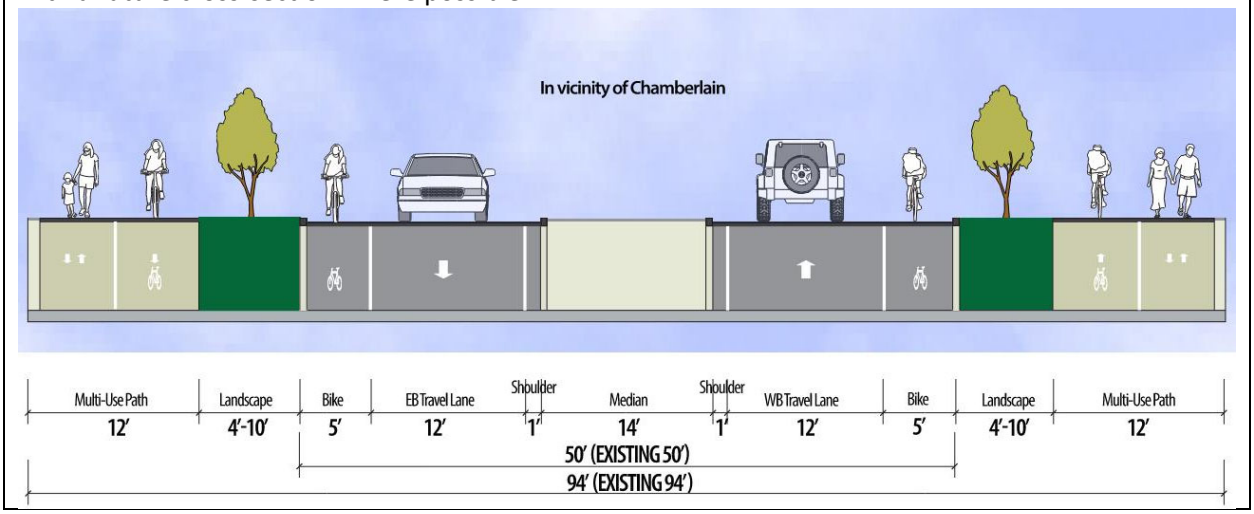
- New pedestrian crossing on the east leg.
- Wayfinding signage for people walking and biking.
- Median cutouts for a bicycle crossing and green pavement markings. Any green striping is subject to ODOT traffic approval and funding to maintain.
- Additional pedestrian and bicycle crossing warning signage.
- Improve visibility of and for pedestrians by removing vegetation in the median.
- Preserving space for future bus stops along Reed Market Road.
- Adding enhanced lighting at the intersection.

**Preferred Alternative Example**

Example of preferred alternative median bicycle crossing

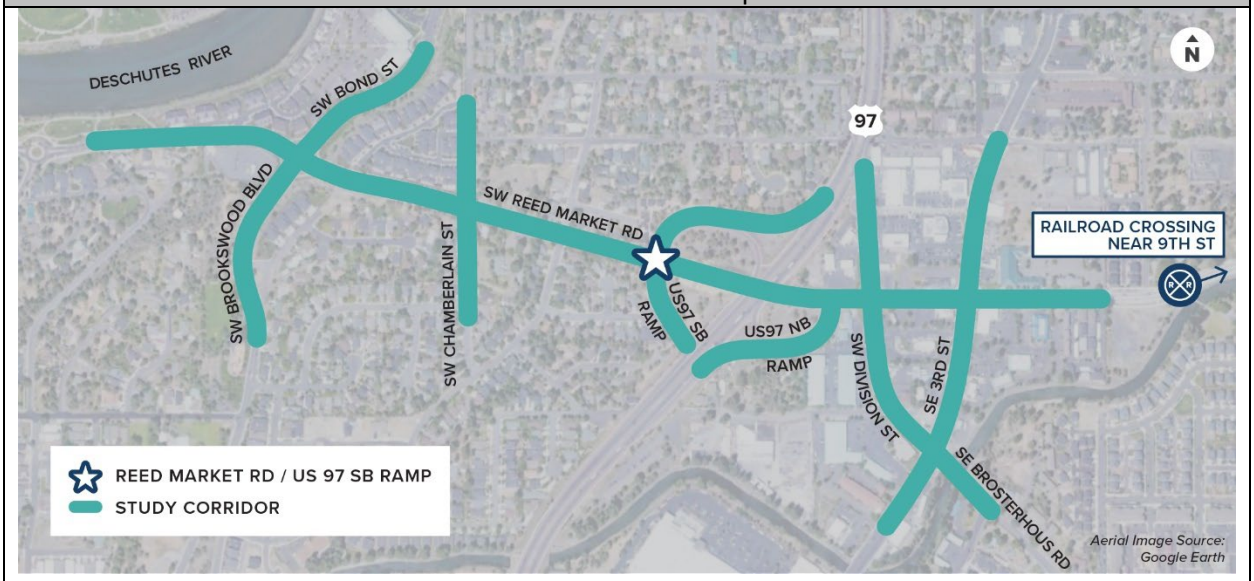
**Typical Proposed Street Sections**

The following cross section is not currently funded and represents a potential ultimate cross section along Reed Market in the vicinity of Chamberlain Street. The preferred alternative could be constructed to be consistent with the existing cross section while maintaining forward compatibility with a future cross-section where possible.



# Prospectus Sheets

**Intersection:** Reed Market Road and US 97 Southbound Ramps




**Problem Statement:** The Reed Market Road and US 97 southbound ramp terminal is currently signalized and has a southbound left turn lane and shared left-through-right turn lane. Congestion at the intersection is projected to exceed the adopted mobility target, with the intersection operating near capacity. In addition, even today, westbound queues from the Reed Market Road/Brookswood Boulevard intersection spill back through the southbound ramp terminal, making the actual level of congestion experienced worse than calculated. If these conditions are not mitigated, the southbound exit ramp queue could spill back into the portion of the ramp needed for safe deceleration and stopping. Other issues to be addressed include conflicts with the westbound right turn lane drop and the westbound bike lane crossover, and some reported challenges for heavy vehicles attempting to make the westbound right turn to the southbound loop ramp.

**Preferred Alternative Description**

**Signal and bicycle improvements:**

- Provide an additional southbound dedicated right turn lane and improve westbound bicycle safety by shifting the bike lane adjacent to the curb and adding a bike signal at the intersection, with blank out signs for no right turn on red.

**Rough Cost Estimate Summary (2023 Dollars)[1]**

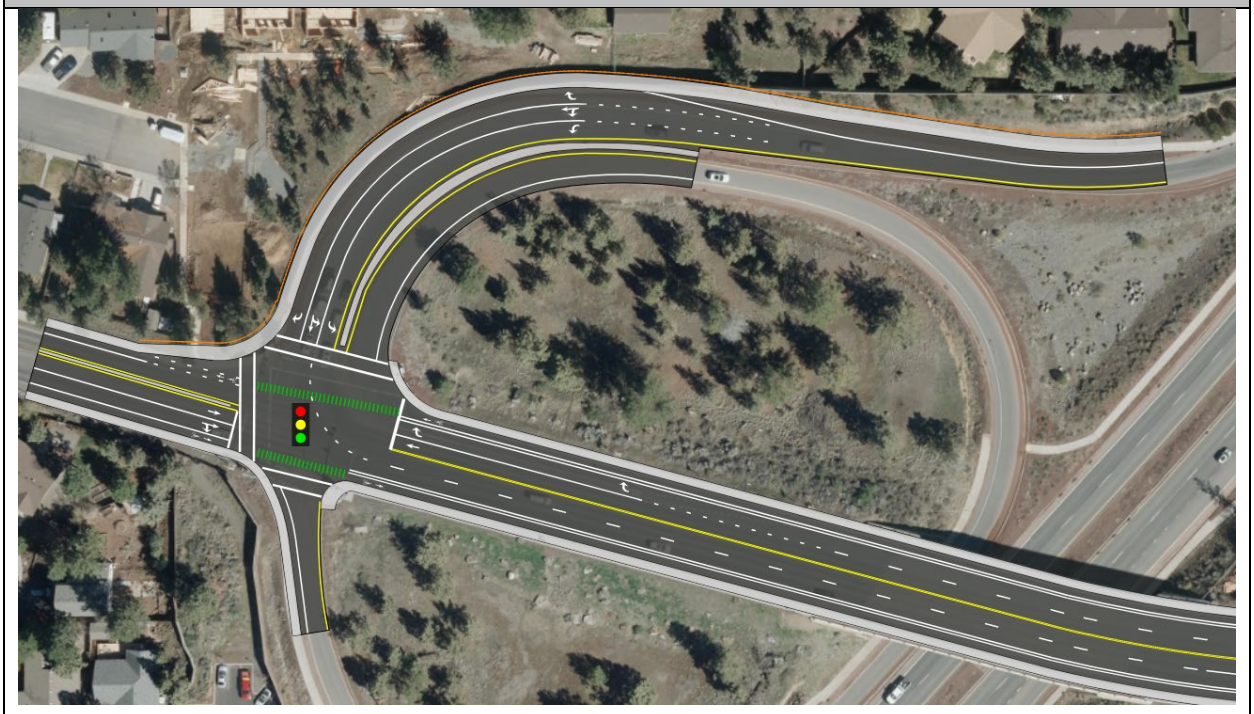
**Preferred Alternative:** $5.7 Million

[1]Cost estimate includes design and construction management, mobilization, right-of-way, and contingency.

**Summary of Benefits or Tradeoffs of Preferred Alternative**

- Adding a southbound right turn lane would require widening along the US 97 off-ramp, but would fit within the existing ROW. This would greatly reduce the overall intersection v/c ratio and delay for the eastbound and westbound movements.
- Providing a bike signal and either a multiuse path or bike lane would minimize conflicts at the westbound right turn.
- Bicycle safety and comfort would be improved with buffered bike lanes and multi-use path on the ramp.
- The crosswalk on the east leg of the intersection is recommended to remain closed (as existing).

**Preferred Alternative**

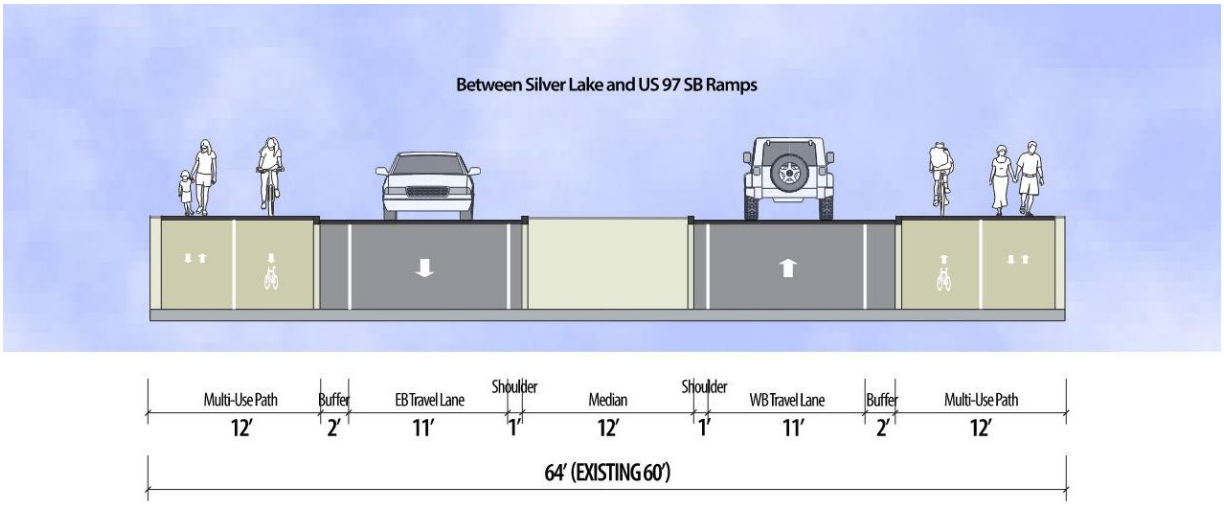


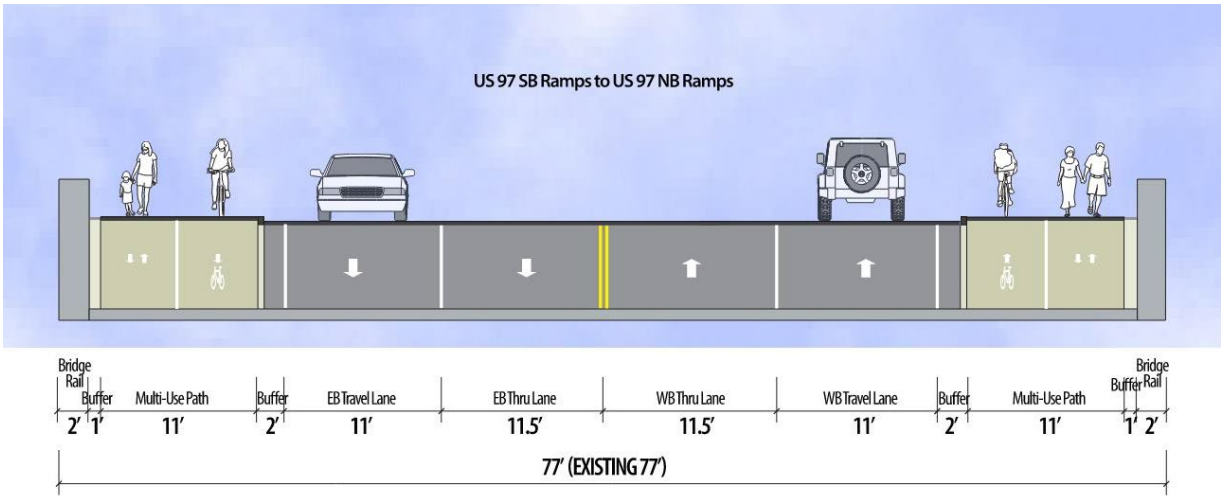
**Design/Construction Constraints and Opportunities**

- Widening may not be needed until later in the planning horizon if improvements are made at Reed Market Road/Brookswood Boulevard. Consider phasing the bicycle improvements with the US 97 Northbound Ramp and/or cross section improvements across the US 97 overpass in the short-term.
- Consider multi-use path approaching intersection to provide greater protection for people walking and biking.
- Consider additional improvements to make the westbound right turn movement easier for trucks while protecting people walking and biking.
- Concept elements may require ODOT approval prior to implementation.

**Typical Street Sections**

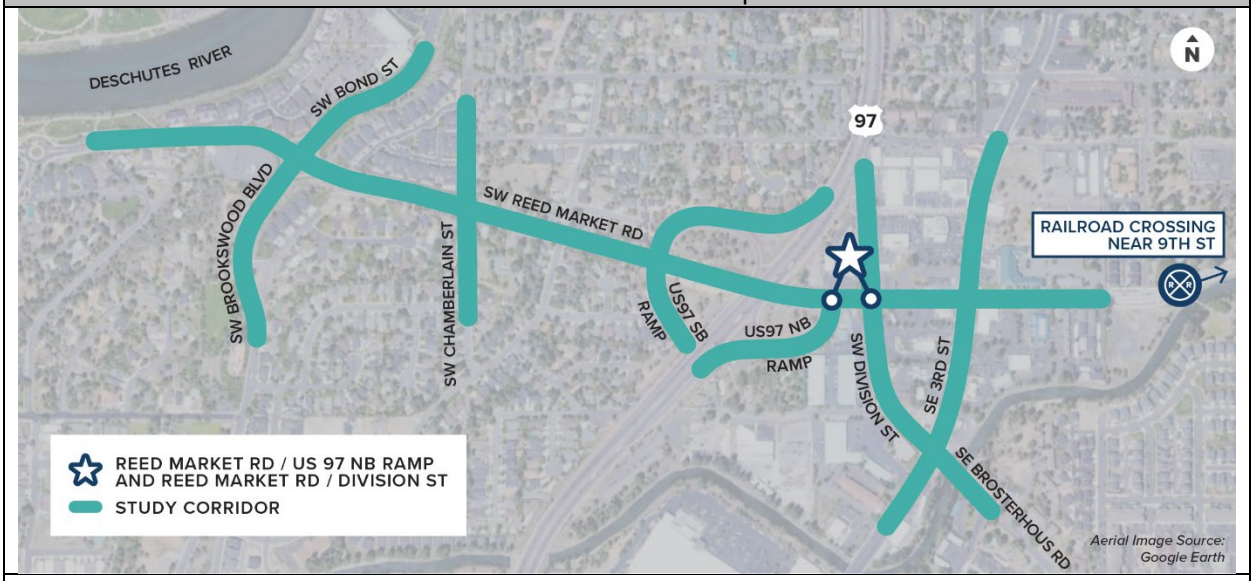
The following cross section is not currently funded and represents a potential, ultimate road cross section. The preferred alternative utilizes short term restriping to reduce vehicle travel lane widths and provide a buffered bike lane, as shown in the concept figures. MAC coordination will be required for narrowing through lanes at this location.



# Prospectus Sheets

**Intersection:** Reed Market Road and US 97 Northbound Ramps




**Problem Statement:** The Reed Market Road/US 97 northbound ramp terminal intersection is currently two-way stop controlled. It can be challenging to turn northbound left during peak hours due to traffic and geometric constraints limiting sight distance. Additionally, the sight line for right turning vehicles may be blocked by left turning traffic. The Reed Market Road and Division Street intersection, located 150 feet east of the US 97 northbound ramp terminal, is also two-way stop controlled. Division Street allows two-way traffic to serve local properties, with the US 97 northbound entrance ramp located at the north terminus of Division Street. This is inconsistent with ODOT's access spacing standards and results in a shorter than standard acceleration lane onto US 97. Currently, there are non-buffered on street bike lanes in both the east and west direction.

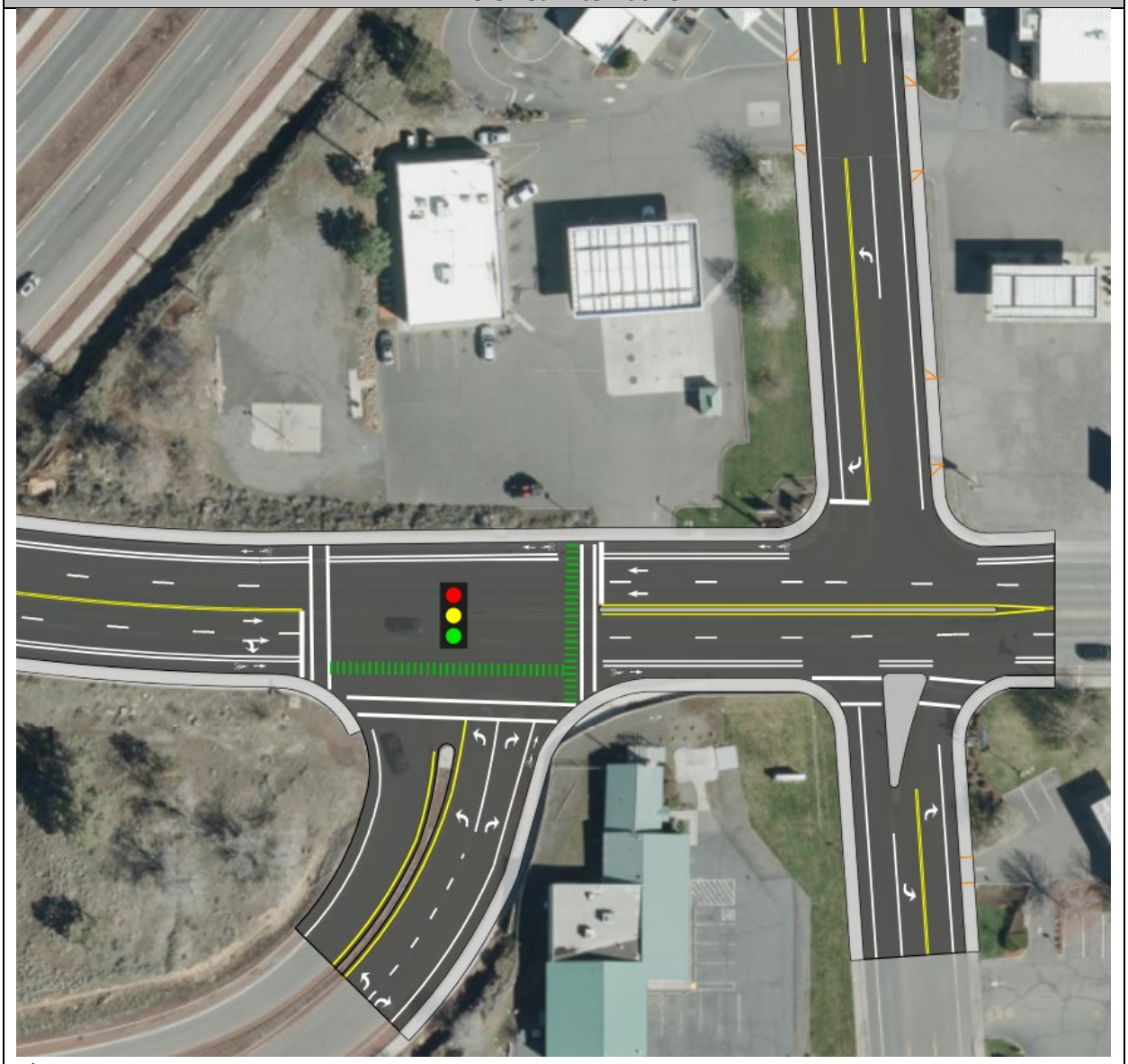
**Preferred Alternative Description**

**Signalize ramp terminal (with option to realign in the long-term):** The preferred alternative is a phased implementation of Alternatives 1 and 2. Phase 1 would construct the traffic signal and convert Division Street to right-in and right-out only, as shown in Alternative 1. The remaining elements of Alternative 2 would be constructed in a future phase or phases.

- Alternative 1 (Short-Term):
  - Construct a traffic signal at the US 97 northbound ramp terminal and provide a bike signal.
  - Convert Division Street to right-in and right-out only by implementing a narrow raised median.
  - Investigate any access modifications needed at the north end of Division Street to provide increased acceleration distance for the US 97 on-ramp.
- Alternative 2 (Long-Term):
  - Separate the northbound entrance ramp from Division Street and align the new entrance ramp with the Reed Market Road/US 97 northbound ramp signalized intersection.
  - Convert the south leg of Division Street to right-in and right-out only by implementing a narrow raised median.

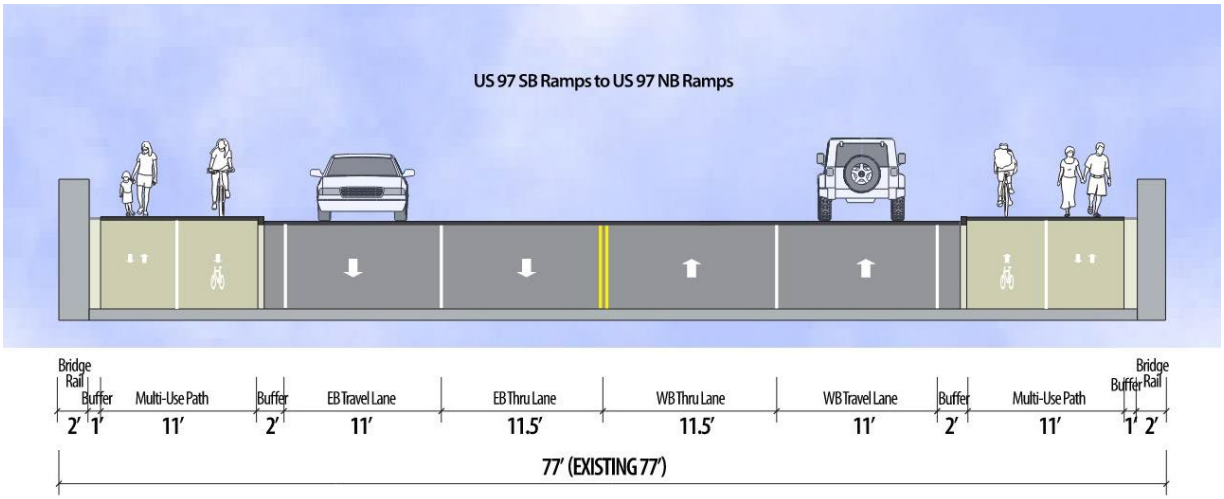
| Rough Cost Estimate Summary (2023 Dollars)[1] |
| --- |
| **Alternative 1: $4.0 Million**<br>**Alternative 2: $9.4 Million** *(inclusive of costs associated with Alternative 1)*<br>[1]Cost estimate includes design and construction management, mobilization, right-of-way, and contingency. |
| **Summary of Benefits or Tradeoffs of Preferred Alternative** |
| • A traffic signal at this intersection would provide a significant improvement to traffic operations.<br>• Converting Division Street to right-in and right-out would reduce conflict points and prevent left turning vehicles from blocking through movements.<br>• The signalized intersection would reduce impacts to adjacent businesses and buildings compared to a roundabout.<br>• Alternative 2 would provide an acceptable acceleration distance onto US 97 and mitigate access management conflicts that exist on Division Street with the current ramp placement. |

**Preferred Alternative**



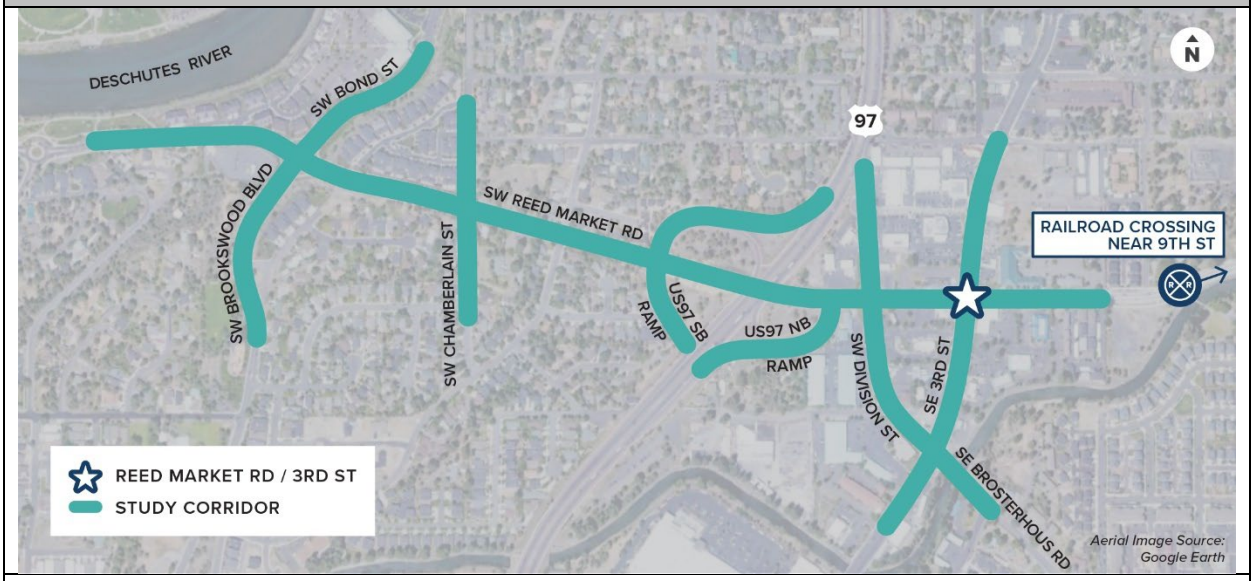
Phase 1

Future phase or phases

| Design/Construction Constraints and Opportunities |
|---|
| • Existing driveway access on Reed Market Road will need to be evaluated and coordinated during design.<br>• Concept elements may require ODOT approval prior to implementation.<br>• Pedestrian and bicycle crossing treatments of the on-ramp acceleration lane should be refined during design. |
| **Typical Proposed Street Sections** |
| This cross section is not currently funded and represents a potential ultimate road cross section. The preferred alternative utilizes short-term restriping to reduce vehicle travel lane widths and provide a buffered bike lane, as shown in the concept figures. MAC coordination will be required for narrowing through lanes at this location.<br>  |

# Prospectus Sheets

**Intersection:** Reed Market Road and 3rd Street




**Problem Statement:** The intersection of Reed Market Road and 3rd Street is at the confluence of two major arterial roadways in Bend and serves high traffic volumes on all approaches. The existing demand volumes exceed the intersection capacity (v/c ratio of 1.05), and the future demand volumes will increase the v/c ratio to 1.26 by 2040. A major contributor to this congestion is the lack of separate eastbound and westbound left turn lanes, which limits signal operations to using split phasing. The existing intersection currently has non-buffered bike lanes on the east and west approaches and buffered bike lanes on the north and south approaches. Additionally, there are several businesses and buildings built close to the right-of-way at the four corners of the intersection.

**Preferred Alternative Description**

**Protected signalized intersection:**

- Construct a protected intersection with added eastbound and westbound left turn lanes.

**Rough Cost Estimate Summary (2023 Dollars)[1]**

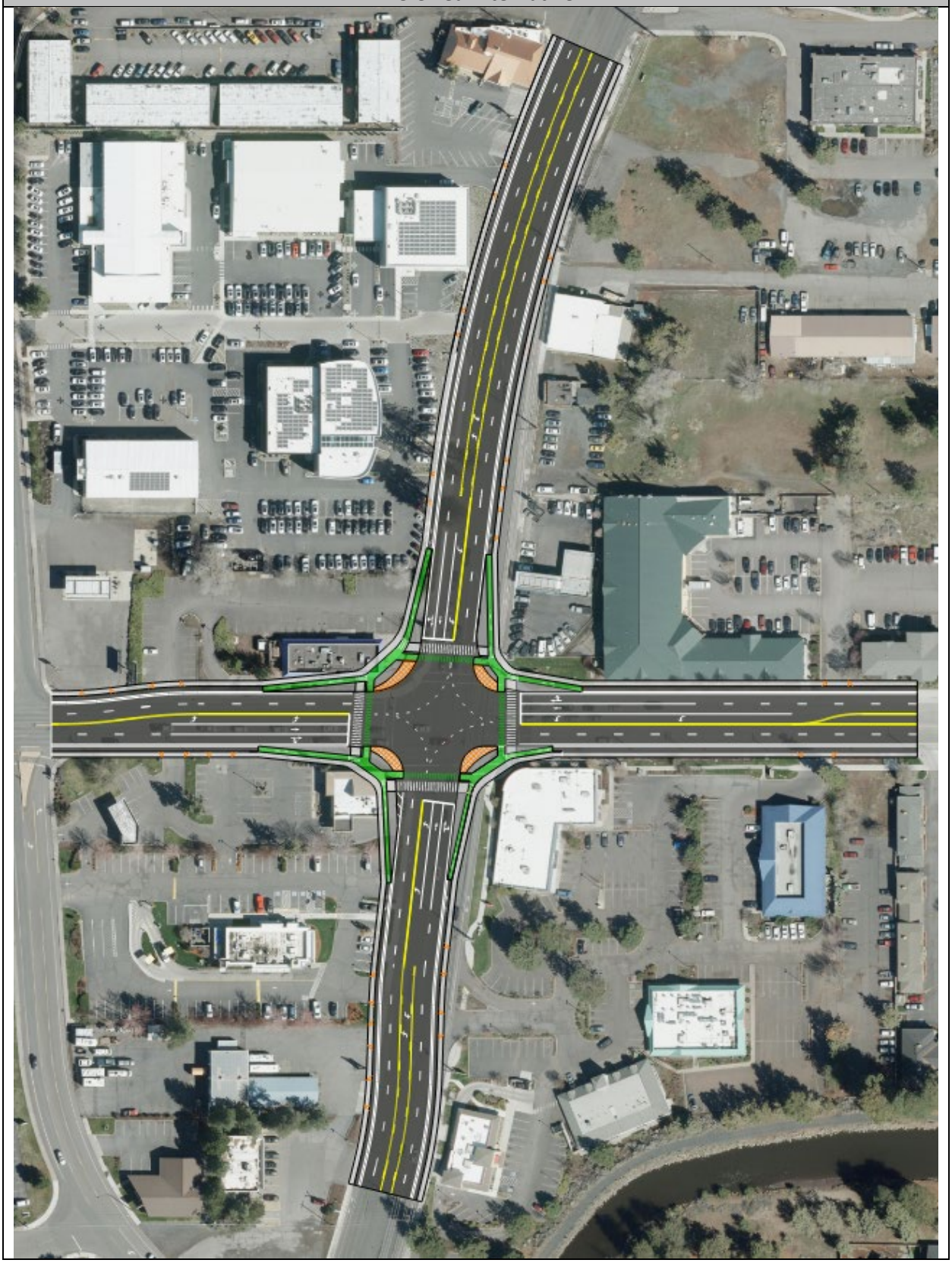
**Preferred Alternative:** $10.3 Million

[1]Cost estimate includes design and construction management, mobilization, right-of-way, and contingency.

**Summary of Benefits or Tradeoffs of Preferred Alternative**

- The protected intersection design would minimize ROW impacts while providing traffic calming via smaller curb radii, minimize pedestrian crossing distance, and provide a protected bicycle crossing.
- The protected intersection would improve the level of traffic stress for people walking and biking.
- Adding eastbound and westbound left turn lanes would provide greater flexibility in traffic signal timing and reduce overall intersection delay.

**Preferred Alternative**

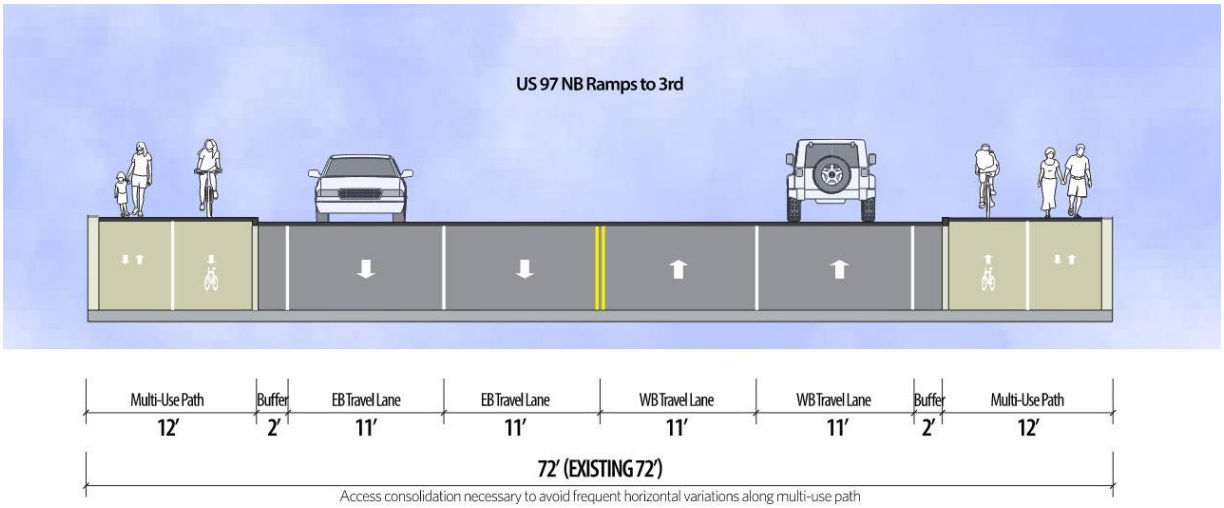


## Design/Construction Constraints and Opportunities

- Intersection concept design shows roadway centerline offset to the west to avoid impacts to building in the southeast corner. This could be refined on the south approach to reduce the length of property impacts.
- Design refinements should consider treatments to reduce impacts to utility lines on the south and east side of the intersection.
- Consider utilizing multi-use paths approaching the intersection instead of at-grade bike lanes to limit ROW impacts (see example cross section below).
- Investigate and revise access management, if necessary, near the intersection – particularly on the east leg.
- Refine intersection design and explore other cost saving measures during design. For example, current cost estimates assume full depth pavement reconstruction for entire project extents shown in the concept figures.
- Adding a southbound right turn lane could improve intersection operations but was not considered as part of the preferred alternative due to costs exceeding available funding and ROW impacts.

## Typical Street Sections

The following cross section is not currently funded and represents a potential ultimate cross section along Reed Market. The preferred alternative utilizes short term restriping (shown in preferred alternative figure) along Reed Market to narrow travel lanes to 11’ and provide a buffered bike lane.



# ATTACHMENT B. TECHNICAL MEMORANDUM #1

## STUDY BACKGROUND AND GOALS AND OBJECTIVES

# TECHNICAL MEMORANDUM 1

DATE: November 07, 2022

TO: Project Team

FROM: Kayla Fleskes-Lane, PE; John Bosket, PE | DKS Associates
Lewis Kelley, Rory Renfro, AICP | HDR Inc

SUBJECT: US 97 at Reed Market Road Operations and Safety Study
Study Background and Goals and Objectives

Project #22129-001

This memorandum introduces the US 97 at Reed Market Road Operations and Safety Study by explaining the problem and purpose; describing the area involved; providing an analysis of demographics in the area; and outlining the goals, objectives, and evaluation criteria that will be used to guide project decisions and select a preferred set of improvements. Appendix A of this memorandum includes a memorandum documenting key methods and assumptions to be applied to the analysis of transportation conditions.

## PROJECT PROBLEM AND PURPOSE

The Oregon Department of Transportation (ODOT) is preparing a study to analyze operational and safety improvements for a segment of the Reed Market Road corridor within the City of Bend from Brookswood Boulevard/Bond Street to 4th Street. Reed Market Road was identified as a critical east-west travel corridor and priority for addressing mobility during the most recent Bend Transportation System Plan/Metropolitan Transportation Plan (TSP/MTP) update. As one of the few crossings of the Deschutes River and US 97, Reed Market Road is heavily relied upon for access to much of southern Bend, including popular destinations such as the Old Mill District, riverfront, Mount Bachelor, and Cascade Lakes Scenic Byway. The study corridor has multiple operations and safety deficiencies that compound to create a significant east-west bottleneck. Furthermore, one of the key findings from the US 97 Parkway Plan was that Reed Market Road congestion limits the ability of any interchange improvements to function adequately, leading to queue spillback and one of the most critical bottlenecks on the Parkway.

As a result of these earlier planning efforts, ODOT and the City of Bend partnered to identify and fund concept-level improvement projects in the Reed Market Road study corridor through the City's Capital Improvement Program (CIP) and general obligation (GO) bonds. However, further project refinement and development of a coordinated plan are needed to support implementation. Therefore, the purposes of this study are to:

- Build upon the results of the Bend TSP/MTP and US 97 Parkway Plan and refine a set of complementary operational and safety improvement projects in the Reed Market Road study corridor that closely align with available funding.
- Develop planning-level concepts and updated cost estimates.
- Align existing project funding with proposed project costs and identify potential funding gaps.
- Provide a prioritized list of projects using a benefit/cost analysis.

## PROJECT STUDY AREA

Figure 1 shows the study area for the project. The study area includes six study intersections:

1. Reed Market Road and Brookswood Boulevard/Bond Street
2. Reed Market Road and US 97 Southbound Ramps
3. Reed Market Road and US 97 Northbound Ramps
4. Reed Market Road and Division Street
5. Reed Market Road and 3rd Street
6. 3rd Street and Brosterhous Road

**FIGURE 1. REED MARKET ROAD OPERATIONS AND SAFETY STUDY AREA**

1 REED MARKET ROAD & BROOKSWOOD BOULEVARD

2 REED MARKET ROAD & US 97 SOUTHBOUND

3 REED MARKET ROAD & US 97 NORTHBOUND

4 REED MARKET ROAD & DIVISION STREET

5 REED MARKET ROAD & 3RD STREET

6 3RD STREET & BROSTERHOUS ROAD

## DEMOGRAPHIC ANALYSIS

Demographic information is provided from the 2020 5-year American Community Survey and is presented in Table 1 (see the map of census block groups in Figure 2). Approximately 9,700 individuals live in the vicinity of the project area within 3,961 households, representing an average household size of 2.46 individuals. The median household income is $61,821 compared to $67,973 for the entire City of Bend. The lowest incomes are found in the neighborhoods immediately adjacent to Reed Market Road, while households west of Brookswood Boulevard significantly raise the median income of the area. Households with no access to private vehicles represent 16.5 percent in the area compared to six percent for the City of Bend. The high concentration of zero-car households is in part due to the presence of several retirement and care homes in the area. Of the 9,700 individuals, 13 percent identified as a minority, equal to the percentage in the City, 15.3 percent are 65 years of age or older compared to 17 percent in the City, and 12.3 percent live in households below the poverty level for the area compared to 10 percent in the City.

**TABLE 1: US 97 AT REED MARKET ROAD STUDY AREA DEMOGRAPIHC SUMMARY, 2020 5-YEAR AMERICAN COMMUNITY SURVEY**

| CENSUS TRACT (BLOCK GROUP) | TOTAL | 15.01(2) | 15.01(3) | 20.02(1) | 21.01(1) | 21.02(1) |
|---|---|---|---|---|---|---|
| **HOUSEHOLD DATA** | | | | | | |
| HOUSEHOLDS | 3,961 | 1,022 | 635 | 925 | 420 | 959 |
| HOUSING UNITS | 4,558 | 1,075 | 714 | 956 | 444 | 1,369 |
| ZERO CAR HOUSEHOLDS | 652 (16%) | 249 (24%) | 98 (15%) | 72 (8%) | 216 (51%) | 17 (2%) |
| **POPULATION DATA** | | | | | | |
| POPULATION | 9,732 | 1,873 | 1,204 | 3,288 | 979 | 2,388 |
| MINORITY POPULATION | 1,256 (13%) | 324 (17%) | 191 (16%) | 445 (14%) | 142 (15%) | 154 (6%) |
| POPULATION 65+ | 1,485 (15%) | 421 (22%) | 153 (13%) | 189 (6%) | 66 (7%) | 656 (27%) |
| POPULATION BELOW POVERTY LEVEL | 1,197 (17%) | 204 (11%) | 30 (2%) | 571 (17%) | 147 (15%) | 245 (10%) |
| **INCOME AND EMPLOYMENT DATA** | | | | | | |
| MEDIAN HOUSEHOLD INCOME | $ 61,821 | $ 45,324 | $ 45,858 | $ 61,250 | $ 62,234 | $ 93,438 |
| EMPLOYMENT | 4,489 | 1,103 | 716 | 1,296 | 489 | 885 |

*Source: 2020 5-Year American Community Survey.*

Figure 2 shows the census blocks and centers with high concentrations of employment or activities, such as the Oregon State University Cascades Campus or the Old Mill District. These centers attract high numbers of visitors daily or during events and generate traffic demand on Reed Market Road and the surrounding streets.

**FIGURE 2: EMPLOYMENT AND ACTIVITY CENTERS IN THE PROJECT AREA**

- STUDY AREA
- CENSUS BLOCK GROUP
- MAJOR EMPLOYER
- ACTIVITY CENTER

1. OSU - CASCADES
2. DESCHUTES BREWERY
3. MILL POINT BUSINESS CAMPUS
4. LIGHT INDUSTRIAL AREAS

1. FRED MEYER
2. ASSISTED LIVING CARE HOMES
3. OLD MILL DISTRICT
4. HAYDEN HOUSE AMPITHEATER
5. FAREWELL BEND PARK
6. VINCE GENNA STADIUM

## GOALS, OBJECTIVES, AND EVALUATION CRITERIA

A draft set of project goals, objectives, and evaluation criteria is provided in Table 1. A **goal** is an overarching principle or a broad statement of intent that informs the range of possible transportation solutions and guides decision-making. **Objectives** are more specific and relevant steps that are taken to meet the goal, while **evaluation criteria** assess how well those objectives would be met by the alternatives considered.

This initial set of goals, objectives, and evaluation criteria were developed with consideration to the project problem and purpose previously described, as well as the goals, objectives, and evaluation criteria from the Bend TSP/MTP and US 97 Parkway Plan (included in Appendix B for reference). As a next step, the goals, objectives and evaluation criteria will be refined through discussions with the project team and input provided by stakeholders. The resulting goals, objectives, and evaluation criteria will guide the development of solutions for the Reed Market Road study corridor and will be used to demonstrate how well improvement alternatives meet the purpose of the project.

The goals and objectives have been numbered to facilitate referencing, but no weighting has been applied, and the order is not an indication of relative importance.

**TABLE 1: US 97 AT REED MARKET ROAD OPERATIONS AND SAFETY STUDY GOALS, OBJECTIVES, AND EVALUATION CRITERIA**

| GOALS | OBJECTIVES | EVALUATION CRITERIA |
|---|---|---|
| 1. Increase system functionality, quality, and connectivity for all users | a. Provide for efficient travel for traffic utilizing US 97. | Meets ODOT's adopted mobility targets at the US 97 ramp terminals with Reed Market Road and Division Street through the planning horizon. |
| | b. Provide for efficient travel on the local roadway system in the interchange area. | Meets City of Bend mobility standards for local system study intersections through the planning horizon. |
| | c. Enhance bicycle and pedestrian facilities along, parallel to, and across US 97. | Based on qualitative criteria, enhances the quality of walking and biking facilities. |
| | | Increases the frequency of low-stress pedestrian and bicycle crossings of Reed Market Road. |
| | | Supports implementation of low-stress pedestrian and bicycle crossings of US 97. |
| | | Implements a planned low-stress bicycle network and key walking and biking routes in the study area. |
| | d. Enhance transit facilities along, parallel to, and across US 97. | Can accommodate planned transit service improvements and expansions. including micromobility. |
| 2. Ensure safety for all users | a. Reduce serious injuries and fatalities. | Reduces the frequency and severity of crashes, as assessed through analysis of crash data and use of Crash Modification Factors. |
| | b. Design and build facilities and routes that maximize safety for pedestrians and bicyclists. | Minimizes conflicts and risk factors that could lead to crashes. |
| | | Increases the physical separation between users. |
| | c. Move toward meeting ODOT's adopted access spacing standards along US 97, Reed Market Road, and Division Street, or meet the standards where feasible. | Meets or improves access spacing pursuant to ODOT's adopted access spacing standards. |
| 3. Support economic development | a. Maintain effective access to properties along Reed Market Road and Division Street in a manner that supports the economic development objectives of existing and future businesses, consistent with the Bend Comprehensive Plan. | Maintains accessibility to properties consistent with the documented needs of existing land uses, City of Bend standards, and anticipated potential needs of future uses based on Comprehensive Plan designations. |
| | b. Develop an interchange design that facilitates truck freight movement along US 97 and to and from destinations along Reed Market Road. | Proposed interchange geometry, such as curves, clearances, and grades, accommodates trucks and oversize vehicles while finding an appropriate balance with the needs of people walking and biking. |
| 4. Protect livability and ensure equity and access | a. Incorporate a complete streets approach along the Reed Market Road corridor through the interchange area. | Based on qualitative criteria, addresses existing barriers for people walking and biking across or along Reed Market Road. |
| | | Can accommodate planned transit service improvements and expansions. |
| | b. Strive for people of all income levels and abilities to have access to the transportation options that best meet their needs. | Impacts to properties owned, used by, or accessed by historically underrepresented community members are proportionate to those of other populations. |
| 5. Steward the environment | a. Reduce vehicle emissions through reduction of vehicular delay, improved connections in the local system, and the use of alternative travel modes. | Qualitatively assesses reductions in vehicular delay and vehicle-miles traveled, as well as improvements supporting walking, biking, and use of transit. |
| 6. Develop solutions that are cost-effective and implementable | a. Prioritize low-cost, high-benefit solutions. | Based on qualitative criteria, finds solutions that are effective at addressing goals and objectives compared to costs and would reasonably fit within funding expectations for project partners. |
| | b. Prioritize solutions that that leverage partnerships, existing planned projects, and programs. | Creates solutions that are compatible with recommendations from the US 97 Parkway Plan, Bend TSP/MTP, and planned Bend CIP/GO Bond projects and align with available funding. |
| | c. Develop a design that is constructable in phases and could be reasonably maintained. | Can be implemented incrementally in functional phases. |
| | | Minimizes the number of potential design exceptions. |
| | | Does not create maintenance challenges. |
| | | Is easily constructable with regard to the ability to maintain movement of all modes during construction. |

# APPENDIX A: METHODOLOGY MEMORANDUM

# APPENDIX A

DATE: November 07, 2022

TO: Rick Williams | Oregon Department of Transportation

FROM: Kayla Fleskes-Lane, PE; Aaron Berger, PE (WA); John Bosket, PE | DKS Associates

SUBJECT: US 97 at Reed Market Road Operations and Safety Study
TM #1, Appendix A - Methodology Memorandum

Project #22129-001

This memorandum documents the methodology and key assumptions to be used in generating the existing and future conditions traffic analysis for the US 97 at Reed Market Road Operations and Safety Study in Bend, Oregon. This includes a description of the study intersections and the proposed methodology for volume development, traffic operations analysis, and safety analysis.

## STUDY AREA AND INTERSECTIONS

The project study area and study intersections are shown in Figure 1 and Figure 2 in the main memorandum (*Technical Memorandum #1*). The study intersections for system operations include:

1. Reed Market Road and Brookswood Boulevard/Bond Street
2. Reed Market Road and US 97 Southbound Ramps
3. Reed Market Road and US 97 Northbound Ramps
4. Reed Market Road and Division Street
5. Reed Market Road and 3rd Street
6. 3rd Street and Brosterhous Road

## VOLUME DEVELOPMENT

Traffic operations will be analyzed at study intersections using traffic counts collected in August 2022 to represent conditions with the 30th highest annual hour traffic volumes (30HV). The 2022 traffic counts will be compared to historical traffic counts from the US 97 Parkway Plan (collected April 2017), to determine if traffic volumes have rebounded from reductions in vehicle travel associated with the COVID-19 pandemic.

## FUTURE TRAFFIC SCENARIO ASSUMPTIONS

### 2040 BASELINE SCENARIO LAND USE ASSUMPTIONS

A Future Baseline (No-Build) scenario will be run in the Bend Redmond Regional Travel Demand Model (BRM) tool in the EMME software platform. This scenario will use the 2040 land use assumptions developed for the most recent City of Bend Transportation System Plan (TSP) update with the addition of recent refinements associated with the Stevens Road Tract[1] and Stevens Ranch Tract[2] developments located east of 27th Street between Ferguson Road and Reed Market Road. This scenario will be used as the basis to estimate year 2040 traffic growth at all study intersections, using the calibrated base year (2019) model and 2040 scenario. Raw link level volumes from the BRM will be post-processed using methods consistent with the ODOT Analysis Procedures Manual (APM). This approach is derived from methodologies outlined in the National Cooperative Highway Research Program (NCHRP) Report 765 *Analytical Travel Forecasting Approaches for Project-Level Planning and Design*.

### 2040 BASELINE SCENARIO NETWORK ASSUMPTIONS

The 2040 Baseline scenario network will be based on financially constrained projects listed in the Statewide Transportation Improvement Program, Bend Transportation GO Bond project list and the Capital Improvement Program (CIP) project list. In addition to the financially constrained projects, a closure of right-on, right-off access on US 97 will be assumed, as that planned project[3] has a noticeable impact on the volume of traffic at the interchange. Network assumptions that may influence traffic demand near the study area are listed in Table 1.

Several projects that are included in the Bend TSP's project list are not financially constrained (i.e., funding has not been committed for the project) and will not be included in 2040 Baseline scenario. This includes the following projects near the study area:

- Ramp metering US 97 (C-42, Bend TSP Mid-Term project list)
- Powers Road Interchange (C-41, Bend TSP Mid-Term project list)
- Improvements identified in the GO Bond along the Reed Market Road corridor (as these improvements will be tested as part of the build alternatives for this study).

[1] Stevens Road Tract Concept Plan, June 2022

[2] Stevens Ranch Major Community Master Plan, October 2021

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**TABLE 1: BASELINE SCENARIO TRANSPORTATION NETWORK ASSUMPTIONS**

| PROJECT | SOURCE | PROJECT NUMBER |
|---|---|---|
| **CHASE ROAD CONNECTION** | Bend GO Bond | - |
| **REED MARKET ROAD RAILROAD OVERCROSSING** (9TH STREET ACCESS REMOVAL) | Bend GO Bond | - |
| **US 97/MURPHY ROAD INTERCHANGE RAMPS** | Bend MTP | 26 |
| **US 97 FRONTAGE ROADS NEAR MURPHY RD** (BETWEEN BADGER ROAD AND PONDEROSA STREET) | Bend MTP | 18/19 |
| **CLOSE US 97 RIGHT-ON, RIGHT-OFF ACCESS** | Bend TSP Mid-Term project list | C-42 |

## INTERSECTION OPERATIONS ANALYSIS

Intersection operations will be reported for typical 30 HV conditions at each of the six study intersections for future conditions (year 2040). Intersection analysis will be performed using Synchro and Sidra analysis software and *Highway Capacity Manual 6th Edition*[4] procedures. Results will be reported as volume-to-capacity ratios, level of service, and seconds of delay.

## CRASH ANALYSIS

Crash history in the study area will be summarized based on analysis conducted for the US 97 Parkway Plan, Bend TSP and the Bend Transportation Safety Action Plan. For a comparison of the safety impacts of each alternative, crash modification factors will be used with mitigation measures selected to address types of crashes trending, when applicable. Mitigation measures will be aligned with the elements of the Safe System Approach and selected from the FHWA Proven Safety Countermeasures list where available.[5] Crash history will be summarized for vehicles, bikes, and pedestrians where applicable and may be supplemented with an overview of crash information from the DASH tool created for the ODOT ARTS projects.

## ACTIVE TRANSPORTATION

An inventory of existing and planned active transportation facilities will be documented and a qualitative assessment of how each alternative enhances bicycle and pedestrian facilities will be

[4] *Highway Capacity Manual 6th Edition: A Guide to Multimodal Mobility Analysis,* Transportation Research Board, 2016

[5] https://safety.fhwa.dot.gov/provencountermeasures/

included. The qualitative assessment will at a minimum include degree of separation; continuity, out of direction travel, and connection to the City's low-stress network; connectivity and out of direction travel to access transit stops; and relative safety risk.

## MICROSIMULATION ANALYSIS

To understand and test the interactions between localized solutions along the Reed Market Road corridor, a corridor Vissim model will be created. The Vissim models used for the US 97 Parkway Plan will be refined to include the study area for this project. The model will extend from Reed Market Road/Brookswood Roundabout eastward to the intersection of 4th Street. The northern terminus is the intersection of 3rd Street and Roosevelt Avenue and the southern terminus is the intersection of 3rd Street and Brosterhous Road. This will include the on-ramp and off-ramps to US 97 but will not include the US 97 mainline. This model is intended only to refine the preferred alternative projects and will not be used to develop the performance measures supporting the screening process.

The Vissim model will be developed per the ODOT Vissim Protocol guidelines[6], which will include a Vissim Protocol Calibration and Validation Report. The Vissim study period will be the two-hour p.m. peak period (4-6 p.m.) with a 15-minute seeding period. Performance measures will be collected and reported for the modeled one-hour system peak. The following data is required to build and calibrate the existing conditions Vissim model:

- Roadway Geometric Data: includes number of lanes, lengths of storage bays and tapers, pedestrian/bike crossing locations, and roadway segment lengths; will be obtained from aerial photos, Google Street View, and field observations.
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- Traffic Volume Data: motor vehicle, pedestrian, bicycle, and heavy vehicle volume data collected during the p.m. peak period. The turn movement counts will be used in development of motor vehicle and pedestrian volume inputs, routing, and peaking profile in the Vissim model.
- Transit Data: bus schedules, headways and stop locations obtained from Cascades East Transit website.
- Field Observations: conducted in the study area during the weekday p.m. peak period will be used to verify roadway geometry and traffic control data, as well as to identify queuing issues and areas of congestion.

The consultant team will use the Bend-Redmond travel demand model to develop origin-destination (O-D) and routing data for each of the Vissim analysis scenarios. The O-D development process involves the following steps for the existing year scenario:

[6] *Protocol for Vissim Simulation,* Oregon Department of Transportation, June 2011

1. Extract a subarea network with the same extents as the Vissim model areas from the Bend-Redmond travel demand model in Emme and import it into a Visum network model.
2. Factor Bend-Redmond Model p.m. peak hour subarea matrix to 2-hour volumes, using net peak to two-hour ratio (1.96) from the traffic counts.
3. Refine the subarea model network in Visum to include detailed street network (including all Vissim model intersections).
4. Use an O-D matrix estimation method (TFlowFuzzy[7] procedure in Visum) to calibrate the O-D matrix of the subarea model to fit the traffic count data. Use the Bend-Redmond travel demand model to verify routing assumptions.

The end results of this process will be traffic demand with complete O-D routing that maintains the Bend-Redmond travel demand model trip distribution patterns while matching each turn movement volume to the count data. These volumes and routes will then be exported to Vissim for microsimulation analysis.

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The calibration targets will be evaluated based on the methodology outlined in the *ODOT Vissim Protocol*[8]*.* Simulation results will be based on an average of 10 simulation runs. The performance measures reported from the model will include:

- 95$^{th}$ percentile queues
- Vehicle delay and throughput
- Congestion plots (based on relative speed)

The existing conditions Vissim microsimulation models will be updated with future 2040 volumes, origin-destination data from the travel demand model, and future funded projects, as applicable. The ODOT Vissim Protocol will be followed for this future no-build analysis. The same performance measures as the existing conditions analysis will be reported.

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# APPENDIX B: BEND TRANSPORTATION SYSTEM PLAN AND US 97 PARKWAY PLANS GOALS

# 2

# Goals, Policies & Actions

## Introduction

Bend's TSP Goals define the community's desired outcomes for the transportation system. The Goals shaped and guided development of the policies, actions, projects, and programs in the TSP and guide its projects and programs.

## Goals

**Preamble:** The Goals articulated in this document were developed by the CTAC after consideration and review of the City Council's articulated goals for CTAC, and through an extensive CTAC-led process of identifying issues and potential solutions from stakeholders in our regional and city transportation systems.

### 1 Increase System Capacity, Quality, and Connectivity for All Users

(e.g., drivers, walkers, bicyclists, transit riders, mobility device users, commercial vehicles, and other forms of transportation)

- Increase route choices and connections for all users
  - **Roads**: increase capacity and efficiency
  - **Sidewalks:** increase access and connectivity
  - **Bicycle facilities:** increase total miles of bike routes/facilities
  - **Transit:** increase transit participation
- Use technology to enhance system performance, including accessible technology (i.e., audible signals)
- Increase the number of people who walk, ride a bike, and/or take transit
- Provide reliable travel times for commuters, emergency vehicles, and commercial users
- Minimize congestion
- Reduce vehicle operating and maintenance costs due to poor pavement conditions
- Emphasize asset management

## 2 Ensure Safety for All Users

- Reduce serious injuries and fatalities
- Maximize safe routes within and between neighborhoods and throughout the community for all users
- Design and build facilities and routes that maximize safety for pedestrians and bicyclists
- Ensure safe speeds

## 3 Facilitate Housing Supply, Job Creation, and Economic Development to Meet Demand/Growth

- Build new roads and upgrade existing roads to serve areas targeted for growth (prioritizing opportunity and expansion areas) and job creation
- Provide access and connectivity to expanded housing supply
- Improve connectivity and route choices for commercial users

## 4 Protect Livability and Ensure Equity and Access

- Incorporate a complete streets approach for all new road projects and road reconstruction
- Increase Safe Routes to Schools
- Ensure that people of all income levels and abilities have access to the transportation options that best meet their needs
- Encourage the use of roads for their stated classification
- Keep through freight traffic on ODOT facilities

## 5 Steward the Environment

- Minimize the impacts of the transportation system on natural features
- Minimize the impacts of the system on air and water quality and noise
- Reduce carbon emissions from transportation

## 6 Have a Regional Outlook and Future Focus

- Coordinate and partner with other public and private capital improvement projects and local/regional planning initiatives
- Create a system that is designed to implement innovative and emerging transportation technologies

## 7 Implement a Comprehensive Funding and Implementation Plan

- Identify stable, equitable, adequate, and achievable funding for transportation programs and projects
- Ensure that the financial plan and investment priorities are transparent, understandable, and broadly supported by the community
- Produce a funding plan that includes contributions from residents, visitors, and businesses and that delivers benefits to all users and geographies equitably and in a timely manner
- Include performance measures/benchmarks and a formal process to periodically assess progress to date and adjust or update the plan as needed
- Achieve financial stability

**Table 5: First and Second Level Screening Evaluation Criteria**

| GOAL | OBJECTIVES | QUALITATIVE EVALUATION CRITERIA (FIRST LEVEL) | EVALUATION CRITERIA (SECOND LEVEL) |
|---|---|---|---|
| **1. Improve safety for all modes** | Reduce the frequency and severity of crashes for all modes with an emphasis on severe and fatal injuries | Potential to reduce crashes | Reduction in crash frequency (all modes) |
| | | N/A | Reduction in crash severity (all modes) |
| **2. Support economic development throughout the region and state** | Support efficient movement of people, goods and services, and recreational traffic to, within and through the City of Bend | Ability to improve travel time reliability on US 97 | Travel Time Reliability measures on the Bend Parkway (planning time index) |
| | | N/A | Percent through traffic on congested segments (modeled demand/capacity ratio $\geq$ 1.0) of the Bend Parkway |
| | Develop strategies to accommodate planned growth through provision of transportation options now, and into the future | Enhances travel for multiple modes | Degree to which the alternative enhances travel for multiple modes (qualitative assessment) |
| **3. Manage transportation mobility into the future** | Evaluate the ability to achieve ODOT volume/capacity (V/C) targets and develop alternative mobility measures and targets, where appropriate | Would reduce congestion on US 97 | Ability to meet ODOT v/c targets |
| | Assess impacts on local system | Would reduce congestion on city streets | Ability to meet Bend mobility standards (v/c ratios and LOS) |
| **4. Consider accessibility to key destinations now and in the future** | Evaluate and assess reliable travel times between key destinations during peak periods | N/A | Travel Time Reliability measures (planning time index) for specific routes during PM peak hour |
| **5. Facilitate the use of multimodal travel options** | Enhance transit, bicycle and pedestrian facilities along, parallel to, and across, US 97 | Supports implementation of low-stress pedestrian and bicycle crossings of US 97 | Number of bike and pedestrian crossing locations on the Bend Parkway with low Level of Traffic Stress (LTS 2 or lower) |
| | | Supports implementation of a parallel low-stress walking and biking network along the US 97 corridor | Miles of north-south bike and pedestrian facilities with low Level of Traffic Stress within 0.25 mile of the Bend Parkway |
| | Look for transportation demand management opportunities | Supports travel demand management strategies (or supports the transit system) | Does the alternative allow for transportation demand management strategies? |

| GOAL | OBJECTIVES | QUALITATIVE EVALUATION CRITERIA (FIRST LEVEL) | EVALUATION CRITERIA (SECOND LEVEL) |
|---|---|---|---|
| **6. Enhance the environment** | Reduce emissions through reduction of vehicular delay, improved connections in the local system, and the use of alternative modes | N/A | Total PM peak-hour vehicle delay (vehicle hours) |
| | | Potential to reduce vehicle miles traveled | Total PM peak-hour vehicle miles traveled (regional measure) |
| | Minimize right-of-way impacts | Would impact property | Approximate degree of right-of-way impacts (order of magnitude costs) |
| | Design projects to avoid, mitigate and minimize impacts | Would impact the environment | |
| **7. Identify cost effective solutions** | Prioritize low cost, high benefit solutions | Order of magnitude cost | Total cost |
| | Prioritize solutions that that leverage existing planned projects and programs | N/A | Does alternative leverage existing planned projects and programs? |
| **8. Develop an implementation plan** | Consider available funding sources and existing planned project and programs | Ability to construct in reasonably affordable phases | Can the alternative be separated into reasonably fundable and constructible phases? |
| | Recommend potential future funding sources | N/A | |
| | Include partner commitments to short-term actions | N/A | Does the alternative have local agency support? |
| **Additional Criteria (from Scope of Work)** | | Can be constructed to comply with design standards (geometric feasibility) | |
| | | Would impact freight movement | |
| | | Substantial conflicts with ODOT, City, or County policies and regulations | |

# ATTACHMENT C. TECHNICAL MEMORANDUM #2

## CURRENT TRANSPORTATION SYSTEM CONDITIONS

DKS 720 SW WASHINGTON STREET, SUITE 500, PORTLAND, OR 97205 • 503.243.3500 • DKSASSOCIATES.COM

# TECHNICAL MEMORANDUM 2

DATE: November 10, 2022

TO: Project Team

FROM: Eileen Chai, EIT; Kayla Fleskes-Lane, PE; John Bosket, PE | DKS Associates

SUBJECT: US 97 at Reed Market Road Operations and Safety Study
Current Transportation System Conditions

Project #22129-001

This memorandum summarizes existing traffic operations and safety conditions in the study area, including documentation of current traffic operations and safety, walking, biking, and transit conditions. This summary is based on field observations collected on August 3, 2022, and a synthesis of analysis findings from the following studies:

- US 97 Parkway Plan[1]
- Bend Metropolitan Transportation Plan/Bend Transportation System Plan (MTP/TSP)[2]
- Bond-Reed Market-Brookswood Roundabout Metering Pilot Test[3]
- Bend Area Transportation Safety Action Plan (TSAP)[4]

The information provided in this memorandum, in combination with *Technical Memorandum #3: Future Baseline (No-Build) Conditions,* will help provide a baseline understanding of the "No-Build" condition and will be used to identify deficiencies and inform the development of solutions.

## TRAFFIC OPERATIONS

Reed Market Road is a major arterial roadway that serves as one of the primary east-west connections across the city. As one of the few crossings of the Deschutes River and US 97, it is heavily relied upon for access to much of southern Bend, including popular destinations such as the Old Mill District, riverfront, Mount Bachelor, USFS land, and Cascade Lakes Scenic Byway. This study focuses on Reed Market Road in the area of the US 97/Reed Market Road interchange. The western terminus is the Reed Market Road/Brookswood Boulevard Roundabout, and the eastern

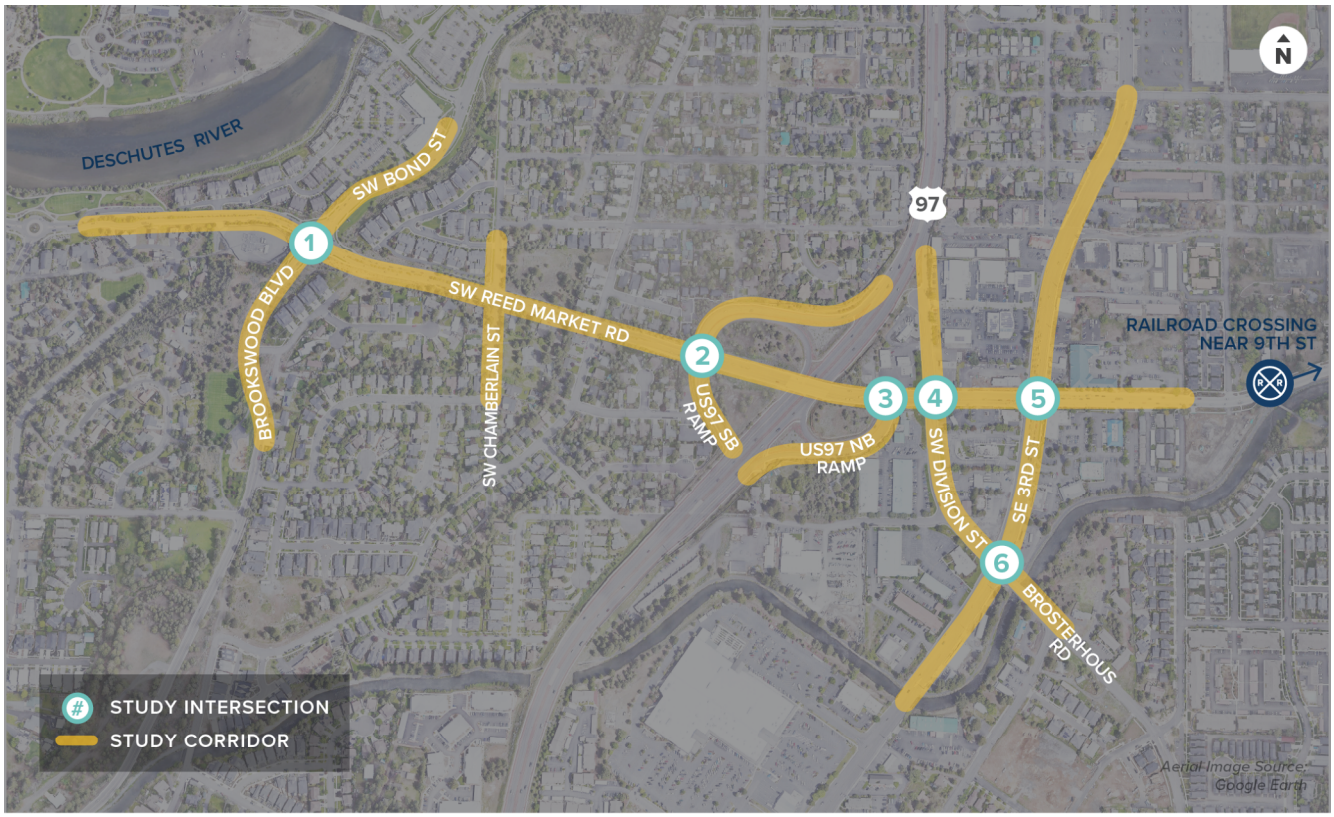
[1] US 97 Parkway Plan, August 6, 2020, Oregon Department of Transportation.

[2] Bend Transportation System Plan, 2020, City of Bend.

[3] Bond-Reed Market-Brookswood Roundabout Metering Pilot Test, April 20, 2020, Kittelson and Associates.

[4] Bend Area Transportation Safety Action Plan, September 30, 2019, Kittelson and Associates.

terminus is the 4th Street/Reed Market Road intersection. The northern terminus is the intersection of 3rd Street and Roosevelt Avenue, and the southern terminus is the intersection of 3rd Street and Brosterhous Road. The project study area will include six study intersections, as shown in Figure 1, to analyze the operational and safety improvements for the study corridor.




1 REED MARKET ROAD & BROOKSWOOD BOULEVARD/BOND STREET

2 REED MARKET ROAD & US 97 SOUTHBOUND

3 REED MARKET ROAD & US 97 NORTHBOUND

4 REED MARKET ROAD & DIVISION STREET

5 REED MARKET ROAD & 3RD STREET

6 3RD STREET & BROSTERHOUS ROAD

**FIGURE 1. STUDY AREA**

## TRAFFIC COUNTS

Turning movement counts were collected on Wednesday, August 3, 2022, during evening peak hours from 4:00 p.m. to 6:00 p.m. at 5-minute intervals, including the movements of vehicles, pedestrians, and bicyclists. The peak hour of traffic for the three westernmost study intersections starts at 4:50 p.m. while the peak hour for the three easternmost occurs earlier, starting between 4:10 p.m. and 4:15 p.m. Figure 2 summarizes existing lane configurations, traffic control, and counted weekday p.m. peak-hour turning-movement traffic volumes for each study intersection and two driveways located on Division Street north of Reed Market Road. One driveway (Number 7 in Figure 2) provides access to the Chevron gas station, and the other driveway (Number 8 in the figure) provides access to BMW of Bend. Traffic counts are included in Appendix A for reference.

The collected counts were compared with traffic counts previously collected in April 2017 for the US 97 Parkway Plan to confirm that traffic volumes have rebounded from the reductions in vehicle travel associated with the COVID-19 pandemic. The newly collected traffic counts are generally 5 to 10 percent higher than the counts collected in April 2017, reflecting seasonal changes in Bend during the summer when counts are higher than counts collected in the spring. Once accounting for seasonality, the newer traffic counts reflect slightly different travel patterns than the historical counts, with nearly 10 percent less volume traveling through the US 97 ramp terminals but roughly 3 percent more volume traveling through the intersections at 3rd Street and Brookswood Boulevard. In general, traffic volumes decreased eastbound on Reed Market Road (by 10 to 15 percent) but increased westbound by a similar magnitude, with the exception of Reed Market Road/3rd Street, where westbound volumes were significantly higher in 2022. This higher volume is potentially due in part to an ongoing construction closure along Wilson Avenue, as well as changes to developments and travel patterns in the city since 2017.

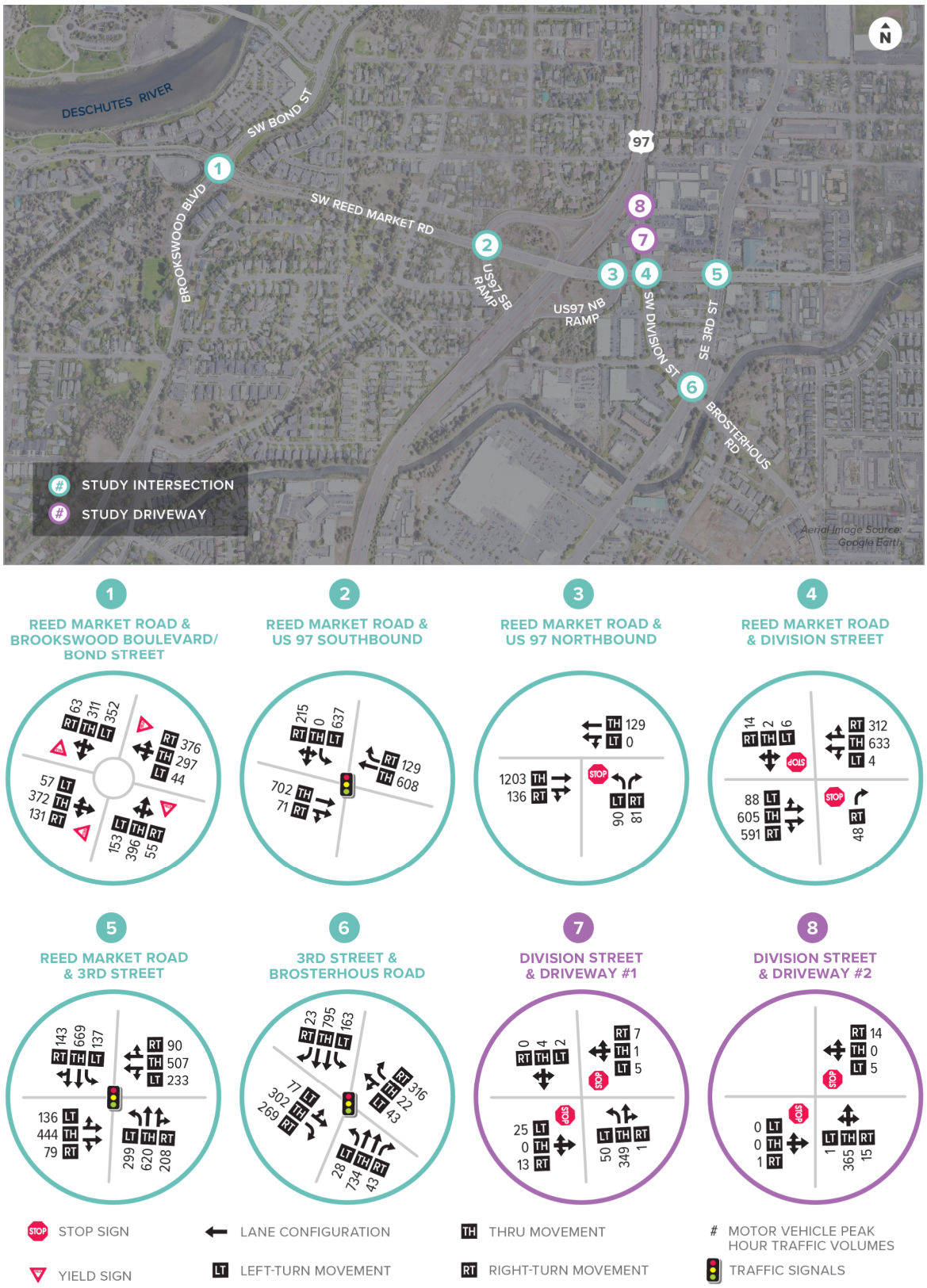



**FIGURE 2. EXISTING (AUGUST 2022) BALANCED TRAFFIC COUNTS**

## INTERSECTION OPERATIONS

Table 1 shows the operations analysis summary for the study intersections in 2017 from the US 97 Parkway Plan. Volume-to-capacity (V/C) ratios, level of service (LOS)[5], and delay are typically used as performance measures for intersection operations. Most of the study intersections failed to meet the adopted mobility targets.[6] This indicated there was a significant amount of congestion at these study intersections during the peak hour. The congestion issues observed at the study intersections along the Reed Market Road corridor in 2017 were consistent with the field observations in 2022.

**TABLE 1. EXISTING[A] (2017) 30HV INTERSECTION OPERATIONS ANALYSIS SUMMARY**

| INTERSECTION | CONTROL | MOBILITY TARGET | V/C[B] | LOS[C] | DELAY[D] (SEC) |
|---|---|---|---|---|---|
| **REED MARKET RD & BROOKSWOOD BLVD** | Roundabout | ≤ 1.00 | **1.14** | F | 60.6 |
| **REED MARKET RD & US 97 SB** | Signalized | ≤ 0.90[F] | **0.95** | C | 34.0 |
| **REED MARKET RD & US 97 NB** | TWSC | ≤ 0.85 (ramp)<br>≤ 0.85 (Reed Market Rd) | NA/**1.53** | NA/F | NA/>100 |
| **REED MARKET RD & DIVISION ST** | TWSC | ≤ 1.00 | 0.14/0.12 | B/C | 13.4/17.2 |
| **REED MARKET RD & 3RD ST** | Signalized | ≤ 1.00 | **1.05** | F | 92.3 |

30HV = 30th highest hour; LOS = level of service; NA = not applicable; NB = northbound; TWSC = two-way stop-controlled; V/C = volume to capacity.

**Bold and red** indicate a failure to meet the mobility target.

[A] Existing conditions are results from the US 97 Parkway Plan.

[B] V/C ratio is reported as overall intersection V/C ratio at signalized intersections, worse case approach V/C at roundabouts, and V/C ratio for Major Street/Minor Street at TWSC (two-way stop-controlled) intersections.

[C] Level of service (LOS) is reported as the worst case major street LOS/minor street LOS for TWSC intersections, worst case approach LOS for roundabouts, and overall intersection LOS for signalized intersections.

[D] Control delay is reported for the worst case major street/minor street for TWSC intersections, worst case approach delay for roundabouts, and overall intersection delay for signalized intersections.

[F] ODOT adopted an alternative mobility target for this intersection as part of the US 97 Parkway Plan. It should be a maximum V/C of 0.90 during the 30 HV, and 95th percentile queues cannot extend into the portion of the exit ramp needed for deceleration.

[G] The 3rd Street/Brosterhous Road intersection is not included in the table as it was not analyzed in the US 97 Parkway Plan.

[5] LOS is based on delay and ranges from LOS A to LOS F, similar to a report card rating.

[6] The City of Bend mobility targets are based on the average weekday volume.

Figure 3 on the following page summarizes the observed queueing within the study area. A detailed description of operations based on an analysis conducted for previous studies and field observations in August 2022 at each intersection is included in the following sections. Each deficiency creates localized problems that collectively are compounded, sometimes spilling into each other, resulting in a significant east-west bottleneck that restricts access to much of southern Bend.

Additionally, the Reed Market Road corridor congestion limits the interchange's ability to function adequately, leading to queue spillback onto the Parkway. This is not only a major safety concern, but in the long term will be the most critical bottleneck in the southern half of the Parkway. This may be worsened when adjacent Parkway access ramps such as Truman Avenue and Reed Lane are closed, diverting additional traffic to Reed Market Road.

### REED MARKET ROAD AT BROOKSWOOD BOULEVARD

According to the Bend TSP, the Reed Market Road/Brookswood Boulevard roundabout experienced heavy traffic demand during the evening peak hour that led to queue spillback on all approaches. Given that this intersection is a roundabout, the queues operated as slow (less than 5 mph) rolling queues instead of completely standstill queues. The queues from this intersection spilled back through several intersections on Reed Market Road and Bond Street. Given the severe queueing observed at this intersection, it is likely that some drivers may attempt to bypass the congestion by using the local streets as an alternative route, impacting neighborhood livability. The intersection operations results from the US 97 Parkway Plan indicated this roundabout operates at capacity during average weekday conditions, likely because the intersection serves commuters in both the southbound and eastbound direction.

A pilot test was conducted for the City at this intersection in March 2020 to evaluate the ability of roundabout meters to improve operations. The pilot test used a set of temporary traffic signals to control the roundabout and collected weekday morning and evening peak queuing and volume data over four days. A microsimulation analysis was performed prior to the field work to determine appropriate signal timing for the metering.

The pilot test results indicate the metering produced no adverse safety outcomes, but intersection capacities remained essentially the same with or without the metering system. However, metering signals were found to be generally beneficial in reducing queuing during the peak periods, especially during the morning peak. The evening peak is challenging because of the simultaneous heavy surges on southbound Bond Street and eastbound Reed Market Road, where metering needs to begin early enough to prevent queues from growing too quickly. Also, design details and metering signal logic require further investigation to avoid unintentionally long queues. Because of these challenges, the City did not pursue the installation of roundabout meters and is moving forward to explore other alternatives as part of this study.

**FIGURE 3. QUEUEING PATTERNS ALONG REED MARKET ROAD**

In August of 2022, excessive queuing was observed, and the queues spilled back into multiple other intersections as shown in Figure 3. Significant queue spillback was observed on all approaches, especially in the eastbound and westbound directions on Reed Market Road and southbound on Bond Street. The queues observed in the field in 2022 were slightly worse than what was observed in 2017 during the US 97 Parkway Plan development.

### REED MARKET ROAD AT US 97 SOUTHBOUND RAMP

According to the US 97 Parkway Plan, the US 97 southbound ramp terminal fails to meet the mobility target with a V/C ratio of 0.95 (greater than the 0.85 V/C target). Additionally, the high volume at the intersection resulted in southbound right turns spilling back and blocking access to the left-turn lane. However, the back of the queue did not spill back into the space needed for vehicles to safely exit the US 97 mainline and decelerate to a stop, also known as the *safe stopping distance*.

These results are consistent with what was observed in the field in August 2022. In addition, inefficient lane use utilization on the southbound ramp was observed. Many vehicles were observed queuing in the outside turn lane (i.e., left-through-right lane) to perform the left-turn movement, likely in order to make an eastbound right turn at Division Street. Additionally, the efficiency of the signal was reduced, as southbound right-turning and westbound through vehicles were unable to move through the intersection due to queue spillback from the Reed Market Road/Brookswood Boulevard roundabout.

### REED MARKET ROAD AT US 97 NORTHBOUND RAMP

Results from the US 97 Parkway Plan indicate that high volumes of traffic on Reed Market Road at this intersection result in northbound right-turn vehicles spilling back into the segment of the exit ramp needed for safe deceleration and stopping, indicating a safety concern.

This queue spillback was not observed in August 2022. More recent observations indicate limited left-turn sight distance and high volumes along Reed Market Road, making the northbound left turn a challenging movement. The challenging northbound left turn leads to significant delays, but queuing was relatively limited due to the low observed traffic volume. This could be an indicator of drivers choosing to use a different exit on the Parkway.

### REED MARKET ROAD AT DIVISION STREET

As listed in Table 1 above, the Reed Market Road at Division Street intersection meets adopted mobility targets. Additionally, the northbound Division Street ramp that merges onto US 97 operates with a V/C ratio of 0.54, meeting the mobility target of 0.85.

Around 600 vehicles were counted in 2022 that made an eastbound right turn at this intersection, as drivers try to avoid congestion at the signal at the 3rd Street/Reed Market Road intersection. Queue spillback from 3rd Street/Reed Market Road frequently blocked this intersection.

### REED MARKET ROAD AT 3RD STREET

According to the US 97 Parkway Plan, travel demand exceeds the capacity of this intersection during peak summer conditions, with congestion on nearly all approaches. This intersection is at the confluence of two major arterial roadways in Bend and serves high traffic volumes on all approaches.

This is consistent with observations in August 2022. The traffic signal has shared left and through traffic lanes, which requires the use of less-efficient split-phase signal timing (which does not allow eastbound and westbound through traffic to run at the same time). Ongoing construction of a new commercial building on the northwest corner of the intersection and existing commercial buildings on the southwest and southeast corners may limit the feasibility of expanding the intersection footprint due to high land acquisition costs. The signal does operate with a leading pedestrian interval on the east and west leg crosswalks, allowing pedestrians to enter the crosswalk prior to right turning vehicles.

### 3RD STREET AT BROSTERHOUS ROAD

This intersection was not analyzed extensively in previous studies. From field observations in August 2022, congestion at this intersection was generally limited. However, the intersection operates with shared left-through lanes, an atypical configuration, and permissive left turns on the eastbound and westbound approaches, causing delay for through movements and increasing conflicts between drivers and people walking at the intersection. The City is currently contracting a project to evaluate a lane reconfiguration for the eastbound and westbound approaches to provide protected eastbound left turns and improve safety.

## CONDITIONS FOR PEOPLE WALKING, BICYCLING, AND TAKING TRANSIT

Walking and bicycling facilities (primarily sidewalks and on-street bike lanes) are consistently provided within the study area. Sidewalks exist on both sides of nearly all major study area streets, while a relatively complete network exists on one or both sides of surrounding residential streets. Except for limited segments of Reed Market Road, most sidewalks along the study area street network are curb-tight with widths ranging between five and seven feet.

Marked pedestrian crossings primarily exist at the intersections of major streets. Along the segment of Reed Market Road within the study area, distances between marked crossings range from approximately 750 feet to 1,500 feet, with crossing treatments varying by location (e.g., transverse or continental markings, supplemental signage, and/or signalization). Marked crossings include controlled crossings at the signalized intersections and an enhanced crossing (median island) at Chamberlain Street.

Crossing opportunities along US 97 are limited to the Reed Market Road overcrossing, with the nearest adjacent crossings located at Wilson Avenue (an overcrossing approximately 2,400 feet to the north) and the canal (an undercrossing approximately 1,700 feet to the south). Along 3rd Street, there are controlled crossings at Reed Market Road and Division Street/Brosterhous Road, and an enhanced crossing with a rectangular rapid-flashing beacon (RRFB) at the canal.

Bicycle facilities generally consist of on-street bike lanes in various forms. Conventional bike lanes exist along the entirety of Reed Market Road, Division Street, Brookswood Boulevard, and Bond Street within the study area. Conventional bike lanes with fading red pavement surface application exist along US 97 and on the Reed Market Road interchange ramps. Immediately west of the Brookswood roundabout, the Reed Market Road bike lanes transition to raised bike lanes (with faded red pavement surface application). At the study area's east end, buffered bike lanes exist along 3rd Street. At most locations, bike lane widths range from five to six feet, while buffers typically measure about two feet wide. Shared roadway environments exist on all other study area streets.

Figures 4 and 5 depict typical walking and bicycling conditions within the study area. During field observations, deteriorating surface conditions were observed along some sidewalk and bike lane segments, including uneven walking surfaces, pavement cracking, and fading surface application on colored bike lane segments.

The 2022 study area intersection turning movement counts included people walking and bicycling while using the crosswalk and were collected on a hot, sunny day. In general, less than 10 people were observed crossing any leg of the study intersections during the weekday p.m. peak hour. The low pedestrian volume may have been influenced by the heat on the day of the counts. Micromobility travel modes (i.e., scooter, e-bike) were observed in the study area during the evening peak hour.

**FIGURE 4. BICYCLING (LEFT) AND WALKING (RIGHT) FACILITIES ON REED MARKET ROAD**

**FIGURE 5. REED MARKET ROAD/BROOKSWOOD BOULEVARD ROUNDABOUT BIKE LANE**

## LEVEL OF TRAFFIC STRESS (LTS)

Bicycle and Pedestrian Level of Traffic Stress (LTS) was evaluated in the US 97 Parkway Plan and the Bend TSP to measure the level of comfort for people walking and bicycling. The LTS analysis scored roadway segments based on characteristics such as motor vehicle traffic volumes and speeds, presence of walking and bicycling facilities, and degree of separation between motorized and nonmotorized users. The possible scores range from 1 to 4, with 1 representing the lowest stress and 4 representing the highest stress.

Table 2 and 3 present LTS analyses provided by the City for both study intersections and segments within the study area. Key findings from the LTS analysis provided by the City and LTS analysis documented in the US 97 Parkway Plan include the following:

- The US 97 mainline is a high-stress facility due to the close proximity of the Bend Parkway walking and bicycling facilities relative to adjacent high-speed traffic.
- Reed Market Road is identified as a high-stress roadway (Bicycle LTS 3) east of the US 97 southbound ramp.
- Division Street is identified as a high-stress roadway (Pedestrian LTS 3) in the study area.
- The US 97 northbound ramp terminal intersection is identified a high-stress crossing location (Bicycle and Pedestrian LTS 3).
- The Reed Market Road and Division Street intersection is identified as high stress (Bicycle and Pedestrian LTS 4).

**TABLE 2. 2022 STUDY INTERSECTIONS LEVEL OF STRESS**

| INTERSECTION | PEDESTRIAN LTS | BICYCLE LTS |
|---|---|---|
| REED MARKET RD & BROOKSWOOD BLVD | 4 | 3 |
| REED MARKET RD & US 97 SB | 1 | 4 |
| REED MARKET RD & US 97 NB | 3 | 4 |
| REED MARKET RD & DIVISION ST | 4 | 4 |
| REED MARKET RD & 3RD ST | 1 | 4 |
| 3RD ST & BROSTERHOUS RD | 1 | 4 |

LTS = level of traffic stress; NB = northbound; SB = southbound.

**TABLE 3. 2022 SEGMENT LEVEL OF STRESS WITHIN THE STUDY AREA**

| ROADWAY | SEGMENT | PEDESTRIAN LTS | BICYCLE LTS |
|---|---|---|---|
| 3RD STREET | North of Reed Market Rd | 3 | 2 |
| | South of Reed Market Rd | 3 | 2 |
| | South of Brosterhous Rd/Division St | 3 | 2 |
| REED MARKET ROAD | East of 3rd St | EB=1; WB=3 | 3 |
| | Between Divison St & 3rd St | 4 | 3 |
| | Between US 97 NB & Division St | 3 | 3 |
| | Between US 97 NB and US 97 SB | 3 | 3 |
| | Between US 97 SB & Brookswood Blvd | EB=2; WB=1 | 2 |
| DIVISION ST | South of Reed Market Rd | 3 | 2 |
| BROSTERHOUS RD | East of 3rd St | 4 | SB=2; NB=3 |

EB = eastbound; LTS = level of traffic stress; NB = northbound; SB = southbound; WB = westbound.

Figure 6 depicts a few elements of the street network in the study area that make conditions more challenging for people walking and biking (from left to right):

- The westbound right-turn lane drop at the southbound ramp terminal crosses the bicycle lane after a grade change/crest, with limited warning to drivers.
- A long pedestrian crossing at the US 97 northbound ramp terminal that is unsignalized and unmarked.

**FIGURE 6. CHALLENGING WALKING AND BICYCLING CROSSINGS ALONG REED MARKET ROAD CORRIDOR**

According to the Bend TSP, both 3rd Street and SW Chamberlain Street are identified as key walking/bicycling routes and are designated as part of Bend's Low-Stress Network. This section of 3rd Street was designated as a low-stress route because there is no alternate north-south route between Reed Lane and Cleveland Avenue. These corridors are intended to serve bicycle riders of all ages and abilities and could benefit from enhancements to improve their LTS.

Figure 7 summarizes challenges for people walking and bicycling in the study area. Providing frequent low-stress active transportation crossings of US 97 was a strategy that scored very well relative to the US 97 Parkway Plan's goals and objectives. As a result, improving active transportation facilities along Reed Market Road and the overcrossing was ranked as a Tier 2 priority, primarily due to safety issues and demand to use the corridor.

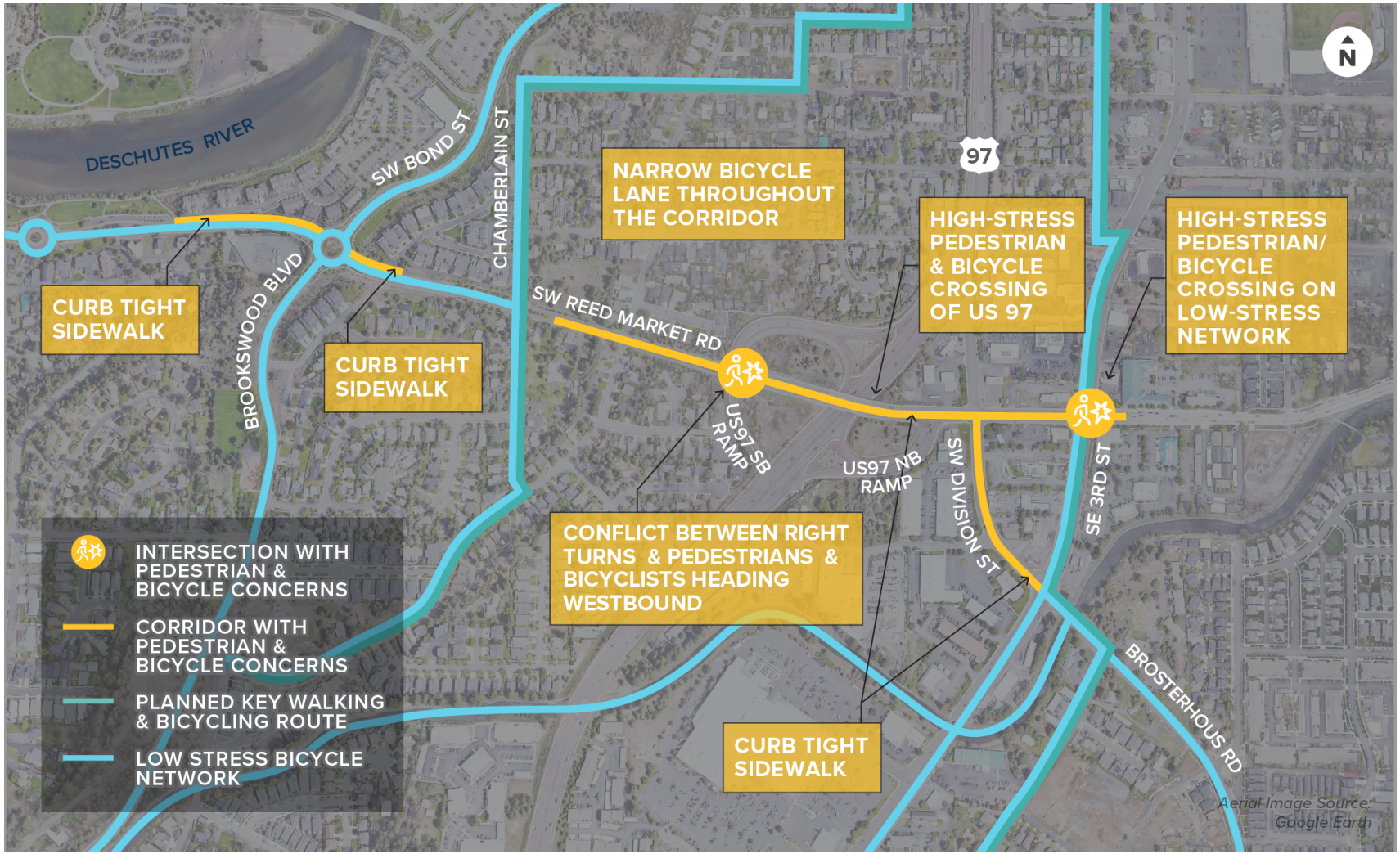



**FIGURE 7. SUMMARY OF CONDITIONS FOR PEOPLE WALKING AND BIKING**

## TRANSIT CONDITIONS

Public transportation in and around the study area is provided by Cascades East Transit (CET) through fixed-route service, inter-city bus service, and recreational shuttle service. As shown in Figure 8, the South 3rd Street (Route 1) and Brookswood (Route 2) lines are two transit routes that pass through the study area in the north-south direction.

The South 3rd Street route has four stops within the study area between Cleveland Road and Division Street. One set of stops is located just south of 3rd Street/Reed Market Road, and another set is just south of 3rd Street/Cleveland Avenue. Controlled, marked crosswalks to access those stops are provided at the 3rd Street/Reed Lane and 3rd Street/Brosterhous Road signals. The crossing between the stops near Cleveland Avenue is uncontrolled and unmarked but can be accessed via the 3rd Street/Reed Market Road signal or the 3rd Street/Roosevelt Avenue enhanced (RRFB) crosswalk.

The Brookswood route has stops north and south of the Reed Market Road/Brookswood Boulevard roundabout. Marked crosswalks to access the stops are provided on each leg of the roundabout. Previous studies indicate the congestion issues at the Reed Market Road/Brookswood Boulevard roundabout impact transit service reliability, particularly during the evening peak hour.

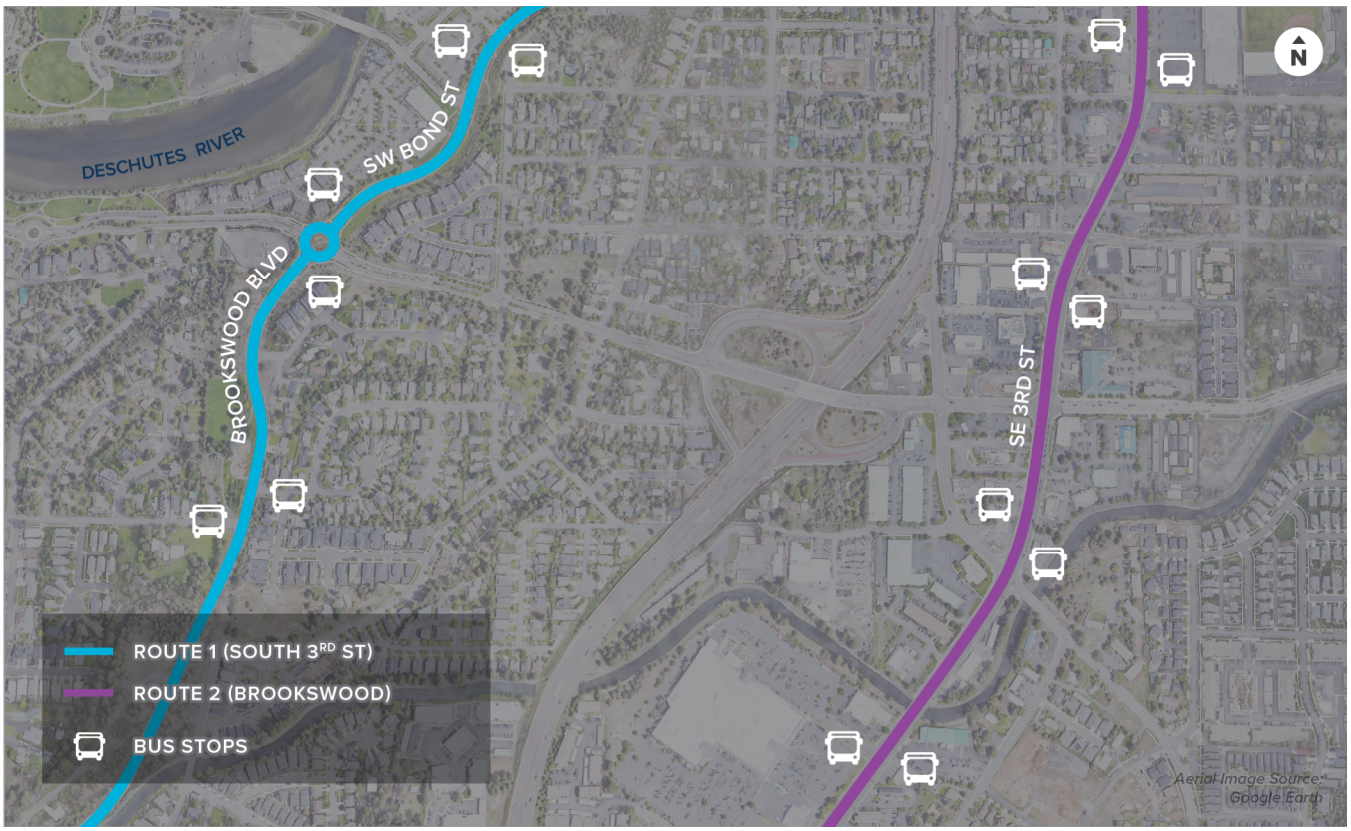



**FIGURE 8. TRANSIT ROUTES WITHIN THE STUDY AREA**

Table 4 provides ridership data for Route 1 and 2 for 2019 and for nine months (January to October) in 2022 from CET. In 2019, Route 1 had the second highest ridership per route, and Route 2 had the third lower ridership per route among the eight transit routes in Bend. While the 2022 data only includes 10 months, Route 1 was the highest ridership route and Route 2 was the second lowest ridership route. In addition, ridership over the past two years has decreased significantly due to the impacts of COVID-19. According to CET 2040 Transit Master Plan[7] published in 2020, Route 1 had the highest ridership in the system with a productivity of 16.7 rides per hour, where Route 2 had a productivity of 8.6 rides per hour.

**TABLE 4. CASCADES EAST TRANSIT RIDERSHIP DATA**

| YEAR | ANNUAL RIDERSHIP | |
|---|---|---|
| | ROUTE 1 | ROUTE 2 |
| 2019 | 66,000 | 27,000 |
| 2022 | 24,000 (10 months) | 11,000 (10 months) |

## SAFETY AND ACCESS

The safety analysis from the US 97 Parkway Plan, Bend TSP, and TSAP analyzed crash data from 2011 to 2016. The data were used to analyze crash patterns and calculate critical crash rates to flag intersections and segments along the US 97 corridor as safety-focus locations. Within the Reed Market Road study area, the Reed Market Road/US 97 northbound ramps intersection was flagged as a safety focus area, as the intersection has a crash rate (0.62) much greater than the critical (0.35) and 90$^{th}$ percentile (0.29) crash rates. In addition, the TSAP utilizes Equivalent Property Damage Only screening to measure the safety performance of the study intersections as it captures the overall frequency and severity of collisions. The intersection of Reed Market Road/3$^{rd}$ Street was listed in the Top 25 critical locations in the City.

Figure 9 presents the summary of safety issues and risk factors within the study area. At the US 97 southbound ramp, safety risk factors for people walking and biking include the narrow on-street walking and biking facilities and the westbound lane drop at the US 97 southbound ramp conflict with the westbound bicycle lane. Also, there is anecdotal observations that the westbound right turn onto US 97 southbound ramp is a challenging movement for heavy vehicles to make, given the topography. Figure 10 shows a large vehicle utilizing the narrow bike lane to help make a right turn at the intersection.

[7] Cascades East Transit 2040 Transit Master Plan, Cascades East Transit, August 2020

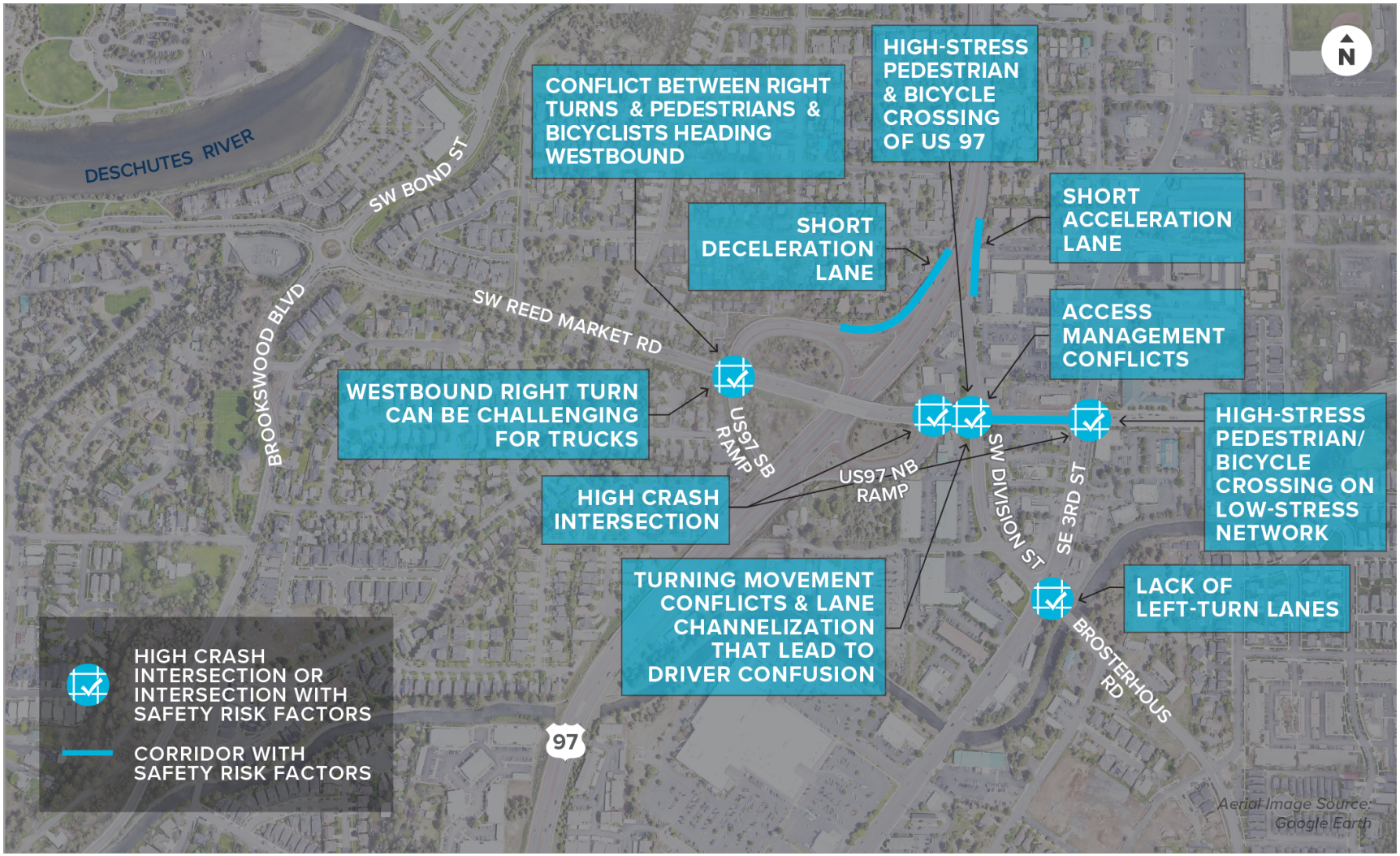



**FIGURE 9. SUMMARY OF SAFETY ISSUES**

**FIGURE 10. HEAVY VEHICLE MAKING A RIGHT TURN TO THE US 97 SOUTHBOUND RAMP**

Other key safety risk factors within the study area include the following:

- The north leg of Division Street/Reed Market Road serves as the US 97 northbound entrance ramp but allows for two-way traffic to serve local properties, which creates turning movement conflicts on the ramp. It also creates a speed differential between vehicles accelerating to merge onto US 97 and vehicles slowing down to access businesses.
- There are numerous driveways and access management conflicts between the US 97 northbound ramp terminal and 3rd Street along Reed Market Road.
- 3rd Street/Brosterhous Road is a skewed intersection with sight distance issues for eastbound and westbound vehicles. Eastbound and westbound permissive left turns also increase the number of conflicts between drivers and people walking.
- Two ramps at the Reed Market Road interchange have short deceleration and acceleration lanes that fail to meet Oregon Department of Transportation Highway Design Manual minimum length requirements, resulting in less-than-standard distances to safely accelerate and decelerate.
- There is limited sight distance for the northbound left-turning movement at the US 97 northbound ramp.
- There are traffic separators (narrowed raised medians) along Reed Market Road between the US 97 northbound ramp and Division Street, leaving drivers to interpret the legitimacy of left-turning movements.

- Many of the study area intersections have no or minimal illumination, making visibility challenging at night, especially for people walking and biking.

In addition to the summary of key safety issues from prior studies, Table 5 below lists the most recent available five years of crash data for the study intersections. The 3rd Street/ Brosterhous Road intersection has the most total crashes between 2016 and 2020. The City is currently contracting a project to evaluate a lane reconfiguration for the eastbound and westbound approaches to provide protected eastbound left turns and improve safety at this intersection. Several crashes within the study area are not captured in this table as they did not occur at study intersections. For example, there was a severe-injury crash located along 3rd Street between Reed Market Road and Brosterhous Road.

**TABLE 5. SUMMARY OF MOST RECENT CRASH DATA (2016-2020)**

| INTERSECTION | TOTAL CRASHES | FATAL OR SEVERE INJURY CRASHES | PEDESTRIAN OR BICYCLE CRASHES | MOST COMMON CRASH TYPE(S) | MOST COMMON CRASH CAUSE(S) |
|---|---|---|---|---|---|
| **REED MARKET RD & BROOKSWOOD BLVD** | 12 | 0 | 0 | Rear-end (67%)<br>Angle (17%)* | Failure to avoid (42%)<br>Following too closely (25%) |
| **REED MARKET RD & US 97 SB** | 16 | 0 | 0 | Rear-end (63%)<br>Turning movement (25%) | Failure to avoid (38%)<br>Too fast for conditions (25%)<br>Following too closely (19%) |
| **REED MARKET RD & US 97 NB** | 4 | 0 | 0 | Turning movement (50%) | NA |
| **REED MARKET RD & DIVISION ST** | 15 | 1 | 0 | Angle (53%)<br>Turning movement (27%) | No yielding (40%) |
| **REED MARKET RD & 3RD ST** | 10 | 0 | 1 | Rear-end (50%)<br>Angle (40%) | Disregarded signal (40%)<br>Failure to avoid (30%) |
| **3RD ST & BROSTERHOUS RD** | 25 | 1 | 1 | Turning movement (52%)<br>Rear-end (24%) | Failure to yield (28%)<br>Disregard signal (24%) |

* While reported as "angle" crashes, these were likely more similar to sideswipe crashes at the roundabout.

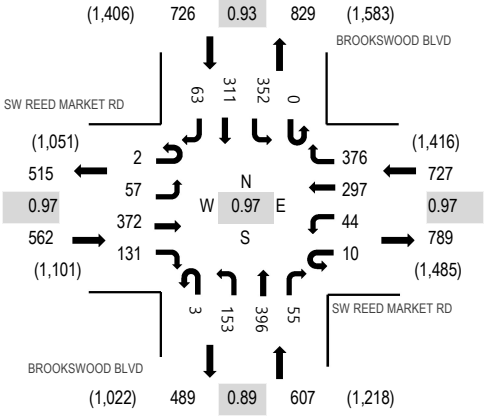
# APPENDIX A: TRAFFIC COUNTS

ALL TRAFFIC DATA SERVICES
(303) 216-2439
www.alltrafficdata.net

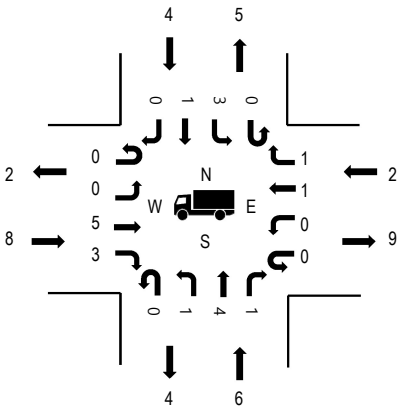
**Location:** 1 BROOKSWOOD BLVD & SW REED MARKET RD PM
**Date:** Wednesday, August 3, 2022
**Peak Hour:** 04:50 PM - 05:50 PM
**Peak 15-Minutes:** 04:55 PM - 05:10 PM

## Peak Hour

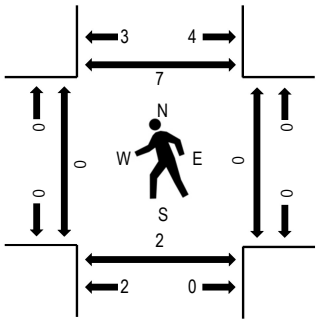
### Motorized Vehicles




### Heavy Vehicles




### Pedestrians




Note: Total study counts contained in parentheses.

| | HV% | PHF |
|---|---|---|
| EB | 1.4% | 0.97 |
| WB | 0.3% | 0.97 |
| NB | 1.0% | 0.89 |
| SB | 0.6% | 0.93 |
| All | 0.8% | 0.97 |

## Traffic Counts - Motorized Vehicles

| Interval Start Time | SW REED MARKET RD Eastbound | | | | SW REED MARKET RD Westbound | | | | BROOKSWOOD BLVD Northbound | | | | BROOKSWOOD BLVD Southbound | | | | | Rolling Hour |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | Total | |
| 4:00 PM | 0 | 3 | 25 | 16 | 1 | 4 | 21 | 37 | 0 | 17 | 31 | 7 | 0 | 30 | 30 | 6 | 228 | 2,544 |
| 4:05 PM | 0 | 2 | 30 | 13 | 0 | 7 | 27 | 31 | 0 | 13 | 21 | 8 | 0 | 25 | 26 | 6 | 209 | 2,533 |
| 4:10 PM | 0 | 6 | 24 | 18 | 1 | 10 | 25 | 16 | 0 | 18 | 26 | 4 | 1 | 20 | 32 | 4 | 205 | 2,559 |
| 4:15 PM | 0 | 2 | 27 | 15 | 2 | 10 | 16 | 26 | 0 | 17 | 25 | 4 | 0 | 28 | 26 | 4 | 202 | 2,568 |
| 4:20 PM | 0 | 3 | 30 | 9 | 1 | 4 | 21 | 30 | 0 | 12 | 34 | 3 | 0 | 28 | 31 | 4 | 210 | 2,587 |
| 4:25 PM | 1 | 4 | 27 | 17 | 1 | 7 | 26 | 38 | 0 | 16 | 17 | 4 | 0 | 31 | 18 | 4 | 211 | 2,603 |
| 4:30 PM | 0 | 7 | 27 | 14 | 1 | 3 | 26 | 32 | 1 | 9 | 23 | 4 | 1 | 34 | 24 | 3 | 209 | 2,604 |
| 4:35 PM | 1 | 4 | 25 | 16 | 0 | 4 | 22 | 20 | 0 | 21 | 35 | 4 | 0 | 21 | 26 | 3 | 202 | 2,609 |
| 4:40 PM | 0 | 5 | 30 | 11 | 0 | 3 | 25 | 29 | 1 | 18 | 40 | 2 | 0 | 34 | 19 | 3 | 220 | 2,620 |
| 4:45 PM | 0 | 5 | 35 | 12 | 0 | 3 | 26 | 26 | 1 | 17 | 34 | 4 | 0 | 24 | 26 | 1 | 214 | 2,617 |
| 4:50 PM | 1 | 6 | 28 | 9 | 1 | 6 | 24 | 21 | 1 | 11 | 41 | 5 | 0 | 30 | 21 | 4 | 209 | 2,622 |
| 4:55 PM | 0 | 5 | 30 | 8 | 0 | 0 | 22 | 38 | 2 | 13 | 36 | 1 | 0 | 36 | 33 | 1 | 225 | 2,614 |
| 5:00 PM | 0 | 4 | 28 | 15 | 1 | 4 | 23 | 36 | 0 | 14 | 28 | 5 | 0 | 30 | 24 | 5 | 217 | 2,597 |
| 5:05 PM | 0 | 3 | 37 | 15 | 1 | 4 | 28 | 30 | 0 | 15 | 40 | 6 | 0 | 24 | 28 | 4 | 235 | |
| 5:10 PM | 0 | 6 | 16 | 13 | 2 | 4 | 20 | 33 | 0 | 18 | 36 | 5 | 0 | 36 | 23 | 2 | 214 | |
| 5:15 PM | 0 | 3 | 37 | 11 | 0 | 3 | 27 | 29 | 0 | 10 | 30 | 5 | 0 | 34 | 27 | 5 | 221 | |
| 5:20 PM | 1 | 6 | 31 | 10 | 2 | 2 | 27 | 36 | 0 | 5 | 38 | 3 | 0 | 32 | 24 | 9 | 226 | |
| 5:25 PM | 0 | 5 | 35 | 8 | 0 | 3 | 17 | 36 | 0 | 13 | 26 | 5 | 0 | 26 | 32 | 6 | 212 | |
| 5:30 PM | 0 | 8 | 28 | 11 | 0 | 4 | 24 | 31 | 0 | 9 | 29 | 5 | 0 | 28 | 30 | 7 | 214 | |
| 5:35 PM | 0 | 4 | 40 | 8 | 0 | 3 | 38 | 24 | 0 | 10 | 29 | 5 | 0 | 25 | 19 | 8 | 213 | |
| 5:40 PM | 0 | 3 | 30 | 14 | 2 | 5 | 20 | 34 | 0 | 20 | 29 | 5 | 0 | 27 | 22 | 6 | 217 | |
| 5:45 PM | 0 | 4 | 32 | 9 | 1 | 6 | 27 | 28 | 0 | 15 | 34 | 5 | 0 | 24 | 28 | 6 | 219 | |
| 5:50 PM | 0 | 2 | 21 | 10 | 0 | 4 | 21 | 29 | 1 | 19 | 38 | 3 | 0 | 20 | 25 | 8 | 201 | |
| 5:55 PM | 0 | 8 | 18 | 16 | 0 | 2 | 25 | 26 | 0 | 19 | 37 | 3 | 0 | 25 | 18 | 11 | 208 | |
| Count Total | 4 | 108 | 691 | 298 | 17 | 105 | 578 | 716 | 7 | 349 | 757 | 105 | 2 | 672 | 612 | 120 | 5,141 | |
| Peak Hour | 2 | 57 | 372 | 131 | 10 | 44 | 297 | 376 | 3 | 153 | 396 | 55 | 0 | 352 | 311 | 63 | 2,622 | |

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

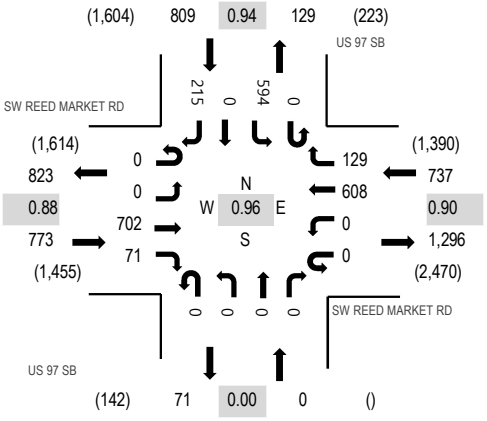
| Interval Start Time | Heavy Vehicles | | | | | Interval Start Time | Bicycles on Roadway | | | | | Interval Start Time | Pedestrians/Bicycles on Crosswalk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | EB | NB | WB | SB | Total | | EB | NB | WB | SB | Total | | EB | NB | WB | SB | Total |
| 4:00 PM | 1 | 1 | 1 | 2 | 5 | 4:00 PM | 0 | 0 | 1 | 0 | 1 | 4:00 PM | 0 | 0 | 0 | 0 | 0 |
| 4:05 PM | 0 | 0 | 1 | 3 | 4 | 4:05 PM | 0 | 0 | 0 | 1 | 1 | 4:05 PM | 0 | 0 | 0 | 1 | 1 |
| 4:10 PM | 1 | 1 | 0 | 0 | 2 | 4:10 PM | 0 | 0 | 0 | 0 | 0 | 4:10 PM | 0 | 0 | 0 | 0 | 0 |
| 4:15 PM | 0 | 0 | 0 | 0 | 0 | 4:15 PM | 0 | 0 | 0 | 0 | 0 | 4:15 PM | 0 | 0 | 0 | 1 | 1 |
| 4:20 PM | 2 | 0 | 0 | 2 | 4 | 4:20 PM | 0 | 0 | 1 | 2 | 3 | 4:20 PM | 0 | 0 | 0 | 0 | 0 |
| 4:25 PM | 1 | 0 | 0 | 0 | 1 | 4:25 PM | 0 | 0 | 0 | 0 | 0 | 4:25 PM | 0 | 0 | 0 | 0 | 0 |
| 4:30 PM | 1 | 0 | 0 | 1 | 2 | 4:30 PM | 0 | 0 | 0 | 0 | 0 | 4:30 PM | 0 | 0 | 0 | 0 | 0 |
| 4:35 PM | 1 | 1 | 2 | 0 | 4 | 4:35 PM | 0 | 0 | 0 | 0 | 0 | 4:35 PM | 0 | 0 | 0 | 3 | 3 |
| 4:40 PM | 0 | 1 | 1 | 0 | 2 | 4:40 PM | 0 | 0 | 0 | 0 | 0 | 4:40 PM | 0 | 0 | 0 | 0 | 0 |
| 4:45 PM | 0 | 0 | 0 | 1 | 1 | 4:45 PM | 1 | 2 | 0 | 0 | 3 | 4:45 PM | 0 | 0 | 0 | 0 | 0 |
| 4:50 PM | 1 | 0 | 0 | 0 | 1 | 4:50 PM | 1 | 0 | 0 | 0 | 1 | 4:50 PM | 0 | 0 | 0 | 2 | 2 |
| 4:55 PM | 1 | 0 | 0 | 0 | 1 | 4:55 PM | 0 | 1 | 1 | 0 | 2 | 4:55 PM | 0 | 0 | 0 | 0 | 0 |
| 5:00 PM | 2 | 1 | 0 | 1 | 4 | 5:00 PM | 0 | 0 | 0 | 0 | 0 | 5:00 PM | 0 | 0 | 0 | 1 | 1 |
| 5:05 PM | 0 | 0 | 1 | 0 | 1 | 5:05 PM | 0 | 0 | 0 | 0 | 0 | 5:05 PM | 0 | 0 | 0 | 1 | 1 |
| 5:10 PM | 1 | 0 | 0 | 0 | 1 | 5:10 PM | 0 | 0 | 0 | 1 | 1 | 5:10 PM | 0 | 2 | 0 | 0 | 2 |
| 5:15 PM | 3 | 1 | 0 | 0 | 4 | 5:15 PM | 0 | 0 | 0 | 0 | 0 | 5:15 PM | 0 | 0 | 0 | 2 | 2 |
| 5:20 PM | 0 | 1 | 0 | 0 | 1 | 5:20 PM | 0 | 0 | 0 | 0 | 0 | 5:20 PM | 0 | 0 | 0 | 0 | 0 |
| 5:25 PM | 0 | 0 | 0 | 1 | 1 | 5:25 PM | 1 | 0 | 1 | 1 | 3 | 5:25 PM | 0 | 0 | 0 | 2 | 2 |
| 5:30 PM | 0 | 1 | 0 | 1 | 2 | 5:30 PM | 0 | 0 | 2 | 1 | 3 | 5:30 PM | 0 | 0 | 0 | 1 | 1 |
| 5:35 PM | 0 | 0 | 0 | 1 | 1 | 5:35 PM | 0 | 0 | 0 | 1 | 1 | 5:35 PM | 0 | 0 | 0 | 1 | 1 |
| 5:40 PM | 0 | 0 | 1 | 0 | 1 | 5:40 PM | 1 | 0 | 0 | 0 | 1 | 5:40 PM | 0 | 0 | 0 | 0 | 0 |
| 5:45 PM | 0 | 2 | 0 | 0 | 2 | 5:45 PM | 0 | 0 | 0 | 0 | 0 | 5:45 PM | 0 | 0 | 0 | 0 | 0 |
| 5:50 PM | 0 | 0 | 0 | 0 | 0 | 5:50 PM | 0 | 0 | 0 | 0 | 0 | 5:50 PM | 0 | 0 | 0 | 3 | 3 |
| 5:55 PM | 1 | 0 | 0 | 1 | 2 | 5:55 PM | 0 | 0 | 0 | 2 | 2 | 5:55 PM | 0 | 0 | 0 | 2 | 2 |
| Count Total | 16 | 10 | 7 | 14 | 47 | Count Total | 4 | 3 | 6 | 9 | 22 | Count Total | 0 | 2 | 0 | 20 | 22 |
| Peak Hour | 8 | 6 | 2 | 4 | 20 | Peak Hour | 3 | 1 | 4 | 4 | 12 | Peak Hour | 0 | 2 | 0 | 10 | 12 |

ALL TRAFFIC DATA SERVICES
(303) 216-2439
www.alltrafficdata.net

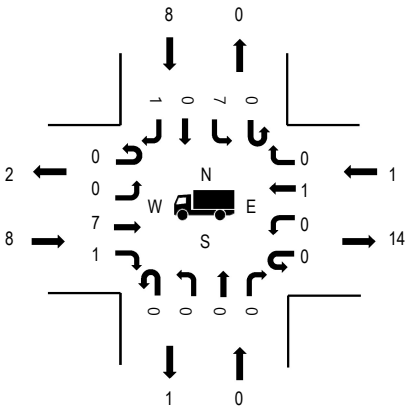
**Location:** 2 US 97 SB & SW REED MARKET RD PM
**Date:** Wednesday, August 3, 2022
**Peak Hour:** 04:50 PM - 05:50 PM
**Peak 15-Minutes:** 05:00 PM - 05:15 PM

## Peak Hour

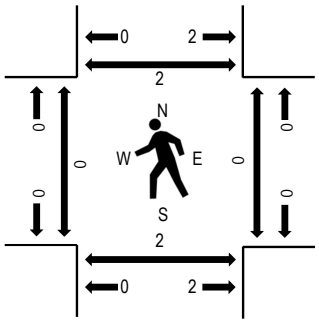
### Motorized Vehicles




### Heavy Vehicles




### Pedestrians




Note: Total study counts contained in parentheses.

| | HV% | PHF |
|---|---|---|
| EB | 1.0% | 0.88 |
| WB | 0.1% | 0.90 |
| NB | 0.0% | 0.00 |
| SB | 1.0% | 0.94 |
| All | 0.7% | 0.96 |

## Traffic Counts - Motorized Vehicles

| Interval Start Time | SW REED MARKET RD Eastbound | | | | SW REED MARKET RD Westbound | | | | US 97 SB Northbound | | | | US 97 SB Southbound | | | | | Rolling Hour |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | Total | |
| 4:00 PM | 0 | 0 | 53 | 2 | 0 | 0 | 41 | 11 | 0 | 0 | 0 | 0 | 0 | 58 | 0 | 17 | 182 | 2,171 |
| 4:05 PM | 0 | 0 | 65 | 7 | 0 | 0 | 52 | 7 | 0 | 0 | 0 | 0 | 0 | 39 | 0 | 13 | 183 | 2,212 |
| 4:10 PM | 0 | 0 | 56 | 7 | 0 | 0 | 33 | 4 | 0 | 0 | 0 | 0 | 0 | 63 | 0 | 18 | 181 | 2,212 |
| 4:15 PM | 0 | 0 | 48 | 4 | 0 | 0 | 43 | 6 | 0 | 0 | 0 | 0 | 0 | 51 | 0 | 21 | 173 | 2,232 |
| 4:20 PM | 0 | 0 | 69 | 8 | 0 | 0 | 57 | 9 | 0 | 0 | 0 | 0 | 0 | 41 | 0 | 14 | 198 | 2,252 |
| 4:25 PM | 0 | 0 | 50 | 8 | 0 | 0 | 50 | 7 | 0 | 0 | 0 | 0 | 0 | 48 | 0 | 30 | 193 | 2,257 |
| 4:30 PM | 0 | 0 | 52 | 1 | 0 | 0 | 61 | 3 | 0 | 0 | 0 | 0 | 0 | 51 | 0 | 17 | 185 | 2,249 |
| 4:35 PM | 0 | 0 | 46 | 9 | 0 | 0 | 45 | 9 | 0 | 0 | 0 | 0 | 0 | 44 | 1 | 24 | 178 | 2,260 |
| 4:40 PM | 0 | 0 | 49 | 5 | 0 | 0 | 40 | 6 | 0 | 0 | 0 | 0 | 0 | 47 | 0 | 23 | 170 | 2,290 |
| 4:45 PM | 0 | 0 | 46 | 10 | 0 | 0 | 32 | 8 | 0 | 0 | 0 | 0 | 0 | 47 | 0 | 21 | 164 | 2,303 |
| 4:50 PM | 0 | 0 | 56 | 6 | 0 | 0 | 48 | 12 | 0 | 0 | 0 | 0 | 0 | 46 | 0 | 12 | 180 | 2,319 |
| 4:55 PM | 0 | 0 | 54 | 6 | 0 | 0 | 43 | 11 | 0 | 0 | 0 | 0 | 0 | 48 | 0 | 22 | 184 | 2,315 |
| 5:00 PM | 0 | 0 | 61 | 9 | 0 | 0 | 53 | 12 | 0 | 0 | 0 | 0 | 0 | 73 | 0 | 15 | 223 | 2,278 |
| 5:05 PM | 0 | 0 | 55 | 3 | 0 | 0 | 45 | 14 | 0 | 0 | 0 | 0 | 0 | 47 | 0 | 19 | 183 | |
| 5:10 PM | 0 | 0 | 59 | 5 | 0 | 0 | 48 | 12 | 0 | 0 | 0 | 0 | 0 | 50 | 0 | 27 | 201 | |
| 5:15 PM | 0 | 0 | 49 | 7 | 0 | 0 | 50 | 9 | 0 | 0 | 0 | 0 | 0 | 63 | 0 | 15 | 193 | |
| 5:20 PM | 0 | 0 | 57 | 9 | 0 | 0 | 56 | 7 | 0 | 0 | 0 | 0 | 0 | 54 | 0 | 20 | 203 | |
| 5:25 PM | 0 | 0 | 63 | 10 | 0 | 0 | 39 | 6 | 0 | 0 | 0 | 0 | 0 | 49 | 0 | 18 | 185 | |
| 5:30 PM | 0 | 0 | 72 | 1 | 0 | 0 | 49 | 13 | 0 | 0 | 0 | 0 | 0 | 39 | 0 | 22 | 196 | |
| 5:35 PM | 0 | 0 | 72 | 2 | 0 | 0 | 67 | 12 | 0 | 0 | 0 | 0 | 0 | 43 | 0 | 12 | 208 | |
| 5:40 PM | 0 | 0 | 48 | 6 | 0 | 0 | 56 | 10 | 0 | 0 | 0 | 0 | 0 | 46 | 0 | 17 | 183 | |
| 5:45 PM | 0 | 0 | 56 | 7 | 0 | 0 | 54 | 11 | 0 | 0 | 0 | 0 | 0 | 36 | 0 | 16 | 180 | |
| 5:50 PM | 0 | 0 | 39 | 7 | 0 | 0 | 54 | 14 | 0 | 0 | 0 | 0 | 0 | 40 | 0 | 22 | 176 | |
| 5:55 PM | 0 | 0 | 39 | 2 | 0 | 0 | 51 | 10 | 0 | 0 | 0 | 0 | 0 | 33 | 0 | 12 | 147 | |
| Count Total | 0 | 0 | 1,314 | 141 | 0 | 0 | 1,167 | 223 | 0 | 0 | 0 | 0 | 0 | 1,156 | 1 | 447 | 4,449 | |
| Peak Hour | 0 | 0 | 702 | 71 | 0 | 0 | 608 | 129 | 0 | 0 | 0 | 0 | 0 | 594 | 0 | 215 | 2,319 | |

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

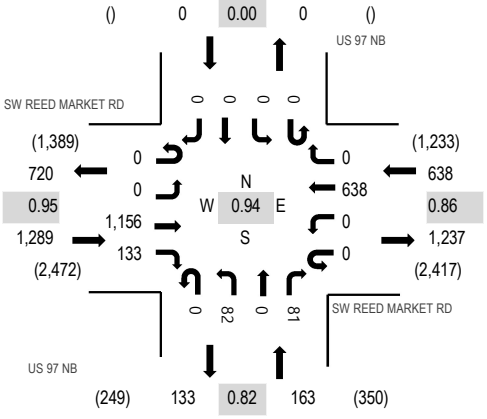
| Interval Start Time | Heavy Vehicles | | | | | Interval Start Time | Bicycles on Roadway | | | | | Interval Start Time | Pedestrians/Bicycles on Crosswalk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | EB | NB | WB | SB | Total | | EB | NB | WB | SB | Total | | EB | NB | WB | SB | Total |
| 4:00 PM | 1 | 0 | 1 | 0 | 2 | 4:00 PM | 0 | 0 | 0 | 0 | 0 | 4:00 PM | 0 | 0 | 0 | 1 | 1 |
| 4:05 PM | 3 | 0 | 1 | 2 | 6 | 4:05 PM | 1 | 0 | 0 | 0 | 1 | 4:05 PM | 0 | 0 | 0 | 0 | 0 |
| 4:10 PM | 0 | 0 | 0 | 1 | 1 | 4:10 PM | 1 | 0 | 0 | 0 | 1 | 4:10 PM | 0 | 0 | 0 | 1 | 1 |
| 4:15 PM | 0 | 0 | 0 | 1 | 1 | 4:15 PM | 0 | 0 | 0 | 0 | 0 | 4:15 PM | 0 | 0 | 0 | 0 | 0 |
| 4:20 PM | 0 | 0 | 1 | 0 | 1 | 4:20 PM | 1 | 0 | 0 | 0 | 1 | 4:20 PM | 0 | 0 | 0 | 0 | 0 |
| 4:25 PM | 0 | 0 | 0 | 2 | 2 | 4:25 PM | 0 | 0 | 0 | 0 | 0 | 4:25 PM | 0 | 0 | 0 | 0 | 0 |
| 4:30 PM | 2 | 0 | 2 | 0 | 4 | 4:30 PM | 0 | 0 | 1 | 0 | 1 | 4:30 PM | 0 | 0 | 0 | 0 | 0 |
| 4:35 PM | 0 | 0 | 0 | 0 | 0 | 4:35 PM | 0 | 0 | 0 | 0 | 0 | 4:35 PM | 0 | 0 | 0 | 0 | 0 |
| 4:40 PM | 1 | 0 | 0 | 1 | 2 | 4:40 PM | 1 | 0 | 0 | 0 | 1 | 4:40 PM | 0 | 0 | 0 | 0 | 0 |
| 4:45 PM | 0 | 0 | 0 | 1 | 1 | 4:45 PM | 0 | 0 | 0 | 0 | 0 | 4:45 PM | 0 | 0 | 0 | 2 | 2 |
| 4:50 PM | 1 | 0 | 0 | 1 | 2 | 4:50 PM | 0 | 0 | 0 | 0 | 0 | 4:50 PM | 0 | 1 | 0 | 0 | 1 |
| 4:55 PM | 1 | 0 | 0 | 0 | 1 | 4:55 PM | 0 | 0 | 1 | 0 | 1 | 4:55 PM | 0 | 1 | 0 | 0 | 1 |
| 5:00 PM | 1 | 0 | 0 | 1 | 2 | 5:00 PM | 0 | 0 | 0 | 0 | 0 | 5:00 PM | 0 | 0 | 0 | 1 | 1 |
| 5:05 PM | 0 | 0 | 0 | 1 | 1 | 5:05 PM | 0 | 0 | 0 | 0 | 0 | 5:05 PM | 0 | 0 | 0 | 0 | 0 |
| 5:10 PM | 1 | 0 | 0 | 1 | 2 | 5:10 PM | 0 | 0 | 0 | 0 | 0 | 5:10 PM | 0 | 0 | 0 | 1 | 1 |
| 5:15 PM | 3 | 0 | 0 | 0 | 3 | 5:15 PM | 1 | 0 | 0 | 0 | 1 | 5:15 PM | 0 | 0 | 0 | 0 | 0 |
| 5:20 PM | 0 | 0 | 0 | 1 | 1 | 5:20 PM | 0 | 0 | 0 | 0 | 0 | 5:20 PM | 0 | 0 | 0 | 0 | 0 |
| 5:25 PM | 0 | 0 | 0 | 1 | 1 | 5:25 PM | 0 | 0 | 1 | 1 | 2 | 5:25 PM | 0 | 0 | 0 | 2 | 2 |
| 5:30 PM | 0 | 0 | 0 | 0 | 0 | 5:30 PM | 1 | 0 | 0 | 0 | 1 | 5:30 PM | 0 | 0 | 0 | 1 | 1 |
| 5:35 PM | 1 | 0 | 0 | 0 | 1 | 5:35 PM | 0 | 0 | 1 | 0 | 1 | 5:35 PM | 0 | 0 | 0 | 0 | 0 |
| 5:40 PM | 0 | 0 | 1 | 1 | 2 | 5:40 PM | 0 | 0 | 0 | 0 | 0 | 5:40 PM | 0 | 0 | 0 | 0 | 0 |
| 5:45 PM | 0 | 0 | 0 | 1 | 1 | 5:45 PM | 0 | 0 | 0 | 0 | 0 | 5:45 PM | 0 | 0 | 0 | 0 | 0 |
| 5:50 PM | 0 | 0 | 0 | 1 | 1 | 5:50 PM | 0 | 0 | 2 | 0 | 2 | 5:50 PM | 0 | 0 | 0 | 0 | 0 |
| 5:55 PM | 1 | 0 | 0 | 1 | 2 | 5:55 PM | 0 | 0 | 0 | 0 | 0 | 5:55 PM | 0 | 3 | 0 | 0 | 3 |
| Count Total | 16 | 0 | 6 | 18 | 40 | Count Total | 6 | 0 | 6 | 1 | 13 | Count Total | 0 | 5 | 0 | 9 | 14 |
| Peak Hour | 8 | 0 | 1 | 8 | 17 | Peak Hour | 2 | 0 | 3 | 1 | 6 | Peak Hour | 0 | 2 | 0 | 5 | 7 |

ALL TRAFFIC DATA SERVICES
(303) 216-2439
www.alltrafficdata.net

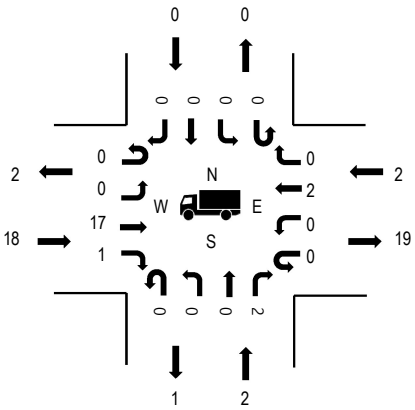
**Location:** 3 US 97 NB & SW REED MARKET RD PM
**Date:** Wednesday, August 3, 2022
**Peak Hour:** 04:50 PM - 05:50 PM
**Peak 15-Minutes:** 05:00 PM - 05:15 PM

## Peak Hour

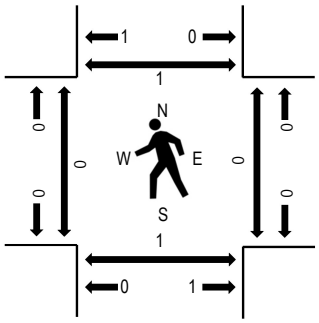
### Motorized Vehicles




### Heavy Vehicles




### Pedestrians




Note: Total study counts contained in parentheses.

| | HV% | PHF |
|---|---|---|
| EB | 1.4% | 0.95 |
| WB | 0.3% | 0.86 |
| NB | 1.2% | 0.82 |
| SB | 0.0% | 0.00 |
| All | 1.1% | 0.94 |

## Traffic Counts - Motorized Vehicles

| Interval Start Time | SW REED MARKET RD Eastbound | | | | SW REED MARKET RD Westbound | | | | US 97 NB Northbound | | | | US 97 NB Southbound | | | | | Rolling Hour |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | Total | |
| 4:00 PM | 0 | 0 | 100 | 8 | 0 | 0 | 52 | 0 | 0 | 2 | 0 | 5 | 0 | 0 | 0 | 0 | 167 | 1,993 |
| 4:05 PM | 0 | 0 | 87 | 9 | 0 | 0 | 46 | 0 | 0 | 6 | 0 | 8 | 0 | 0 | 0 | 0 | 156 | 2,025 |
| 4:10 PM | 0 | 0 | 117 | 10 | 0 | 0 | 44 | 0 | 0 | 3 | 0 | 5 | 0 | 0 | 0 | 0 | 179 | 2,052 |
| 4:15 PM | 0 | 0 | 92 | 13 | 0 | 0 | 46 | 0 | 0 | 5 | 0 | 13 | 0 | 0 | 0 | 0 | 169 | 2,047 |
| 4:20 PM | 0 | 0 | 101 | 7 | 0 | 0 | 47 | 0 | 0 | 9 | 0 | 9 | 0 | 0 | 0 | 0 | 173 | 2,058 |
| 4:25 PM | 0 | 0 | 86 | 14 | 0 | 0 | 53 | 0 | 0 | 10 | 0 | 13 | 0 | 0 | 0 | 0 | 176 | 2,047 |
| 4:30 PM | 0 | 0 | 92 | 7 | 0 | 0 | 49 | 0 | 0 | 7 | 0 | 13 | 0 | 0 | 0 | 0 | 168 | 2,041 |
| 4:35 PM | 0 | 0 | 83 | 12 | 0 | 0 | 58 | 0 | 0 | 8 | 0 | 13 | 0 | 0 | 0 | 0 | 174 | 2,054 |
| 4:40 PM | 0 | 0 | 92 | 6 | 0 | 0 | 51 | 0 | 0 | 4 | 0 | 12 | 0 | 0 | 0 | 0 | 165 | 2,084 |
| 4:45 PM | 0 | 0 | 82 | 9 | 0 | 0 | 39 | 0 | 0 | 6 | 0 | 11 | 0 | 0 | 0 | 0 | 147 | 2,081 |
| 4:50 PM | 0 | 0 | 95 | 9 | 0 | 0 | 50 | 0 | 0 | 3 | 0 | 8 | 0 | 0 | 0 | 0 | 165 | 2,090 |
| 4:55 PM | 0 | 0 | 99 | 7 | 0 | 0 | 33 | 0 | 0 | 9 | 0 | 6 | 0 | 0 | 0 | 0 | 154 | 2,068 |
| 5:00 PM | 0 | 0 | 119 | 9 | 0 | 0 | 59 | 0 | 0 | 4 | 0 | 8 | 0 | 0 | 0 | 0 | 199 | 2,062 |
| 5:05 PM | 0 | 0 | 96 | 8 | 0 | 0 | 59 | 0 | 0 | 8 | 0 | 12 | 0 | 0 | 0 | 0 | 183 | |
| 5:10 PM | 0 | 0 | 96 | 11 | 0 | 0 | 48 | 0 | 0 | 9 | 0 | 10 | 0 | 0 | 0 | 0 | 174 | |
| 5:15 PM | 0 | 0 | 104 | 9 | 0 | 0 | 57 | 0 | 0 | 5 | 0 | 5 | 0 | 0 | 0 | 0 | 180 | |
| 5:20 PM | 0 | 0 | 93 | 11 | 0 | 0 | 43 | 0 | 0 | 9 | 0 | 6 | 0 | 0 | 0 | 0 | 162 | |
| 5:25 PM | 0 | 0 | 93 | 23 | 0 | 0 | 39 | 0 | 0 | 10 | 0 | 5 | 0 | 0 | 0 | 0 | 170 | |
| 5:30 PM | 0 | 0 | 94 | 10 | 0 | 0 | 65 | 0 | 0 | 2 | 0 | 10 | 0 | 0 | 0 | 0 | 181 | |
| 5:35 PM | 0 | 0 | 110 | 13 | 0 | 0 | 72 | 0 | 0 | 6 | 0 | 3 | 0 | 0 | 0 | 0 | 204 | |
| 5:40 PM | 0 | 0 | 80 | 14 | 0 | 0 | 57 | 0 | 0 | 7 | 0 | 4 | 0 | 0 | 0 | 0 | 162 | |
| 5:45 PM | 0 | 0 | 77 | 9 | 0 | 0 | 56 | 0 | 0 | 10 | 0 | 4 | 0 | 0 | 0 | 0 | 156 | |
| 5:50 PM | 0 | 0 | 66 | 10 | 0 | 0 | 58 | 0 | 0 | 4 | 0 | 5 | 0 | 0 | 0 | 0 | 143 | |
| 5:55 PM | 0 | 0 | 69 | 11 | 0 | 0 | 52 | 0 | 0 | 10 | 0 | 6 | 0 | 0 | 0 | 0 | 148 | |
| Count Total | 0 | 0 | 2,223 | 249 | 0 | 0 | 1,233 | 0 | 0 | 156 | 0 | 194 | 0 | 0 | 0 | 0 | 4,055 | |
| Peak Hour | 0 | 0 | 1,156 | 133 | 0 | 0 | 638 | 0 | 0 | 82 | 0 | 81 | 0 | 0 | 0 | 0 | 2,090 | |

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

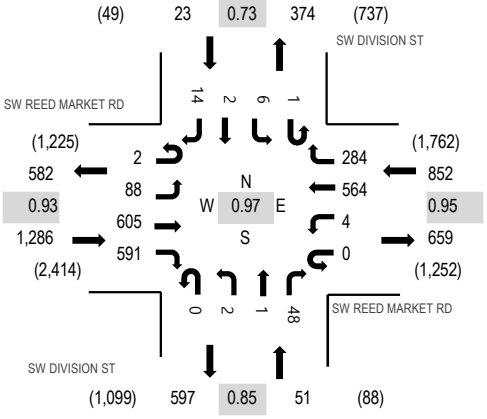
| Interval Start Time | Heavy Vehicles | | | | | Interval Start Time | Bicycles on Roadway | | | | | Interval Start Time | Pedestrians/Bicycles on Crosswalk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | EB | NB | WB | SB | Total | | EB | NB | WB | SB | Total | | EB | NB | WB | SB | Total |
| 4:00 PM | 3 | 0 | 0 | 0 | 3 | 4:00 PM | 0 | 0 | 0 | 0 | 0 | 4:00 PM | 0 | 1 | 0 | 3 | 4 |
| 4:05 PM | 5 | 0 | 2 | 0 | 7 | 4:05 PM | 1 | 0 | 0 | 0 | 1 | 4:05 PM | 0 | 0 | 0 | 0 | 0 |
| 4:10 PM | 1 | 0 | 0 | 0 | 1 | 4:10 PM | 1 | 0 | 0 | 0 | 1 | 4:10 PM | 0 | 0 | 0 | 0 | 0 |
| 4:15 PM | 1 | 1 | 0 | 0 | 2 | 4:15 PM | 0 | 0 | 0 | 0 | 0 | 4:15 PM | 0 | 2 | 0 | 0 | 2 |
| 4:20 PM | 1 | 0 | 1 | 0 | 2 | 4:20 PM | 0 | 0 | 1 | 0 | 1 | 4:20 PM | 0 | 0 | 0 | 0 | 0 |
| 4:25 PM | 1 | 0 | 0 | 0 | 1 | 4:25 PM | 0 | 0 | 0 | 0 | 0 | 4:25 PM | 0 | 0 | 0 | 1 | 1 |
| 4:30 PM | 2 | 1 | 2 | 0 | 5 | 4:30 PM | 0 | 0 | 0 | 0 | 0 | 4:30 PM | 0 | 0 | 0 | 0 | 0 |
| 4:35 PM | 1 | 0 | 0 | 0 | 1 | 4:35 PM | 0 | 0 | 0 | 0 | 0 | 4:35 PM | 0 | 0 | 0 | 0 | 0 |
| 4:40 PM | 3 | 0 | 0 | 0 | 3 | 4:40 PM | 1 | 0 | 0 | 0 | 1 | 4:40 PM | 0 | 0 | 0 | 1 | 1 |
| 4:45 PM | 2 | 0 | 0 | 0 | 2 | 4:45 PM | 0 | 0 | 0 | 0 | 0 | 4:45 PM | 0 | 1 | 0 | 0 | 1 |
| 4:50 PM | 1 | 0 | 0 | 0 | 1 | 4:50 PM | 0 | 0 | 0 | 0 | 0 | 4:50 PM | 0 | 0 | 0 | 2 | 2 |
| 4:55 PM | 1 | 1 | 0 | 0 | 2 | 4:55 PM | 0 | 0 | 1 | 0 | 1 | 4:55 PM | 0 | 0 | 0 | 0 | 0 |
| 5:00 PM | 0 | 1 | 0 | 0 | 1 | 5:00 PM | 0 | 0 | 0 | 0 | 0 | 5:00 PM | 0 | 0 | 0 | 0 | 0 |
| 5:05 PM | 2 | 0 | 0 | 0 | 2 | 5:05 PM | 0 | 0 | 0 | 0 | 0 | 5:05 PM | 0 | 1 | 0 | 0 | 1 |
| 5:10 PM | 2 | 0 | 0 | 0 | 2 | 5:10 PM | 1 | 0 | 0 | 0 | 1 | 5:10 PM | 0 | 1 | 0 | 0 | 1 |
| 5:15 PM | 3 | 0 | 0 | 0 | 3 | 5:15 PM | 1 | 0 | 0 | 0 | 1 | 5:15 PM | 0 | 0 | 0 | 0 | 0 |
| 5:20 PM | 2 | 0 | 1 | 0 | 3 | 5:20 PM | 0 | 0 | 1 | 0 | 1 | 5:20 PM | 0 | 0 | 0 | 0 | 0 |
| 5:25 PM | 1 | 0 | 0 | 0 | 1 | 5:25 PM | 0 | 0 | 0 | 0 | 0 | 5:25 PM | 0 | 2 | 0 | 0 | 2 |
| 5:30 PM | 1 | 0 | 0 | 0 | 1 | 5:30 PM | 2 | 0 | 0 | 0 | 2 | 5:30 PM | 0 | 0 | 0 | 1 | 1 |
| 5:35 PM | 1 | 0 | 1 | 0 | 2 | 5:35 PM | 0 | 0 | 0 | 0 | 0 | 5:35 PM | 0 | 0 | 0 | 0 | 0 |
| 5:40 PM | 3 | 0 | 0 | 0 | 3 | 5:40 PM | 0 | 0 | 0 | 0 | 0 | 5:40 PM | 0 | 0 | 0 | 0 | 0 |
| 5:45 PM | 1 | 0 | 0 | 0 | 1 | 5:45 PM | 0 | 0 | 0 | 0 | 0 | 5:45 PM | 0 | 0 | 0 | 0 | 0 |
| 5:50 PM | 1 | 1 | 1 | 0 | 3 | 5:50 PM | 0 | 0 | 0 | 0 | 0 | 5:50 PM | 0 | 0 | 0 | 3 | 3 |
| 5:55 PM | 3 | 0 | 0 | 0 | 3 | 5:55 PM | 0 | 0 | 0 | 0 | 0 | 5:55 PM | 0 | 0 | 0 | 0 | 0 |
| Count Total | 42 | 5 | 8 | 0 | 55 | Count Total | 7 | 0 | 3 | 0 | 10 | Count Total | 0 | 8 | 0 | 11 | 19 |
| Peak Hour | 18 | 2 | 2 | 0 | 22 | Peak Hour | 4 | 0 | 2 | 0 | 6 | Peak Hour | 0 | 4 | 0 | 3 | 7 |

ALL TRAFFIC DATA SERVICES
(303) 216-2439
www.alltrafficdata.net

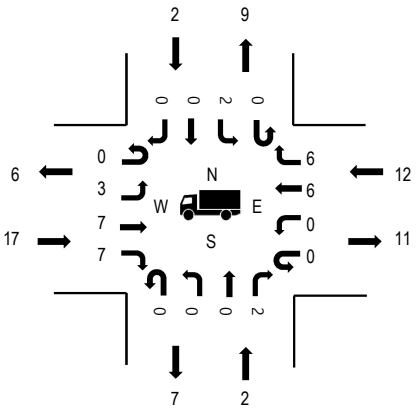
**Location:** 4 SW DIVISION ST & SW REED MARKET RD PM
**Date:** Wednesday, August 3, 2022
**Peak Hour:** 04:10 PM - 05:10 PM
**Peak 15-Minutes:** 04:10 PM - 04:25 PM

## Peak Hour

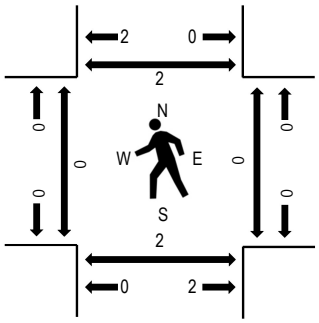
### Motorized Vehicles




### Heavy Vehicles




### Pedestrians




Note: Total study counts contained in parentheses.

| | HV% | PHF |
|---|---|---|
| EB | 1.3% | 0.93 |
| WB | 1.4% | 0.95 |
| NB | 3.9% | 0.85 |
| SB | 8.7% | 0.73 |
| All | 1.5% | 0.97 |

## Traffic Counts - Motorized Vehicles

| Interval Start Time | SW REED MARKET RD Eastbound | | | | SW REED MARKET RD Westbound | | | | SW DIVISION ST Northbound | | | | SW DIVISION ST Southbound | | | | | Rolling Hour |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | Total | |
| 4:00 PM | 0 | 3 | 36 | 44 | 0 | 0 | 50 | 19 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 155 | 2,155 |
| 4:05 PM | 1 | 6 | 53 | 42 | 0 | 0 | 50 | 26 | 0 | 0 | 0 | 3 | 0 | 0 | 1 | 2 | 184 | 2,195 |
| 4:10 PM | 0 | 4 | 55 | 59 | 0 | 0 | 44 | 26 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 1 | 194 | 2,212 |
| 4:15 PM | 0 | 4 | 58 | 61 | 0 | 0 | 44 | 25 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 1 | 195 | 2,207 |
| 4:20 PM | 0 | 6 | 50 | 47 | 0 | 0 | 49 | 26 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 1 | 183 | 2,198 |
| 4:25 PM | 0 | 5 | 55 | 45 | 0 | 1 | 53 | 22 | 0 | 0 | 0 | 6 | 0 | 0 | 1 | 0 | 188 | 2,197 |
| 4:30 PM | 0 | 4 | 56 | 45 | 0 | 1 | 50 | 24 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 1 | 184 | 2,181 |
| 4:35 PM | 0 | 10 | 41 | 37 | 0 | 1 | 53 | 24 | 0 | 1 | 1 | 4 | 0 | 2 | 0 | 3 | 177 | 2,171 |
| 4:40 PM | 1 | 7 | 52 | 47 | 0 | 0 | 46 | 22 | 0 | 0 | 0 | 3 | 0 | 1 | 0 | 2 | 181 | 2,210 |
| 4:45 PM | 1 | 5 | 46 | 43 | 0 | 0 | 40 | 27 | 0 | 1 | 0 | 5 | 0 | 1 | 0 | 1 | 170 | 2,193 |
| 4:50 PM | 0 | 8 | 42 | 53 | 0 | 0 | 48 | 28 | 0 | 0 | 0 | 5 | 1 | 0 | 1 | 1 | 187 | 2,194 |
| 4:55 PM | 0 | 8 | 45 | 54 | 0 | 0 | 29 | 16 | 0 | 0 | 0 | 3 | 0 | 2 | 0 | 0 | 157 | 2,170 |
| 5:00 PM | 0 | 7 | 50 | 54 | 0 | 0 | 57 | 23 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 1 | 195 | 2,158 |
| 5:05 PM | 0 | 20 | 55 | 46 | 0 | 1 | 51 | 21 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 2 | 201 | |
| 5:10 PM | 0 | 11 | 49 | 48 | 0 | 0 | 44 | 31 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 2 | 189 | |
| 5:15 PM | 0 | 8 | 51 | 41 | 0 | 0 | 50 | 29 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 4 | 186 | |
| 5:20 PM | 0 | 3 | 51 | 55 | 0 | 0 | 44 | 25 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 1 | 182 | |
| 5:25 PM | 1 | 9 | 45 | 48 | 0 | 0 | 38 | 26 | 0 | 0 | 0 | 3 | 0 | 2 | 0 | 0 | 172 | |
| 5:30 PM | 0 | 7 | 48 | 36 | 0 | 0 | 58 | 19 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 2 | 174 | |
| 5:35 PM | 1 | 8 | 54 | 58 | 0 | 0 | 68 | 22 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 2 | 216 | |
| 5:40 PM | 0 | 5 | 42 | 37 | 0 | 0 | 53 | 21 | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 3 | 164 | |
| 5:45 PM | 1 | 2 | 47 | 38 | 0 | 0 | 53 | 23 | 0 | 0 | 0 | 3 | 0 | 2 | 0 | 2 | 171 | |
| 5:50 PM | 0 | 3 | 37 | 29 | 0 | 0 | 59 | 31 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 1 | 163 | |
| 5:55 PM | 0 | 7 | 38 | 25 | 0 | 0 | 52 | 19 | 0 | 0 | 0 | 2 | 0 | 2 | 0 | 0 | 145 | |
| Count Total | 6 | 160 | 1,156 | 1,092 | 0 | 4 | 1,183 | 575 | 0 | 3 | 1 | 84 | 1 | 12 | 3 | 33 | 4,313 | |
| Peak Hour | 2 | 88 | 605 | 591 | 0 | 4 | 564 | 284 | 0 | 2 | 1 | 48 | 1 | 6 | 2 | 14 | 2,212 | |

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

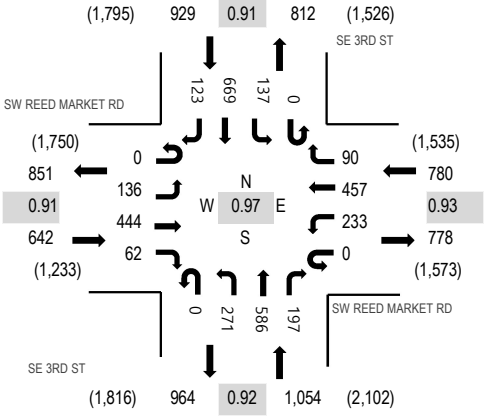
| Interval Start Time | Heavy Vehicles | | | | | Interval Start Time | Bicycles on Roadway | | | | | Interval Start Time | Pedestrians/Bicycles on Crosswalk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | EB | NB | WB | SB | Total | | EB | NB | WB | SB | Total | | EB | NB | WB | SB | Total |
| 4:00 PM | 1 | 0 | 1 | 0 | 2 | 4:00 PM | 0 | 0 | 0 | 0 | 0 | 4:00 PM | 0 | 0 | 0 | 3 | 3 |
| 4:05 PM | 5 | 0 | 2 | 0 | 7 | 4:05 PM | 0 | 0 | 0 | 0 | 0 | 4:05 PM | 0 | 0 | 0 | 0 | 0 |
| 4:10 PM | 1 | 0 | 1 | 0 | 2 | 4:10 PM | 2 | 0 | 0 | 0 | 2 | 4:10 PM | 0 | 0 | 0 | 0 | 0 |
| 4:15 PM | 2 | 1 | 1 | 0 | 4 | 4:15 PM | 0 | 0 | 0 | 0 | 0 | 4:15 PM | 0 | 1 | 0 | 0 | 1 |
| 4:20 PM | 1 | 0 | 1 | 0 | 2 | 4:20 PM | 1 | 0 | 0 | 0 | 1 | 4:20 PM | 0 | 0 | 0 | 0 | 0 |
| 4:25 PM | 2 | 0 | 0 | 0 | 2 | 4:25 PM | 0 | 0 | 1 | 0 | 1 | 4:25 PM | 0 | 0 | 0 | 0 | 0 |
| 4:30 PM | 2 | 0 | 4 | 0 | 6 | 4:30 PM | 0 | 0 | 0 | 0 | 0 | 4:30 PM | 1 | 0 | 0 | 0 | 1 |
| 4:35 PM | 0 | 0 | 1 | 1 | 2 | 4:35 PM | 0 | 0 | 1 | 0 | 1 | 4:35 PM | 0 | 0 | 0 | 0 | 0 |
| 4:40 PM | 2 | 0 | 0 | 1 | 3 | 4:40 PM | 0 | 0 | 0 | 0 | 0 | 4:40 PM | 0 | 0 | 0 | 1 | 1 |
| 4:45 PM | 1 | 1 | 1 | 0 | 3 | 4:45 PM | 0 | 0 | 0 | 0 | 0 | 4:45 PM | 0 | 0 | 0 | 0 | 0 |
| 4:50 PM | 1 | 0 | 1 | 0 | 2 | 4:50 PM | 0 | 0 | 0 | 0 | 0 | 4:50 PM | 0 | 1 | 0 | 1 | 2 |
| 4:55 PM | 2 | 0 | 0 | 0 | 2 | 4:55 PM | 0 | 0 | 0 | 1 | 1 | 4:55 PM | 0 | 0 | 0 | 0 | 0 |
| 5:00 PM | 1 | 0 | 2 | 0 | 3 | 5:00 PM | 0 | 0 | 0 | 0 | 0 | 5:00 PM | 0 | 0 | 0 | 0 | 0 |
| 5:05 PM | 2 | 0 | 0 | 0 | 2 | 5:05 PM | 0 | 0 | 0 | 0 | 0 | 5:05 PM | 0 | 0 | 0 | 0 | 0 |
| 5:10 PM | 3 | 0 | 1 | 0 | 4 | 5:10 PM | 1 | 1 | 0 | 0 | 2 | 5:10 PM | 0 | 0 | 0 | 0 | 0 |
| 5:15 PM | 4 | 0 | 0 | 0 | 4 | 5:15 PM | 1 | 0 | 0 | 0 | 1 | 5:15 PM | 0 | 1 | 0 | 0 | 1 |
| 5:20 PM | 2 | 0 | 3 | 0 | 5 | 5:20 PM | 0 | 0 | 0 | 0 | 0 | 5:20 PM | 0 | 0 | 0 | 0 | 0 |
| 5:25 PM | 1 | 0 | 0 | 0 | 1 | 5:25 PM | 0 | 0 | 0 | 0 | 0 | 5:25 PM | 0 | 0 | 0 | 0 | 0 |
| 5:30 PM | 0 | 0 | 0 | 0 | 0 | 5:30 PM | 2 | 0 | 2 | 0 | 4 | 5:30 PM | 0 | 2 | 0 | 0 | 2 |
| 5:35 PM | 1 | 0 | 1 | 0 | 2 | 5:35 PM | 0 | 0 | 0 | 0 | 0 | 5:35 PM | 0 | 0 | 0 | 2 | 2 |
| 5:40 PM | 3 | 0 | 0 | 0 | 3 | 5:40 PM | 0 | 0 | 0 | 0 | 0 | 5:40 PM | 0 | 0 | 0 | 0 | 0 |
| 5:45 PM | 1 | 0 | 1 | 0 | 2 | 5:45 PM | 0 | 0 | 0 | 0 | 0 | 5:45 PM | 0 | 0 | 0 | 3 | 3 |
| 5:50 PM | 2 | 0 | 2 | 0 | 4 | 5:50 PM | 0 | 0 | 2 | 0 | 2 | 5:50 PM | 0 | 0 | 0 | 1 | 1 |
| 5:55 PM | 2 | 0 | 0 | 0 | 2 | 5:55 PM | 0 | 0 | 0 | 0 | 0 | 5:55 PM | 0 | 0 | 0 | 1 | 1 |
| Count Total | 42 | 2 | 23 | 2 | 69 | Count Total | 7 | 1 | 6 | 1 | 15 | Count Total | 1 | 5 | 0 | 12 | 18 |
| Peak Hour | 17 | 2 | 12 | 2 | 33 | Peak Hour | 3 | 0 | 2 | 1 | 6 | Peak Hour | 1 | 2 | 0 | 2 | 5 |

ALL TRAFFIC DATA SERVICES
(303) 216-2439
www.alltrafficdata.net

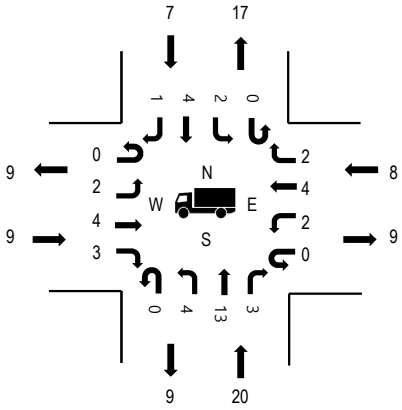
**Location:** 5 SE 3RD ST & SW REED MARKET RD PM
**Date:** Wednesday, August 3, 2022
**Peak Hour:** 04:15 PM - 05:15 PM
**Peak 15-Minutes:** 04:40 PM - 04:55 PM

## Peak Hour

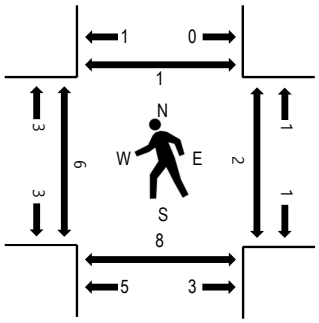
### Motorized Vehicles




### Heavy Vehicles




### Pedestrians




Note: Total study counts contained in parentheses.

| | HV% | PHF |
|---|---|---|
| EB | 1.4% | 0.91 |
| WB | 1.0% | 0.93 |
| NB | 1.9% | 0.92 |
| SB | 0.8% | 0.91 |
| All | 1.3% | 0.97 |

## Traffic Counts - Motorized Vehicles

| Interval Start Time | SW REED MARKET RD Eastbound | | | | SW REED MARKET RD Westbound | | | | SE 3RD ST Northbound | | | | SE 3RD ST Southbound | | | | | Rolling Hour |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | Total | |
| 4:00 PM | 0 | 5 | 26 | 3 | 0 | 21 | 30 | 8 | 0 | 27 | 54 | 28 | 0 | 7 | 68 | 11 | 288 | 3,376 |
| 4:05 PM | 0 | 4 | 47 | 5 | 0 | 18 | 42 | 7 | 0 | 25 | 51 | 15 | 0 | 12 | 43 | 10 | 279 | 3,363 |
| 4:10 PM | 0 | 6 | 53 | 3 | 0 | 11 | 38 | 7 | 0 | 21 | 49 | 21 | 0 | 4 | 51 | 8 | 272 | 3,389 |
| 4:15 PM | 0 | 7 | 47 | 5 | 0 | 18 | 38 | 8 | 0 | 23 | 48 | 16 | 0 | 12 | 51 | 7 | 280 | 3,405 |
| 4:20 PM | 0 | 15 | 34 | 8 | 0 | 21 | 38 | 6 | 0 | 26 | 44 | 17 | 0 | 10 | 54 | 10 | 283 | 3,405 |
| 4:25 PM | 0 | 14 | 37 | 7 | 0 | 21 | 40 | 7 | 0 | 26 | 46 | 22 | 0 | 7 | 51 | 8 | 286 | 3,394 |
| 4:30 PM | 0 | 15 | 37 | 3 | 0 | 23 | 37 | 10 | 0 | 20 | 53 | 12 | 0 | 11 | 54 | 15 | 290 | 3,403 |
| 4:35 PM | 0 | 7 | 33 | 7 | 0 | 19 | 48 | 4 | 0 | 23 | 43 | 12 | 0 | 11 | 59 | 7 | 273 | 3,374 |
| 4:40 PM | 0 | 15 | 38 | 6 | 0 | 18 | 48 | 5 | 0 | 24 | 53 | 19 | 0 | 13 | 50 | 4 | 293 | 3,392 |
| 4:45 PM | 0 | 20 | 26 | 4 | 0 | 21 | 41 | 8 | 0 | 18 | 49 | 18 | 0 | 13 | 62 | 9 | 289 | 3,370 |
| 4:50 PM | 0 | 10 | 29 | 6 | 0 | 22 | 38 | 11 | 0 | 26 | 52 | 19 | 0 | 14 | 62 | 11 | 300 | 3,343 |
| 4:55 PM | 0 | 6 | 36 | 6 | 0 | 6 | 14 | 13 | 0 | 16 | 41 | 14 | 0 | 14 | 64 | 13 | 243 | 3,313 |
| 5:00 PM | 0 | 7 | 38 | 5 | 0 | 14 | 37 | 4 | 0 | 24 | 55 | 14 | 0 | 12 | 52 | 13 | 275 | 3,289 |
| 5:05 PM | 0 | 8 | 50 | 1 | 0 | 28 | 35 | 7 | 0 | 24 | 56 | 18 | 0 | 11 | 55 | 12 | 305 | |
| 5:10 PM | 0 | 12 | 39 | 4 | 0 | 22 | 43 | 7 | 0 | 21 | 46 | 16 | 0 | 9 | 55 | 14 | 288 | |
| 5:15 PM | 0 | 13 | 31 | 4 | 0 | 19 | 48 | 3 | 0 | 24 | 53 | 14 | 0 | 12 | 48 | 11 | 280 | |
| 5:20 PM | 0 | 10 | 37 | 4 | 0 | 11 | 38 | 4 | 0 | 26 | 47 | 15 | 0 | 13 | 61 | 6 | 272 | |
| 5:25 PM | 0 | 5 | 44 | 4 | 0 | 25 | 30 | 7 | 0 | 25 | 47 | 23 | 0 | 14 | 63 | 8 | 295 | |
| 5:30 PM | 0 | 14 | 27 | 3 | 0 | 15 | 40 | 9 | 0 | 24 | 37 | 14 | 0 | 8 | 53 | 17 | 261 | |
| 5:35 PM | 0 | 11 | 41 | 6 | 0 | 12 | 52 | 6 | 0 | 23 | 34 | 25 | 0 | 12 | 59 | 10 | 291 | |
| 5:40 PM | 0 | 4 | 49 | 3 | 0 | 12 | 48 | 8 | 0 | 17 | 46 | 16 | 0 | 7 | 51 | 10 | 271 | |
| 5:45 PM | 0 | 11 | 29 | 3 | 0 | 14 | 40 | 11 | 0 | 24 | 45 | 16 | 0 | 12 | 47 | 10 | 262 | |
| 5:50 PM | 0 | 5 | 38 | 6 | 0 | 10 | 43 | 7 | 0 | 25 | 42 | 26 | 0 | 12 | 36 | 20 | 270 | |
| 5:55 PM | 0 | 5 | 28 | 4 | 0 | 15 | 43 | 3 | 0 | 20 | 36 | 13 | 0 | 6 | 41 | 5 | 219 | |
| Count Total | 0 | 229 | 894 | 110 | 0 | 416 | 949 | 170 | 0 | 552 | 1,127 | 423 | 0 | 256 | 1,290 | 249 | 6,665 | |
| Peak Hour | 0 | 136 | 444 | 62 | 0 | 233 | 457 | 90 | 0 | 271 | 586 | 197 | 0 | 137 | 669 | 123 | 3,405 | |

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

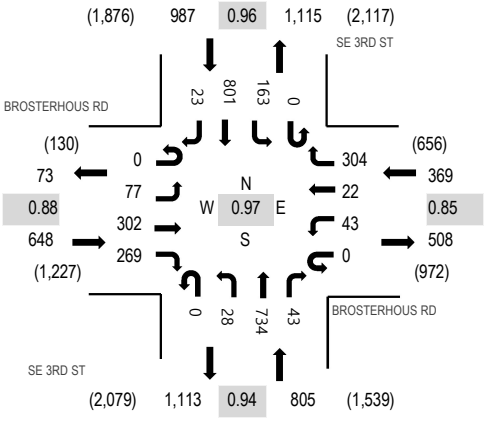
| Interval Start Time | Heavy Vehicles | | | | | Interval Start Time | Bicycles on Roadway | | | | | Interval Start Time | Pedestrians/Bicycles on Crosswalk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | EB | NB | WB | SB | Total | | EB | NB | WB | SB | Total | | EB | NB | WB | SB | Total |
| 4:00 PM | 2 | 1 | 1 | 1 | 5 | 4:00 PM | 0 | 0 | 0 | 0 | 0 | 4:00 PM | 1 | 0 | 0 | 0 | 1 |
| 4:05 PM | 2 | 2 | 1 | 1 | 6 | 4:05 PM | 0 | 1 | 0 | 1 | 2 | 4:05 PM | 0 | 0 | 0 | 0 | 0 |
| 4:10 PM | 3 | 1 | 3 | 0 | 7 | 4:10 PM | 1 | 1 | 0 | 0 | 2 | 4:10 PM | 1 | 0 | 2 | 1 | 4 |
| 4:15 PM | 1 | 2 | 0 | 0 | 3 | 4:15 PM | 0 | 0 | 0 | 0 | 0 | 4:15 PM | 1 | 1 | 0 | 0 | 2 |
| 4:20 PM | 1 | 1 | 1 | 1 | 4 | 4:20 PM | 0 | 1 | 0 | 1 | 2 | 4:20 PM | 0 | 3 | 3 | 1 | 7 |
| 4:25 PM | 2 | 1 | 1 | 0 | 4 | 4:25 PM | 1 | 0 | 1 | 0 | 2 | 4:25 PM | 2 | 1 | 1 | 0 | 4 |
| 4:30 PM | 0 | 3 | 2 | 3 | 8 | 4:30 PM | 0 | 0 | 0 | 0 | 0 | 4:30 PM | 1 | 1 | 0 | 0 | 2 |
| 4:35 PM | 0 | 2 | 3 | 0 | 5 | 4:35 PM | 0 | 0 | 0 | 0 | 0 | 4:35 PM | 0 | 0 | 2 | 0 | 2 |
| 4:40 PM | 1 | 1 | 0 | 1 | 3 | 4:40 PM | 0 | 2 | 0 | 0 | 2 | 4:40 PM | 3 | 1 | 0 | 0 | 4 |
| 4:45 PM | 2 | 2 | 0 | 0 | 4 | 4:45 PM | 0 | 2 | 0 | 0 | 2 | 4:45 PM | 0 | 0 | 1 | 1 | 2 |
| 4:50 PM | 1 | 3 | 0 | 1 | 5 | 4:50 PM | 0 | 0 | 1 | 0 | 1 | 4:50 PM | 0 | 0 | 0 | 0 | 0 |
| 4:55 PM | 0 | 1 | 0 | 0 | 1 | 4:55 PM | 0 | 0 | 0 | 0 | 0 | 4:55 PM | 0 | 1 | 0 | 0 | 1 |
| 5:00 PM | 0 | 1 | 1 | 0 | 2 | 5:00 PM | 0 | 1 | 0 | 0 | 1 | 5:00 PM | 0 | 1 | 0 | 0 | 1 |
| 5:05 PM | 0 | 1 | 0 | 1 | 2 | 5:05 PM | 0 | 2 | 0 | 0 | 2 | 5:05 PM | 0 | 1 | 0 | 0 | 1 |
| 5:10 PM | 1 | 2 | 0 | 0 | 3 | 5:10 PM | 2 | 1 | 0 | 0 | 3 | 5:10 PM | 1 | 1 | 0 | 0 | 2 |
| 5:15 PM | 0 | 0 | 0 | 1 | 1 | 5:15 PM | 0 | 0 | 0 | 1 | 1 | 5:15 PM | 0 | 1 | 1 | 0 | 2 |
| 5:20 PM | 3 | 1 | 2 | 0 | 6 | 5:20 PM | 1 | 0 | 0 | 0 | 1 | 5:20 PM | 0 | 0 | 0 | 0 | 0 |
| 5:25 PM | 0 | 1 | 0 | 1 | 2 | 5:25 PM | 0 | 0 | 0 | 0 | 0 | 5:25 PM | 0 | 0 | 0 | 0 | 0 |
| 5:30 PM | 0 | 1 | 0 | 1 | 2 | 5:30 PM | 0 | 1 | 0 | 0 | 1 | 5:30 PM | 2 | 2 | 0 | 0 | 4 |
| 5:35 PM | 1 | 0 | 1 | 3 | 5 | 5:35 PM | 1 | 0 | 0 | 0 | 1 | 5:35 PM | 0 | 0 | 0 | 0 | 0 |
| 5:40 PM | 1 | 1 | 1 | 2 | 5 | 5:40 PM | 0 | 0 | 0 | 2 | 2 | 5:40 PM | 0 | 0 | 0 | 1 | 1 |
| 5:45 PM | 0 | 1 | 0 | 0 | 1 | 5:45 PM | 0 | 0 | 0 | 0 | 0 | 5:45 PM | 2 | 0 | 0 | 0 | 2 |
| 5:50 PM | 1 | 0 | 1 | 1 | 3 | 5:50 PM | 0 | 1 | 0 | 1 | 2 | 5:50 PM | 1 | 1 | 1 | 2 | 5 |
| 5:55 PM | 1 | 0 | 0 | 0 | 1 | 5:55 PM | 0 | 0 | 0 | 0 | 0 | 5:55 PM | 0 | 0 | 0 | 0 | 0 |
| Count Total | 23 | 29 | 18 | 18 | 88 | Count Total | 6 | 13 | 2 | 6 | 27 | Count Total | 15 | 15 | 11 | 6 | 47 |
| Peak Hour | 9 | 20 | 8 | 7 | 44 | Peak Hour | 3 | 9 | 2 | 1 | 15 | Peak Hour | 8 | 11 | 7 | 2 | 28 |

ALL TRAFFIC DATA SERVICES
(303) 216-2439
www.alltrafficdata.net

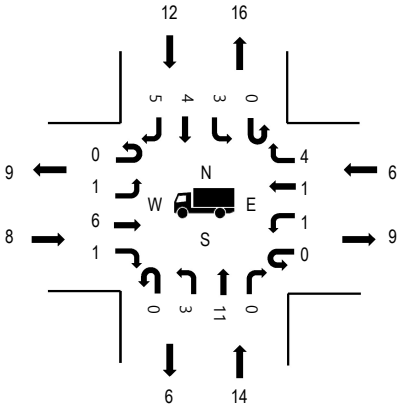
**Location:** 6 SE 3RD ST & BROSTERHOUS RD PM
**Date:** Wednesday, August 3, 2022
**Peak Hour:** 04:10 PM - 05:10 PM
**Peak 15-Minutes:** 04:40 PM - 04:55 PM

## Peak Hour

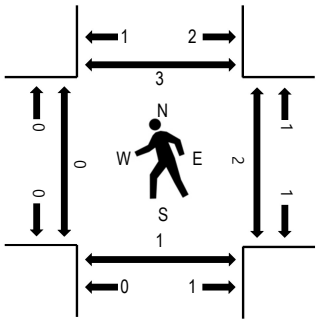
### Motorized Vehicles




### Heavy Vehicles




### Pedestrians




Note: Total study counts contained in parentheses.

| | HV% | PHF |
|---|---|---|
| EB | 1.2% | 0.88 |
| WB | 1.6% | 0.85 |
| NB | 1.7% | 0.94 |
| SB | 1.2% | 0.96 |
| All | 1.4% | 0.97 |

## Traffic Counts - Motorized Vehicles

| Interval Start Time | BROSTERHOUS RD Eastbound | | | | BROSTERHOUS RD Westbound | | | | SE 3RD ST Northbound | | | | SE 3RD ST Southbound | | | | | Rolling Hour |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | Total | |
| 4:00 PM | 0 | 7 | 22 | 18 | 0 | 3 | 3 | 23 | 0 | 2 | 61 | 7 | 0 | 7 | 86 | 0 | 239 | 2,765 |
| 4:05 PM | 0 | 23 | 21 | 29 | 0 | 4 | 0 | 16 | 0 | 4 | 48 | 2 | 0 | 15 | 55 | 2 | 219 | 2,785 |
| 4:10 PM | 0 | 4 | 21 | 35 | 0 | 2 | 1 | 26 | 0 | 2 | 66 | 2 | 0 | 12 | 56 | 4 | 231 | 2,809 |
| 4:15 PM | 0 | 9 | 21 | 23 | 0 | 3 | 1 | 24 | 0 | 4 | 59 | 4 | 0 | 12 | 59 | 4 | 223 | 2,784 |
| 4:20 PM | 0 | 6 | 28 | 23 | 0 | 2 | 1 | 26 | 0 | 2 | 71 | 4 | 0 | 18 | 68 | 2 | 251 | 2,777 |
| 4:25 PM | 0 | 10 | 21 | 17 | 0 | 2 | 2 | 20 | 0 | 3 | 64 | 4 | 0 | 8 | 72 | 1 | 224 | 2,740 |
| 4:30 PM | 0 | 5 | 28 | 24 | 0 | 5 | 3 | 23 | 0 | 2 | 55 | 4 | 0 | 14 | 64 | 2 | 229 | 2,744 |
| 4:35 PM | 0 | 3 | 20 | 15 | 0 | 1 | 2 | 24 | 0 | 1 | 61 | 2 | 0 | 17 | 83 | 0 | 229 | 2,723 |
| 4:40 PM | 0 | 5 | 18 | 16 | 0 | 3 | 1 | 31 | 0 | 0 | 70 | 7 | 0 | 14 | 57 | 1 | 223 | 2,706 |
| 4:45 PM | 0 | 6 | 25 | 20 | 0 | 8 | 5 | 34 | 0 | 4 | 56 | 2 | 0 | 14 | 66 | 3 | 243 | 2,687 |
| 4:50 PM | 0 | 3 | 34 | 23 | 0 | 1 | 1 | 18 | 0 | 2 | 70 | 2 | 0 | 10 | 90 | 4 | 258 | 2,653 |
| 4:55 PM | 0 | 6 | 27 | 21 | 0 | 5 | 2 | 18 | 0 | 6 | 42 | 3 | 0 | 16 | 49 | 1 | 196 | 2,561 |
| 5:00 PM | 0 | 11 | 35 | 28 | 0 | 5 | 2 | 24 | 0 | 0 | 65 | 4 | 0 | 17 | 68 | 0 | 259 | 2,533 |
| 5:05 PM | 0 | 9 | 24 | 24 | 0 | 6 | 1 | 36 | 0 | 2 | 55 | 5 | 0 | 11 | 69 | 1 | 243 | |
| 5:10 PM | 0 | 3 | 23 | 17 | 0 | 0 | 1 | 17 | 0 | 0 | 56 | 3 | 0 | 15 | 70 | 1 | 206 | |
| 5:15 PM | 0 | 6 | 30 | 15 | 0 | 3 | 0 | 26 | 0 | 3 | 57 | 2 | 0 | 7 | 64 | 3 | 216 | |
| 5:20 PM | 0 | 5 | 28 | 16 | 0 | 1 | 1 | 25 | 0 | 2 | 62 | 0 | 0 | 18 | 55 | 1 | 214 | |
| 5:25 PM | 0 | 3 | 23 | 26 | 0 | 2 | 0 | 21 | 0 | 2 | 61 | 7 | 0 | 12 | 68 | 3 | 228 | |
| 5:30 PM | 0 | 6 | 21 | 20 | 0 | 1 | 1 | 22 | 0 | 7 | 47 | 3 | 0 | 15 | 64 | 1 | 208 | |
| 5:35 PM | 0 | 6 | 29 | 22 | 0 | 1 | 1 | 16 | 0 | 0 | 57 | 3 | 0 | 16 | 58 | 3 | 212 | |
| 5:40 PM | 0 | 6 | 17 | 17 | 0 | 2 | 2 | 20 | 0 | 2 | 62 | 1 | 0 | 17 | 57 | 1 | 204 | |
| 5:45 PM | 0 | 7 | 27 | 13 | 0 | 3 | 1 | 31 | 0 | 3 | 59 | 5 | 0 | 7 | 52 | 1 | 209 | |
| 5:50 PM | 0 | 9 | 17 | 15 | 0 | 3 | 0 | 21 | 0 | 2 | 46 | 3 | 0 | 11 | 38 | 1 | 166 | |
| 5:55 PM | 0 | 2 | 15 | 15 | 0 | 2 | 1 | 13 | 0 | 1 | 52 | 2 | 0 | 13 | 51 | 1 | 168 | |
| Count Total | 0 | 160 | 575 | 492 | 0 | 68 | 33 | 555 | 0 | 56 | 1,402 | 81 | 0 | 316 | 1,519 | 41 | 5,298 | |
| Peak Hour | 0 | 77 | 302 | 269 | 0 | 43 | 22 | 304 | 0 | 28 | 734 | 43 | 0 | 163 | 801 | 23 | 2,809 | |

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

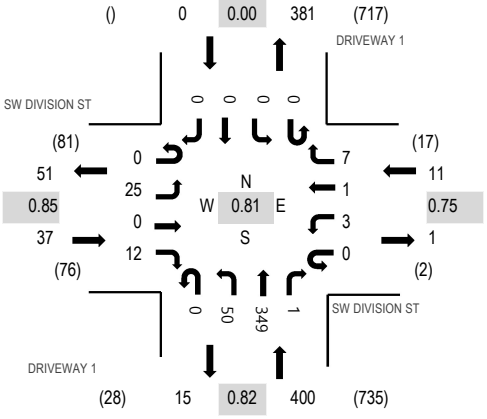
| Interval Start Time | Heavy Vehicles | | | | | Interval Start Time | Bicycles on Roadway | | | | | Interval Start Time | Pedestrians/Bicycles on Crosswalk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | EB | NB | WB | SB | Total | | EB | NB | WB | SB | Total | | EB | NB | WB | SB | Total |
| 4:00 PM | 1 | 2 | 0 | 0 | 3 | 4:00 PM | 0 | 0 | 0 | 0 | 0 | 4:00 PM | 1 | 0 | 0 | 1 | 2 |
| 4:05 PM | 1 | 2 | 0 | 2 | 5 | 4:05 PM | 0 | 0 | 0 | 0 | 0 | 4:05 PM | 1 | 1 | 0 | 1 | 3 |
| 4:10 PM | 0 | 2 | 1 | 1 | 4 | 4:10 PM | 1 | 0 | 0 | 0 | 1 | 4:10 PM | 0 | 0 | 0 | 0 | 0 |
| 4:15 PM | 0 | 1 | 0 | 2 | 3 | 4:15 PM | 0 | 0 | 0 | 0 | 0 | 4:15 PM | 0 | 0 | 0 | 0 | 0 |
| 4:20 PM | 0 | 1 | 0 | 1 | 2 | 4:20 PM | 0 | 0 | 0 | 0 | 0 | 4:20 PM | 0 | 0 | 0 | 1 | 1 |
| 4:25 PM | 1 | 1 | 1 | 0 | 3 | 4:25 PM | 0 | 0 | 1 | 0 | 1 | 4:25 PM | 0 | 0 | 0 | 0 | 0 |
| 4:30 PM | 1 | 2 | 1 | 1 | 5 | 4:30 PM | 0 | 0 | 0 | 0 | 0 | 4:30 PM | 1 | 0 | 0 | 0 | 1 |
| 4:35 PM | 1 | 2 | 1 | 3 | 7 | 4:35 PM | 0 | 0 | 0 | 0 | 0 | 4:35 PM | 0 | 0 | 0 | 0 | 0 |
| 4:40 PM | 1 | 1 | 1 | 1 | 4 | 4:40 PM | 0 | 0 | 0 | 0 | 0 | 4:40 PM | 1 | 1 | 0 | 0 | 2 |
| 4:45 PM | 0 | 1 | 0 | 1 | 2 | 4:45 PM | 0 | 0 | 0 | 2 | 2 | 4:45 PM | 1 | 0 | 0 | 0 | 1 |
| 4:50 PM | 1 | 1 | 0 | 0 | 2 | 4:50 PM | 0 | 0 | 1 | 0 | 1 | 4:50 PM | 0 | 0 | 1 | 1 | 2 |
| 4:55 PM | 1 | 1 | 0 | 1 | 3 | 4:55 PM | 0 | 0 | 0 | 0 | 0 | 4:55 PM | 0 | 0 | 1 | 1 | 2 |
| 5:00 PM | 1 | 1 | 1 | 0 | 3 | 5:00 PM | 0 | 0 | 0 | 0 | 0 | 5:00 PM | 0 | 0 | 0 | 0 | 0 |
| 5:05 PM | 1 | 0 | 0 | 1 | 2 | 5:05 PM | 0 | 0 | 1 | 1 | 2 | 5:05 PM | 0 | 1 | 0 | 1 | 2 |
| 5:10 PM | 0 | 1 | 0 | 0 | 1 | 5:10 PM | 1 | 0 | 0 | 0 | 1 | 5:10 PM | 0 | 1 | 1 | 2 | 4 |
| 5:15 PM | 0 | 0 | 0 | 0 | 0 | 5:15 PM | 0 | 0 | 0 | 1 | 1 | 5:15 PM | 1 | 0 | 1 | 2 | 4 |
| 5:20 PM | 0 | 0 | 0 | 0 | 0 | 5:20 PM | 0 | 0 | 0 | 0 | 0 | 5:20 PM | 0 | 0 | 0 | 0 | 0 |
| 5:25 PM | 0 | 1 | 0 | 2 | 3 | 5:25 PM | 0 | 0 | 0 | 1 | 1 | 5:25 PM | 0 | 0 | 0 | 1 | 1 |
| 5:30 PM | 0 | 1 | 0 | 1 | 2 | 5:30 PM | 0 | 0 | 0 | 0 | 0 | 5:30 PM | 1 | 1 | 0 | 0 | 2 |
| 5:35 PM | 1 | 0 | 0 | 4 | 5 | 5:35 PM | 0 | 0 | 0 | 0 | 0 | 5:35 PM | 0 | 0 | 0 | 0 | 0 |
| 5:40 PM | 1 | 0 | 0 | 3 | 4 | 5:40 PM | 0 | 0 | 0 | 0 | 0 | 5:40 PM | 0 | 0 | 2 | 0 | 2 |
| 5:45 PM | 0 | 1 | 1 | 0 | 2 | 5:45 PM | 0 | 0 | 0 | 0 | 0 | 5:45 PM | 1 | 0 | 0 | 0 | 1 |
| 5:50 PM | 0 | 0 | 0 | 1 | 1 | 5:50 PM | 0 | 0 | 0 | 1 | 1 | 5:50 PM | 0 | 0 | 0 | 0 | 0 |
| 5:55 PM | 0 | 0 | 0 | 0 | 0 | 5:55 PM | 0 | 0 | 0 | 0 | 0 | 5:55 PM | 0 | 0 | 1 | 0 | 1 |
| Count Total | 12 | 22 | 7 | 25 | 66 | Count Total | 2 | 0 | 3 | 6 | 11 | Count Total | 8 | 5 | 7 | 11 | 31 |
| Peak Hour | 8 | 14 | 6 | 12 | 40 | Peak Hour | 1 | 0 | 3 | 3 | 7 | Peak Hour | 3 | 2 | 2 | 4 | 11 |

ALL TRAFFIC DATA SERVICES
(303) 216-2439
www.alltrafficdata.net

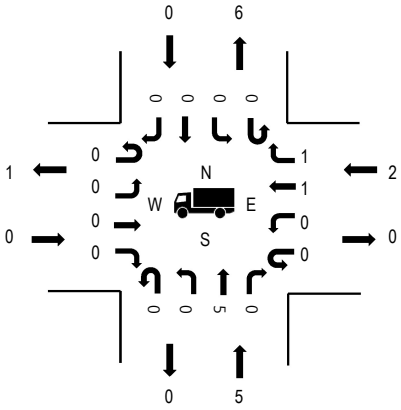
**Location:** 7 DRIVEWAY 1 & SW DIVISION ST PM
**Date:** Wednesday, August 3, 2022
**Peak Hour:** 04:35 PM - 05:35 PM
**Peak 15-Minutes:** 05:05 PM - 05:20 PM

## Peak Hour

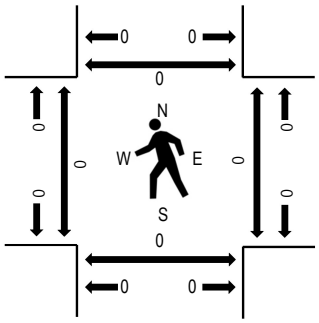
### Motorized Vehicles




### Heavy Vehicles




### Pedestrians




Note: Total study counts contained in parentheses.

| | HV% | PHF |
|---|---|---|
| EB | 0.0% | 0.85 |
| WB | 18.2% | 0.75 |
| NB | 1.3% | 0.82 |
| SB | 0.0% | 0.00 |
| All | 1.6% | 0.81 |

## Traffic Counts - Motorized Vehicles

| Interval Start Time | SW DIVISION ST Eastbound | | | | SW DIVISION ST Westbound | | | | DRIVEWAY 1 Northbound | | | | DRIVEWAY 1 Southbound | | | | | Rolling Hour |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | Total | |
| 4:00 PM | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 22 | 0 | 0 | 0 | 0 | 0 | 27 | 405 |
| 4:05 PM | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 2 | 28 | 0 | 0 | 0 | 0 | 0 | 32 | 410 |
| 4:10 PM | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 28 | 0 | 0 | 0 | 0 | 0 | 31 | 422 |
| 4:15 PM | 0 | 5 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 30 | 0 | 0 | 0 | 0 | 0 | 38 | 441 |
| 4:20 PM | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 3 | 29 | 0 | 0 | 0 | 0 | 0 | 34 | 447 |
| 4:25 PM | 0 | 2 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 2 | 24 | 0 | 0 | 0 | 0 | 0 | 30 | 445 |
| 4:30 PM | 0 | 2 | 1 | 2 | 0 | 0 | 0 | 1 | 0 | 1 | 23 | 0 | 0 | 0 | 0 | 0 | 30 | 447 |
| 4:35 PM | 0 | 2 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 4 | 30 | 0 | 0 | 0 | 0 | 0 | 39 | 448 |
| 4:40 PM | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 3 | 27 | 0 | 0 | 0 | 0 | 0 | 33 | 436 |
| 4:45 PM | 0 | 5 | 0 | 2 | 0 | 0 | 0 | 2 | 0 | 2 | 28 | 1 | 0 | 0 | 0 | 0 | 40 | 432 |
| 4:50 PM | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 5 | 31 | 0 | 0 | 0 | 0 | 0 | 38 | 425 |
| 4:55 PM | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 5 | 25 | 0 | 0 | 0 | 0 | 0 | 33 | 423 |
| 5:00 PM | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 6 | 22 | 0 | 0 | 0 | 0 | 0 | 32 | 423 |
| 5:05 PM | 0 | 3 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 9 | 31 | 0 | 0 | 0 | 0 | 0 | 44 | |
| 5:10 PM | 0 | 4 | 0 | 1 | 0 | 0 | 0 | 2 | 0 | 6 | 37 | 0 | 0 | 0 | 0 | 0 | 50 | |
| 5:15 PM | 0 | 1 | 0 | 3 | 0 | 1 | 0 | 0 | 0 | 2 | 37 | 0 | 0 | 0 | 0 | 0 | 44 | |
| 5:20 PM | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 30 | 0 | 0 | 0 | 0 | 0 | 32 | |
| 5:25 PM | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 28 | 0 | 0 | 0 | 0 | 0 | 32 | |
| 5:30 PM | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 6 | 23 | 0 | 0 | 0 | 0 | 0 | 31 | |
| 5:35 PM | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 4 | 21 | 0 | 0 | 0 | 0 | 0 | 27 | |
| 5:40 PM | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 5 | 22 | 0 | 0 | 0 | 0 | 0 | 29 | |
| 5:45 PM | 0 | 4 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 26 | 0 | 0 | 0 | 0 | 0 | 33 | |
| 5:50 PM | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 31 | 0 | 0 | 0 | 0 | 0 | 36 | |
| 5:55 PM | 0 | 3 | 0 | 1 | 0 | 0 | 0 | 2 | 0 | 5 | 22 | 0 | 0 | 0 | 0 | 0 | 33 | |
| Count Total | 0 | 50 | 1 | 25 | 0 | 3 | 2 | 12 | 0 | 79 | 655 | 1 | 0 | 0 | 0 | 0 | 828 | |
| Peak Hour | 0 | 25 | 0 | 12 | 0 | 3 | 1 | 7 | 0 | 50 | 349 | 1 | 0 | 0 | 0 | 0 | 448 | |

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

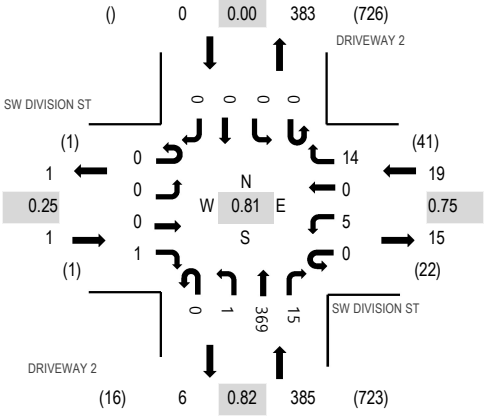
| Interval Start Time | Heavy Vehicles | | | | | Interval Start Time | Bicycles on Roadway | | | | | Interval Start Time | Pedestrians/Bicycles on Crosswalk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | EB | NB | WB | SB | Total | | EB | NB | WB | SB | Total | | EB | NB | WB | SB | Total |
| 4:00 PM | 0 | 0 | 0 | 0 | 0 | 4:00 PM | 0 | 0 | 0 | 0 | 0 | 4:00 PM | 0 | 0 | 0 | 0 | 0 |
| 4:05 PM | 0 | 1 | 0 | 0 | 1 | 4:05 PM | 0 | 0 | 0 | 0 | 0 | 4:05 PM | 0 | 0 | 0 | 0 | 0 |
| 4:10 PM | 0 | 1 | 0 | 0 | 1 | 4:10 PM | 0 | 0 | 0 | 0 | 0 | 4:10 PM | 0 | 0 | 0 | 0 | 0 |
| 4:15 PM | 0 | 0 | 1 | 0 | 1 | 4:15 PM | 0 | 0 | 0 | 0 | 0 | 4:15 PM | 0 | 0 | 0 | 0 | 0 |
| 4:20 PM | 0 | 0 | 0 | 0 | 0 | 4:20 PM | 0 | 0 | 0 | 0 | 0 | 4:20 PM | 0 | 0 | 0 | 0 | 0 |
| 4:25 PM | 0 | 0 | 0 | 0 | 0 | 4:25 PM | 0 | 0 | 0 | 0 | 0 | 4:25 PM | 0 | 0 | 0 | 0 | 0 |
| 4:30 PM | 0 | 0 | 0 | 0 | 0 | 4:30 PM | 0 | 0 | 0 | 0 | 0 | 4:30 PM | 0 | 0 | 0 | 0 | 0 |
| 4:35 PM | 0 | 1 | 0 | 0 | 1 | 4:35 PM | 0 | 0 | 0 | 0 | 0 | 4:35 PM | 0 | 0 | 0 | 0 | 0 |
| 4:40 PM | 0 | 0 | 0 | 0 | 0 | 4:40 PM | 0 | 0 | 0 | 0 | 0 | 4:40 PM | 0 | 0 | 0 | 0 | 0 |
| 4:45 PM | 0 | 1 | 1 | 0 | 2 | 4:45 PM | 0 | 0 | 0 | 0 | 0 | 4:45 PM | 0 | 0 | 0 | 0 | 0 |
| 4:50 PM | 0 | 0 | 0 | 0 | 0 | 4:50 PM | 0 | 0 | 0 | 0 | 0 | 4:50 PM | 0 | 0 | 0 | 0 | 0 |
| 4:55 PM | 0 | 0 | 0 | 0 | 0 | 4:55 PM | 0 | 0 | 0 | 0 | 0 | 4:55 PM | 0 | 0 | 1 | 0 | 1 |
| 5:00 PM | 0 | 1 | 0 | 0 | 1 | 5:00 PM | 0 | 0 | 0 | 0 | 0 | 5:00 PM | 0 | 0 | 0 | 0 | 0 |
| 5:05 PM | 0 | 1 | 0 | 0 | 1 | 5:05 PM | 0 | 0 | 0 | 0 | 0 | 5:05 PM | 0 | 0 | 0 | 0 | 0 |
| 5:10 PM | 0 | 0 | 0 | 0 | 0 | 5:10 PM | 0 | 0 | 0 | 0 | 0 | 5:10 PM | 0 | 0 | 0 | 0 | 0 |
| 5:15 PM | 0 | 0 | 0 | 0 | 0 | 5:15 PM | 0 | 0 | 0 | 0 | 0 | 5:15 PM | 0 | 0 | 0 | 0 | 0 |
| 5:20 PM | 0 | 1 | 0 | 0 | 1 | 5:20 PM | 0 | 0 | 0 | 0 | 0 | 5:20 PM | 0 | 0 | 0 | 0 | 0 |
| 5:25 PM | 0 | 0 | 0 | 0 | 0 | 5:25 PM | 0 | 0 | 0 | 0 | 0 | 5:25 PM | 0 | 0 | 0 | 0 | 0 |
| 5:30 PM | 0 | 0 | 1 | 0 | 1 | 5:30 PM | 0 | 0 | 0 | 0 | 0 | 5:30 PM | 0 | 0 | 0 | 0 | 0 |
| 5:35 PM | 0 | 0 | 0 | 0 | 0 | 5:35 PM | 1 | 0 | 0 | 0 | 1 | 5:35 PM | 0 | 0 | 4 | 0 | 4 |
| 5:40 PM | 0 | 0 | 0 | 0 | 0 | 5:40 PM | 0 | 0 | 0 | 0 | 0 | 5:40 PM | 0 | 0 | 0 | 0 | 0 |
| 5:45 PM | 0 | 0 | 0 | 0 | 0 | 5:45 PM | 0 | 0 | 0 | 0 | 0 | 5:45 PM | 0 | 0 | 1 | 0 | 1 |
| 5:50 PM | 0 | 0 | 0 | 0 | 0 | 5:50 PM | 0 | 0 | 0 | 0 | 0 | 5:50 PM | 0 | 0 | 0 | 0 | 0 |
| 5:55 PM | 0 | 0 | 1 | 0 | 1 | 5:55 PM | 0 | 0 | 0 | 0 | 0 | 5:55 PM | 0 | 0 | 0 | 0 | 0 |
| Count Total | 0 | 7 | 4 | 0 | 11 | Count Total | 1 | 0 | 0 | 0 | 1 | Count Total | 0 | 0 | 6 | 0 | 6 |
| Peak Hour | 0 | 5 | 2 | 0 | 7 | Peak Hour | 0 | 0 | 0 | 0 | 0 | Peak Hour | 0 | 0 | 1 | 0 | 1 |

ALL TRAFFIC DATA SERVICES
(303) 216-2439
www.alltrafficdata.net

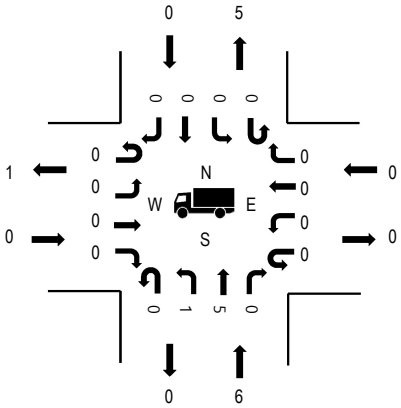
**Location:** 8 DRIVEWAY 2 & SW DIVISION ST PM
**Date:** Wednesday, August 3, 2022
**Peak Hour:** 04:15 PM - 05:15 PM
**Peak 15-Minutes:** 05:00 PM - 05:15 PM

## Peak Hour

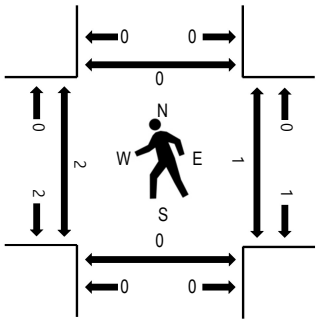
### Motorized Vehicles




### Heavy Vehicles



### Pedestrians



Note: Total study counts contained in parentheses.

| | HV% | PHF |
|---|---|---|
| EB | 0.0% | 0.25 |
| WB | 0.0% | 0.75 |
| NB | 1.6% | 0.82 |
| SB | 0.0% | 0.00 |
| All | 1.5% | 0.81 |

## Traffic Counts - Motorized Vehicles

| Interval Start Time | SW DIVISION ST Eastbound | | | | SW DIVISION ST Westbound | | | | DRIVEWAY 2 Northbound | | | | DRIVEWAY 2 Southbound | | | | | Rolling Hour |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | Total | |
| 4:00 PM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 34 | 0 | 0 | 0 | 0 | 0 | 37 | 373 |
| 4:05 PM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 23 | 1 | 0 | 0 | 0 | 0 | 25 | 375 |
| 4:10 PM | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 29 | 1 | 0 | 0 | 0 | 0 | 31 | 390 |
| 4:15 PM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 31 | 0 | 0 | 0 | 0 | 0 | 32 | 405 |
| 4:20 PM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 29 | 2 | 0 | 0 | 0 | 0 | 31 | 404 |
| 4:25 PM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 28 | 1 | 0 | 0 | 0 | 0 | 29 | 404 |
| 4:30 PM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 28 | 2 | 0 | 0 | 0 | 0 | 30 | 402 |
| 4:35 PM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 30 | 2 | 0 | 0 | 0 | 0 | 34 | 404 |
| 4:40 PM | 0 | 0 | 0 | 1 | 0 | 3 | 0 | 1 | 0 | 0 | 35 | 0 | 0 | 0 | 0 | 0 | 40 | 394 |
| 4:45 PM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 28 | 0 | 0 | 0 | 0 | 0 | 29 | 382 |
| 4:50 PM | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 29 | 0 | 0 | 0 | 0 | 0 | 31 | 378 |
| 4:55 PM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 22 | 1 | 0 | 0 | 0 | 0 | 24 | 381 |
| 5:00 PM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 31 | 4 | 0 | 0 | 0 | 0 | 39 | 392 |
| 5:05 PM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 36 | 1 | 0 | 0 | 0 | 0 | 40 | |
| 5:10 PM | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 42 | 2 | 0 | 0 | 0 | 0 | 46 | |
| 5:15 PM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 31 | 0 | 0 | 0 | 0 | 0 | 31 | |
| 5:20 PM | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 29 | 0 | 0 | 0 | 0 | 0 | 31 | |
| 5:25 PM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 26 | 0 | 0 | 0 | 0 | 0 | 27 | |
| 5:30 PM | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 2 | 0 | 0 | 26 | 1 | 0 | 0 | 0 | 0 | 32 | |
| 5:35 PM | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 0 | 0 | 20 | 1 | 0 | 0 | 0 | 0 | 24 | |
| 5:40 PM | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 26 | 0 | 0 | 0 | 0 | 0 | 28 | |
| 5:45 PM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 24 | 1 | 0 | 0 | 0 | 0 | 25 | |
| 5:50 PM | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 2 | 0 | 0 | 29 | 1 | 0 | 0 | 0 | 0 | 34 | |
| 5:55 PM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 34 | 1 | 0 | 0 | 0 | 0 | 35 | |
| Count Total | 0 | 0 | 0 | 1 | 0 | 15 | 0 | 26 | 0 | 1 | 700 | 22 | 0 | 0 | 0 | 0 | 765 | |
| Peak Hour | 0 | 0 | 0 | 1 | 0 | 5 | 0 | 14 | 0 | 1 | 369 | 15 | 0 | 0 | 0 | 0 | 405 | |

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

| Interval Start Time | Heavy Vehicles | | | | | Interval Start Time | Bicycles on Roadway | | | | | Interval Start Time | Pedestrians/Bicycles on Crosswalk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | EB | NB | WB | SB | Total | | EB | NB | WB | SB | Total | | EB | NB | WB | SB | Total |
| 4:00 PM | 0 | 1 | 0 | 0 | 1 | 4:00 PM | 0 | 0 | 0 | 0 | 0 | 4:00 PM | 0 | 0 | 0 | 0 | 0 |
| 4:05 PM | 0 | 0 | 0 | 0 | 0 | 4:05 PM | 0 | 0 | 0 | 0 | 0 | 4:05 PM | 0 | 0 | 0 | 0 | 0 |
| 4:10 PM | 0 | 1 | 0 | 0 | 1 | 4:10 PM | 0 | 0 | 0 | 0 | 0 | 4:10 PM | 0 | 0 | 0 | 0 | 0 |
| 4:15 PM | 0 | 1 | 0 | 0 | 1 | 4:15 PM | 0 | 0 | 0 | 0 | 0 | 4:15 PM | 0 | 0 | 0 | 0 | 0 |
| 4:20 PM | 0 | 0 | 0 | 0 | 0 | 4:20 PM | 0 | 0 | 0 | 0 | 0 | 4:20 PM | 0 | 0 | 0 | 0 | 0 |
| 4:25 PM | 0 | 0 | 0 | 0 | 0 | 4:25 PM | 0 | 0 | 1 | 0 | 1 | 4:25 PM | 0 | 0 | 0 | 0 | 0 |
| 4:30 PM | 0 | 1 | 0 | 0 | 1 | 4:30 PM | 0 | 0 | 0 | 0 | 0 | 4:30 PM | 0 | 0 | 0 | 0 | 0 |
| 4:35 PM | 0 | 0 | 0 | 0 | 0 | 4:35 PM | 0 | 0 | 0 | 0 | 0 | 4:35 PM | 0 | 0 | 0 | 0 | 0 |
| 4:40 PM | 0 | 1 | 0 | 0 | 1 | 4:40 PM | 0 | 0 | 0 | 0 | 0 | 4:40 PM | 0 | 0 | 0 | 0 | 0 |
| 4:45 PM | 0 | 1 | 0 | 0 | 1 | 4:45 PM | 0 | 0 | 0 | 0 | 0 | 4:45 PM | 0 | 0 | 0 | 0 | 0 |
| 4:50 PM | 0 | 0 | 0 | 0 | 0 | 4:50 PM | 0 | 0 | 0 | 0 | 0 | 4:50 PM | 0 | 0 | 0 | 0 | 0 |
| 4:55 PM | 0 | 1 | 0 | 0 | 1 | 4:55 PM | 0 | 0 | 0 | 0 | 0 | 4:55 PM | 0 | 0 | 1 | 0 | 1 |
| 5:00 PM | 0 | 0 | 0 | 0 | 0 | 5:00 PM | 0 | 0 | 0 | 0 | 0 | 5:00 PM | 0 | 0 | 0 | 0 | 0 |
| 5:05 PM | 0 | 1 | 0 | 0 | 1 | 5:05 PM | 0 | 0 | 0 | 0 | 0 | 5:05 PM | 0 | 0 | 0 | 0 | 0 |
| 5:10 PM | 0 | 0 | 0 | 0 | 0 | 5:10 PM | 0 | 0 | 0 | 0 | 0 | 5:10 PM | 2 | 0 | 0 | 0 | 2 |
| 5:15 PM | 0 | 0 | 0 | 0 | 0 | 5:15 PM | 0 | 0 | 0 | 0 | 0 | 5:15 PM | 0 | 0 | 0 | 0 | 0 |
| 5:20 PM | 0 | 0 | 0 | 0 | 0 | 5:20 PM | 0 | 0 | 0 | 0 | 0 | 5:20 PM | 0 | 0 | 0 | 0 | 0 |
| 5:25 PM | 0 | 0 | 0 | 0 | 0 | 5:25 PM | 0 | 0 | 0 | 0 | 0 | 5:25 PM | 0 | 0 | 0 | 0 | 0 |
| 5:30 PM | 0 | 0 | 0 | 0 | 0 | 5:30 PM | 0 | 0 | 0 | 0 | 0 | 5:30 PM | 0 | 0 | 0 | 0 | 0 |
| 5:35 PM | 0 | 1 | 0 | 0 | 1 | 5:35 PM | 0 | 0 | 0 | 0 | 0 | 5:35 PM | 0 | 0 | 0 | 0 | 0 |
| 5:40 PM | 0 | 0 | 0 | 0 | 0 | 5:40 PM | 0 | 0 | 0 | 0 | 0 | 5:40 PM | 0 | 0 | 0 | 0 | 0 |
| 5:45 PM | 0 | 1 | 0 | 0 | 1 | 5:45 PM | 0 | 0 | 0 | 0 | 0 | 5:45 PM | 0 | 0 | 0 | 0 | 0 |
| 5:50 PM | 0 | 0 | 0 | 0 | 0 | 5:50 PM | 0 | 0 | 0 | 0 | 0 | 5:50 PM | 0 | 0 | 0 | 0 | 0 |
| 5:55 PM | 0 | 1 | 0 | 0 | 1 | 5:55 PM | 0 | 0 | 0 | 0 | 0 | 5:55 PM | 0 | 0 | 0 | 0 | 0 |
| Count Total | 0 | 11 | 0 | 0 | 11 | Count Total | 0 | 0 | 1 | 0 | 1 | Count Total | 2 | 0 | 1 | 0 | 3 |
| Peak Hour | 0 | 6 | 0 | 0 | 6 | Peak Hour | 0 | 0 | 1 | 0 | 1 | Peak Hour | 2 | 0 | 1 | 0 | 3 |

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# TECHNICAL MEMORANDUM #2

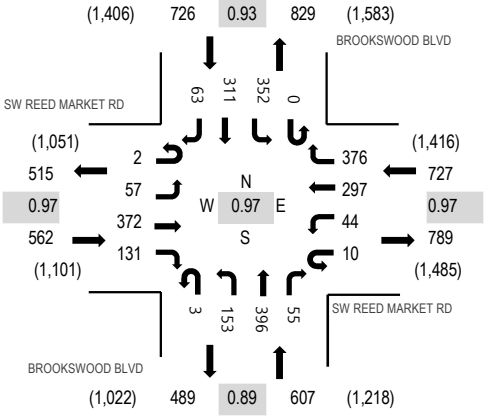
# APPENDIX A: TRAFFIC COUNTS

ALL TRAFFIC DATA SERVICES
(303) 216-2439
www.alltrafficdata.net

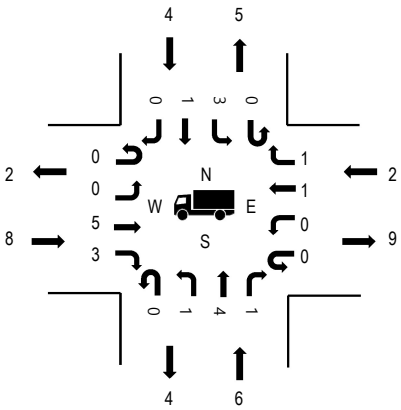
**Location:** 1 BROOKSWOOD BLVD & SW REED MARKET RD PM
**Date:** Wednesday, August 3, 2022
**Peak Hour:** 04:50 PM - 05:50 PM
**Peak 15-Minutes:** 04:55 PM - 05:10 PM

## Peak Hour

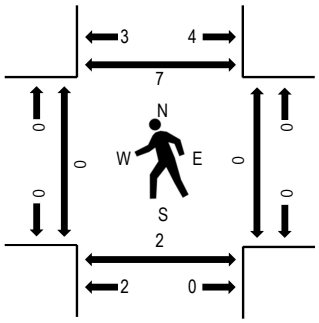
### Motorized Vehicles




### Heavy Vehicles




### Pedestrians




Note: Total study counts contained in parentheses.

| | HV% | PHF |
|---|---|---|
| EB | 1.4% | 0.97 |
| WB | 0.3% | 0.97 |
| NB | 1.0% | 0.89 |
| SB | 0.6% | 0.93 |
| All | 0.8% | 0.97 |

## Traffic Counts - Motorized Vehicles

| Interval Start Time | SW REED MARKET RD Eastbound | | | | SW REED MARKET RD Westbound | | | | BROOKSWOOD BLVD Northbound | | | | BROOKSWOOD BLVD Southbound | | | | | Rolling Hour |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | Total | |
| 4:00 PM | 0 | 3 | 25 | 16 | 1 | 4 | 21 | 37 | 0 | 17 | 31 | 7 | 0 | 30 | 30 | 6 | 228 | 2,544 |
| 4:05 PM | 0 | 2 | 30 | 13 | 0 | 7 | 27 | 31 | 0 | 13 | 21 | 8 | 0 | 25 | 26 | 6 | 209 | 2,533 |
| 4:10 PM | 0 | 6 | 24 | 18 | 1 | 10 | 25 | 16 | 0 | 18 | 26 | 4 | 1 | 20 | 32 | 4 | 205 | 2,559 |
| 4:15 PM | 0 | 2 | 27 | 15 | 2 | 10 | 16 | 26 | 0 | 17 | 25 | 4 | 0 | 28 | 26 | 4 | 202 | 2,568 |
| 4:20 PM | 0 | 3 | 30 | 9 | 1 | 4 | 21 | 30 | 0 | 12 | 34 | 3 | 0 | 28 | 31 | 4 | 210 | 2,587 |
| 4:25 PM | 1 | 4 | 27 | 17 | 1 | 7 | 26 | 38 | 0 | 16 | 17 | 4 | 0 | 31 | 18 | 4 | 211 | 2,603 |
| 4:30 PM | 0 | 7 | 27 | 14 | 1 | 3 | 26 | 32 | 1 | 9 | 23 | 4 | 1 | 34 | 24 | 3 | 209 | 2,604 |
| 4:35 PM | 1 | 4 | 25 | 16 | 0 | 4 | 22 | 20 | 0 | 21 | 35 | 4 | 0 | 21 | 26 | 3 | 202 | 2,609 |
| 4:40 PM | 0 | 5 | 30 | 11 | 0 | 3 | 25 | 29 | 1 | 18 | 40 | 2 | 0 | 34 | 19 | 3 | 220 | 2,620 |
| 4:45 PM | 0 | 5 | 35 | 12 | 0 | 3 | 26 | 26 | 1 | 17 | 34 | 4 | 0 | 24 | 26 | 1 | 214 | 2,617 |
| 4:50 PM | 1 | 6 | 28 | 9 | 1 | 6 | 24 | 21 | 1 | 11 | 41 | 5 | 0 | 30 | 21 | 4 | 209 | 2,622 |
| 4:55 PM | 0 | 5 | 30 | 8 | 0 | 0 | 22 | 38 | 2 | 13 | 36 | 1 | 0 | 36 | 33 | 1 | 225 | 2,614 |
| 5:00 PM | 0 | 4 | 28 | 15 | 1 | 4 | 23 | 36 | 0 | 14 | 28 | 5 | 0 | 30 | 24 | 5 | 217 | 2,597 |
| 5:05 PM | 0 | 3 | 37 | 15 | 1 | 4 | 28 | 30 | 0 | 15 | 40 | 6 | 0 | 24 | 28 | 4 | 235 | |
| 5:10 PM | 0 | 6 | 16 | 13 | 2 | 4 | 20 | 33 | 0 | 18 | 36 | 5 | 0 | 36 | 23 | 2 | 214 | |
| 5:15 PM | 0 | 3 | 37 | 11 | 0 | 3 | 27 | 29 | 0 | 10 | 30 | 5 | 0 | 34 | 27 | 5 | 221 | |
| 5:20 PM | 1 | 6 | 31 | 10 | 2 | 2 | 27 | 36 | 0 | 5 | 38 | 3 | 0 | 32 | 24 | 9 | 226 | |
| 5:25 PM | 0 | 5 | 35 | 8 | 0 | 3 | 17 | 36 | 0 | 13 | 26 | 5 | 0 | 26 | 32 | 6 | 212 | |
| 5:30 PM | 0 | 8 | 28 | 11 | 0 | 4 | 24 | 31 | 0 | 9 | 29 | 5 | 0 | 28 | 30 | 7 | 214 | |
| 5:35 PM | 0 | 4 | 40 | 8 | 0 | 3 | 38 | 24 | 0 | 10 | 29 | 5 | 0 | 25 | 19 | 8 | 213 | |
| 5:40 PM | 0 | 3 | 30 | 14 | 2 | 5 | 20 | 34 | 0 | 20 | 29 | 5 | 0 | 27 | 22 | 6 | 217 | |
| 5:45 PM | 0 | 4 | 32 | 9 | 1 | 6 | 27 | 28 | 0 | 15 | 34 | 5 | 0 | 24 | 28 | 6 | 219 | |
| 5:50 PM | 0 | 2 | 21 | 10 | 0 | 4 | 21 | 29 | 1 | 19 | 38 | 3 | 0 | 20 | 25 | 8 | 201 | |
| 5:55 PM | 0 | 8 | 18 | 16 | 0 | 2 | 25 | 26 | 0 | 19 | 37 | 3 | 0 | 25 | 18 | 11 | 208 | |
| Count Total | 4 | 108 | 691 | 298 | 17 | 105 | 578 | 716 | 7 | 349 | 757 | 105 | 2 | 672 | 612 | 120 | 5,141 | |
| Peak Hour | 2 | 57 | 372 | 131 | 10 | 44 | 297 | 376 | 3 | 153 | 396 | 55 | 0 | 352 | 311 | 63 | 2,622 | |

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

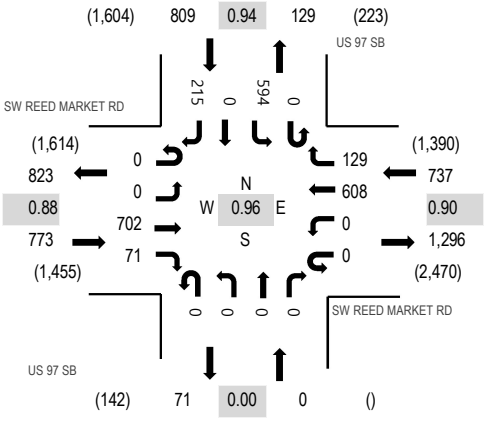
| Interval Start Time | Heavy Vehicles | | | | | Interval Start Time | Bicycles on Roadway | | | | | Interval Start Time | Pedestrians/Bicycles on Crosswalk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | EB | NB | WB | SB | Total | | EB | NB | WB | SB | Total | | EB | NB | WB | SB | Total |
| 4:00 PM | 1 | 1 | 1 | 2 | 5 | 4:00 PM | 0 | 0 | 1 | 0 | 1 | 4:00 PM | 0 | 0 | 0 | 0 | 0 |
| 4:05 PM | 0 | 0 | 1 | 3 | 4 | 4:05 PM | 0 | 0 | 0 | 1 | 1 | 4:05 PM | 0 | 0 | 0 | 1 | 1 |
| 4:10 PM | 1 | 1 | 0 | 0 | 2 | 4:10 PM | 0 | 0 | 0 | 0 | 0 | 4:10 PM | 0 | 0 | 0 | 0 | 0 |
| 4:15 PM | 0 | 0 | 0 | 0 | 0 | 4:15 PM | 0 | 0 | 0 | 0 | 0 | 4:15 PM | 0 | 0 | 0 | 1 | 1 |
| 4:20 PM | 2 | 0 | 0 | 2 | 4 | 4:20 PM | 0 | 0 | 1 | 2 | 3 | 4:20 PM | 0 | 0 | 0 | 0 | 0 |
| 4:25 PM | 1 | 0 | 0 | 0 | 1 | 4:25 PM | 0 | 0 | 0 | 0 | 0 | 4:25 PM | 0 | 0 | 0 | 0 | 0 |
| 4:30 PM | 1 | 0 | 0 | 1 | 2 | 4:30 PM | 0 | 0 | 0 | 0 | 0 | 4:30 PM | 0 | 0 | 0 | 0 | 0 |
| 4:35 PM | 1 | 1 | 2 | 0 | 4 | 4:35 PM | 0 | 0 | 0 | 0 | 0 | 4:35 PM | 0 | 0 | 0 | 3 | 3 |
| 4:40 PM | 0 | 1 | 1 | 0 | 2 | 4:40 PM | 0 | 0 | 0 | 0 | 0 | 4:40 PM | 0 | 0 | 0 | 0 | 0 |
| 4:45 PM | 0 | 0 | 0 | 1 | 1 | 4:45 PM | 1 | 2 | 0 | 0 | 3 | 4:45 PM | 0 | 0 | 0 | 0 | 0 |
| 4:50 PM | 1 | 0 | 0 | 0 | 1 | 4:50 PM | 1 | 0 | 0 | 0 | 1 | 4:50 PM | 0 | 0 | 0 | 2 | 2 |
| 4:55 PM | 1 | 0 | 0 | 0 | 1 | 4:55 PM | 0 | 1 | 1 | 0 | 2 | 4:55 PM | 0 | 0 | 0 | 0 | 0 |
| 5:00 PM | 2 | 1 | 0 | 1 | 4 | 5:00 PM | 0 | 0 | 0 | 0 | 0 | 5:00 PM | 0 | 0 | 0 | 1 | 1 |
| 5:05 PM | 0 | 0 | 1 | 0 | 1 | 5:05 PM | 0 | 0 | 0 | 0 | 0 | 5:05 PM | 0 | 0 | 0 | 1 | 1 |
| 5:10 PM | 1 | 0 | 0 | 0 | 1 | 5:10 PM | 0 | 0 | 0 | 1 | 1 | 5:10 PM | 0 | 2 | 0 | 0 | 2 |
| 5:15 PM | 3 | 1 | 0 | 0 | 4 | 5:15 PM | 0 | 0 | 0 | 0 | 0 | 5:15 PM | 0 | 0 | 0 | 2 | 2 |
| 5:20 PM | 0 | 1 | 0 | 0 | 1 | 5:20 PM | 0 | 0 | 0 | 0 | 0 | 5:20 PM | 0 | 0 | 0 | 0 | 0 |
| 5:25 PM | 0 | 0 | 0 | 1 | 1 | 5:25 PM | 1 | 0 | 1 | 1 | 3 | 5:25 PM | 0 | 0 | 0 | 2 | 2 |
| 5:30 PM | 0 | 1 | 0 | 1 | 2 | 5:30 PM | 0 | 0 | 2 | 1 | 3 | 5:30 PM | 0 | 0 | 0 | 1 | 1 |
| 5:35 PM | 0 | 0 | 0 | 1 | 1 | 5:35 PM | 0 | 0 | 0 | 1 | 1 | 5:35 PM | 0 | 0 | 0 | 1 | 1 |
| 5:40 PM | 0 | 0 | 1 | 0 | 1 | 5:40 PM | 1 | 0 | 0 | 0 | 1 | 5:40 PM | 0 | 0 | 0 | 0 | 0 |
| 5:45 PM | 0 | 2 | 0 | 0 | 2 | 5:45 PM | 0 | 0 | 0 | 0 | 0 | 5:45 PM | 0 | 0 | 0 | 0 | 0 |
| 5:50 PM | 0 | 0 | 0 | 0 | 0 | 5:50 PM | 0 | 0 | 0 | 0 | 0 | 5:50 PM | 0 | 0 | 0 | 3 | 3 |
| 5:55 PM | 1 | 0 | 0 | 1 | 2 | 5:55 PM | 0 | 0 | 0 | 2 | 2 | 5:55 PM | 0 | 0 | 0 | 2 | 2 |
| Count Total | 16 | 10 | 7 | 14 | 47 | Count Total | 4 | 3 | 6 | 9 | 22 | Count Total | 0 | 2 | 0 | 20 | 22 |
| Peak Hour | 8 | 6 | 2 | 4 | 20 | Peak Hour | 3 | 1 | 4 | 4 | 12 | Peak Hour | 0 | 2 | 0 | 10 | 12 |

ALL TRAFFIC DATA SERVICES
(303) 216-2439
www.alltrafficdata.net

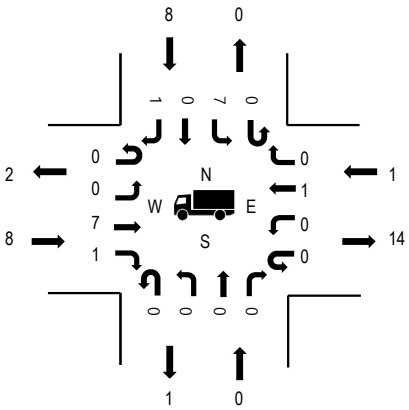
**Location:** 2 US 97 SB & SW REED MARKET RD PM
**Date:** Wednesday, August 3, 2022
**Peak Hour:** 04:50 PM - 05:50 PM
**Peak 15-Minutes:** 05:00 PM - 05:15 PM

## Peak Hour

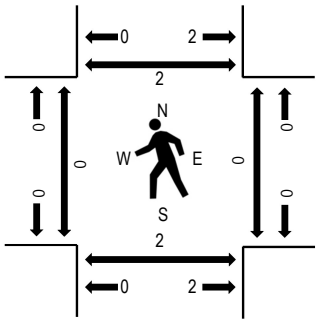
### Motorized Vehicles




### Heavy Vehicles




### Pedestrians




Note: Total study counts contained in parentheses.

| | HV% | PHF |
|---|---|---|
| EB | 1.0% | 0.88 |
| WB | 0.1% | 0.90 |
| NB | 0.0% | 0.00 |
| SB | 1.0% | 0.94 |
| All | 0.7% | 0.96 |

## Traffic Counts - Motorized Vehicles

| Interval Start Time | SW REED MARKET RD Eastbound | | | | SW REED MARKET RD Westbound | | | | US 97 SB Northbound | | | | US 97 SB Southbound | | | | | Rolling Hour |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | Total | |
| 4:00 PM | 0 | 0 | 53 | 2 | 0 | 0 | 41 | 11 | 0 | 0 | 0 | 0 | 0 | 58 | 0 | 17 | 182 | 2,171 |
| 4:05 PM | 0 | 0 | 65 | 7 | 0 | 0 | 52 | 7 | 0 | 0 | 0 | 0 | 0 | 39 | 0 | 13 | 183 | 2,212 |
| 4:10 PM | 0 | 0 | 56 | 7 | 0 | 0 | 33 | 4 | 0 | 0 | 0 | 0 | 0 | 63 | 0 | 18 | 181 | 2,212 |
| 4:15 PM | 0 | 0 | 48 | 4 | 0 | 0 | 43 | 6 | 0 | 0 | 0 | 0 | 0 | 51 | 0 | 21 | 173 | 2,232 |
| 4:20 PM | 0 | 0 | 69 | 8 | 0 | 0 | 57 | 9 | 0 | 0 | 0 | 0 | 0 | 41 | 0 | 14 | 198 | 2,252 |
| 4:25 PM | 0 | 0 | 50 | 8 | 0 | 0 | 50 | 7 | 0 | 0 | 0 | 0 | 0 | 48 | 0 | 30 | 193 | 2,257 |
| 4:30 PM | 0 | 0 | 52 | 1 | 0 | 0 | 61 | 3 | 0 | 0 | 0 | 0 | 0 | 51 | 0 | 17 | 185 | 2,249 |
| 4:35 PM | 0 | 0 | 46 | 9 | 0 | 0 | 45 | 9 | 0 | 0 | 0 | 0 | 0 | 44 | 1 | 24 | 178 | 2,260 |
| 4:40 PM | 0 | 0 | 49 | 5 | 0 | 0 | 40 | 6 | 0 | 0 | 0 | 0 | 0 | 47 | 0 | 23 | 170 | 2,290 |
| 4:45 PM | 0 | 0 | 46 | 10 | 0 | 0 | 32 | 8 | 0 | 0 | 0 | 0 | 0 | 47 | 0 | 21 | 164 | 2,303 |
| 4:50 PM | 0 | 0 | 56 | 6 | 0 | 0 | 48 | 12 | 0 | 0 | 0 | 0 | 0 | 46 | 0 | 12 | 180 | 2,319 |
| 4:55 PM | 0 | 0 | 54 | 6 | 0 | 0 | 43 | 11 | 0 | 0 | 0 | 0 | 0 | 48 | 0 | 22 | 184 | 2,315 |
| 5:00 PM | 0 | 0 | 61 | 9 | 0 | 0 | 53 | 12 | 0 | 0 | 0 | 0 | 0 | 73 | 0 | 15 | 223 | 2,278 |
| 5:05 PM | 0 | 0 | 55 | 3 | 0 | 0 | 45 | 14 | 0 | 0 | 0 | 0 | 0 | 47 | 0 | 19 | 183 | |
| 5:10 PM | 0 | 0 | 59 | 5 | 0 | 0 | 48 | 12 | 0 | 0 | 0 | 0 | 0 | 50 | 0 | 27 | 201 | |
| 5:15 PM | 0 | 0 | 49 | 7 | 0 | 0 | 50 | 9 | 0 | 0 | 0 | 0 | 0 | 63 | 0 | 15 | 193 | |
| 5:20 PM | 0 | 0 | 57 | 9 | 0 | 0 | 56 | 7 | 0 | 0 | 0 | 0 | 0 | 54 | 0 | 20 | 203 | |
| 5:25 PM | 0 | 0 | 63 | 10 | 0 | 0 | 39 | 6 | 0 | 0 | 0 | 0 | 0 | 49 | 0 | 18 | 185 | |
| 5:30 PM | 0 | 0 | 72 | 1 | 0 | 0 | 49 | 13 | 0 | 0 | 0 | 0 | 0 | 39 | 0 | 22 | 196 | |
| 5:35 PM | 0 | 0 | 72 | 2 | 0 | 0 | 67 | 12 | 0 | 0 | 0 | 0 | 0 | 43 | 0 | 12 | 208 | |
| 5:40 PM | 0 | 0 | 48 | 6 | 0 | 0 | 56 | 10 | 0 | 0 | 0 | 0 | 0 | 46 | 0 | 17 | 183 | |
| 5:45 PM | 0 | 0 | 56 | 7 | 0 | 0 | 54 | 11 | 0 | 0 | 0 | 0 | 0 | 36 | 0 | 16 | 180 | |
| 5:50 PM | 0 | 0 | 39 | 7 | 0 | 0 | 54 | 14 | 0 | 0 | 0 | 0 | 0 | 40 | 0 | 22 | 176 | |
| 5:55 PM | 0 | 0 | 39 | 2 | 0 | 0 | 51 | 10 | 0 | 0 | 0 | 0 | 0 | 33 | 0 | 12 | 147 | |
| Count Total | 0 | 0 | 1,314 | 141 | 0 | 0 | 1,167 | 223 | 0 | 0 | 0 | 0 | 0 | 1,156 | 1 | 447 | 4,449 | |
| Peak Hour | 0 | 0 | 702 | 71 | 0 | 0 | 608 | 129 | 0 | 0 | 0 | 0 | 0 | 594 | 0 | 215 | 2,319 | |

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

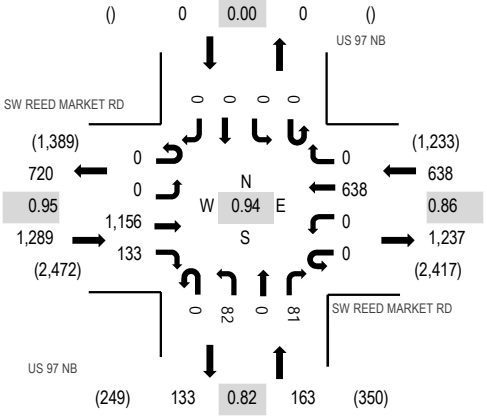
| Interval Start Time | Heavy Vehicles | | | | | Interval Start Time | Bicycles on Roadway | | | | | Interval Start Time | Pedestrians/Bicycles on Crosswalk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | EB | NB | WB | SB | Total | | EB | NB | WB | SB | Total | | EB | NB | WB | SB | Total |
| 4:00 PM | 1 | 0 | 1 | 0 | 2 | 4:00 PM | 0 | 0 | 0 | 0 | 0 | 4:00 PM | 0 | 0 | 0 | 1 | 1 |
| 4:05 PM | 3 | 0 | 1 | 2 | 6 | 4:05 PM | 1 | 0 | 0 | 0 | 1 | 4:05 PM | 0 | 0 | 0 | 0 | 0 |
| 4:10 PM | 0 | 0 | 0 | 1 | 1 | 4:10 PM | 1 | 0 | 0 | 0 | 1 | 4:10 PM | 0 | 0 | 0 | 1 | 1 |
| 4:15 PM | 0 | 0 | 0 | 1 | 1 | 4:15 PM | 0 | 0 | 0 | 0 | 0 | 4:15 PM | 0 | 0 | 0 | 0 | 0 |
| 4:20 PM | 0 | 0 | 1 | 0 | 1 | 4:20 PM | 1 | 0 | 0 | 0 | 1 | 4:20 PM | 0 | 0 | 0 | 0 | 0 |
| 4:25 PM | 0 | 0 | 0 | 2 | 2 | 4:25 PM | 0 | 0 | 0 | 0 | 0 | 4:25 PM | 0 | 0 | 0 | 0 | 0 |
| 4:30 PM | 2 | 0 | 2 | 0 | 4 | 4:30 PM | 0 | 0 | 1 | 0 | 1 | 4:30 PM | 0 | 0 | 0 | 0 | 0 |
| 4:35 PM | 0 | 0 | 0 | 0 | 0 | 4:35 PM | 0 | 0 | 0 | 0 | 0 | 4:35 PM | 0 | 0 | 0 | 0 | 0 |
| 4:40 PM | 1 | 0 | 0 | 1 | 2 | 4:40 PM | 1 | 0 | 0 | 0 | 1 | 4:40 PM | 0 | 0 | 0 | 0 | 0 |
| 4:45 PM | 0 | 0 | 0 | 1 | 1 | 4:45 PM | 0 | 0 | 0 | 0 | 0 | 4:45 PM | 0 | 0 | 0 | 2 | 2 |
| 4:50 PM | 1 | 0 | 0 | 1 | 2 | 4:50 PM | 0 | 0 | 0 | 0 | 0 | 4:50 PM | 0 | 1 | 0 | 0 | 1 |
| 4:55 PM | 1 | 0 | 0 | 0 | 1 | 4:55 PM | 0 | 0 | 1 | 0 | 1 | 4:55 PM | 0 | 1 | 0 | 0 | 1 |
| 5:00 PM | 1 | 0 | 0 | 1 | 2 | 5:00 PM | 0 | 0 | 0 | 0 | 0 | 5:00 PM | 0 | 0 | 0 | 1 | 1 |
| 5:05 PM | 0 | 0 | 0 | 1 | 1 | 5:05 PM | 0 | 0 | 0 | 0 | 0 | 5:05 PM | 0 | 0 | 0 | 0 | 0 |
| 5:10 PM | 1 | 0 | 0 | 1 | 2 | 5:10 PM | 0 | 0 | 0 | 0 | 0 | 5:10 PM | 0 | 0 | 0 | 1 | 1 |
| 5:15 PM | 3 | 0 | 0 | 0 | 3 | 5:15 PM | 1 | 0 | 0 | 0 | 1 | 5:15 PM | 0 | 0 | 0 | 0 | 0 |
| 5:20 PM | 0 | 0 | 0 | 1 | 1 | 5:20 PM | 0 | 0 | 0 | 0 | 0 | 5:20 PM | 0 | 0 | 0 | 0 | 0 |
| 5:25 PM | 0 | 0 | 0 | 1 | 1 | 5:25 PM | 0 | 0 | 1 | 1 | 2 | 5:25 PM | 0 | 0 | 0 | 2 | 2 |
| 5:30 PM | 0 | 0 | 0 | 0 | 0 | 5:30 PM | 1 | 0 | 0 | 0 | 1 | 5:30 PM | 0 | 0 | 0 | 1 | 1 |
| 5:35 PM | 1 | 0 | 0 | 0 | 1 | 5:35 PM | 0 | 0 | 1 | 0 | 1 | 5:35 PM | 0 | 0 | 0 | 0 | 0 |
| 5:40 PM | 0 | 0 | 1 | 1 | 2 | 5:40 PM | 0 | 0 | 0 | 0 | 0 | 5:40 PM | 0 | 0 | 0 | 0 | 0 |
| 5:45 PM | 0 | 0 | 0 | 1 | 1 | 5:45 PM | 0 | 0 | 0 | 0 | 0 | 5:45 PM | 0 | 0 | 0 | 0 | 0 |
| 5:50 PM | 0 | 0 | 0 | 1 | 1 | 5:50 PM | 0 | 0 | 2 | 0 | 2 | 5:50 PM | 0 | 0 | 0 | 0 | 0 |
| 5:55 PM | 1 | 0 | 0 | 1 | 2 | 5:55 PM | 0 | 0 | 0 | 0 | 0 | 5:55 PM | 0 | 3 | 0 | 0 | 3 |
| Count Total | 16 | 0 | 6 | 18 | 40 | Count Total | 6 | 0 | 6 | 1 | 13 | Count Total | 0 | 5 | 0 | 9 | 14 |
| Peak Hour | 8 | 0 | 1 | 8 | 17 | Peak Hour | 2 | 0 | 3 | 1 | 6 | Peak Hour | 0 | 2 | 0 | 5 | 7 |

ALL TRAFFIC DATA SERVICES
(303) 216-2439
www.alltrafficdata.net

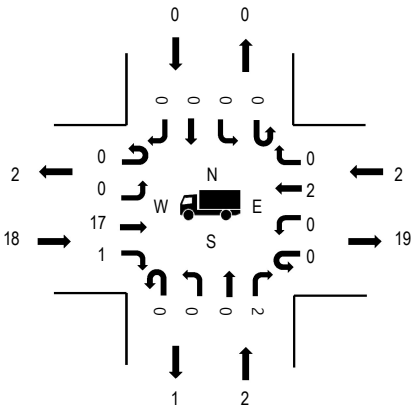
**Location:** 3 US 97 NB & SW REED MARKET RD PM
**Date:** Wednesday, August 3, 2022
**Peak Hour:** 04:50 PM - 05:50 PM
**Peak 15-Minutes:** 05:00 PM - 05:15 PM

## Peak Hour

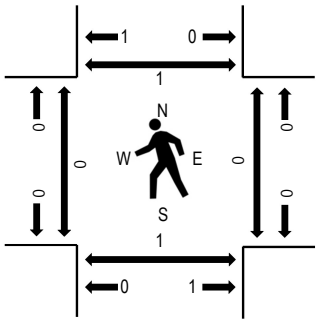
### Motorized Vehicles




### Heavy Vehicles




### Pedestrians




Note: Total study counts contained in parentheses.

| | HV% | PHF |
|---|---|---|
| EB | 1.4% | 0.95 |
| WB | 0.3% | 0.86 |
| NB | 1.2% | 0.82 |
| SB | 0.0% | 0.00 |
| All | 1.1% | 0.94 |

## Traffic Counts - Motorized Vehicles

| Interval Start Time | SW REED MARKET RD Eastbound | | | | SW REED MARKET RD Westbound | | | | US 97 NB Northbound | | | | US 97 NB Southbound | | | | | Rolling Hour |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | Total | |
| 4:00 PM | 0 | 0 | 100 | 8 | 0 | 0 | 52 | 0 | 0 | 2 | 0 | 5 | 0 | 0 | 0 | 0 | 167 | 1,993 |
| 4:05 PM | 0 | 0 | 87 | 9 | 0 | 0 | 46 | 0 | 0 | 6 | 0 | 8 | 0 | 0 | 0 | 0 | 156 | 2,025 |
| 4:10 PM | 0 | 0 | 117 | 10 | 0 | 0 | 44 | 0 | 0 | 3 | 0 | 5 | 0 | 0 | 0 | 0 | 179 | 2,052 |
| 4:15 PM | 0 | 0 | 92 | 13 | 0 | 0 | 46 | 0 | 0 | 5 | 0 | 13 | 0 | 0 | 0 | 0 | 169 | 2,047 |
| 4:20 PM | 0 | 0 | 101 | 7 | 0 | 0 | 47 | 0 | 0 | 9 | 0 | 9 | 0 | 0 | 0 | 0 | 173 | 2,058 |
| 4:25 PM | 0 | 0 | 86 | 14 | 0 | 0 | 53 | 0 | 0 | 10 | 0 | 13 | 0 | 0 | 0 | 0 | 176 | 2,047 |
| 4:30 PM | 0 | 0 | 92 | 7 | 0 | 0 | 49 | 0 | 0 | 7 | 0 | 13 | 0 | 0 | 0 | 0 | 168 | 2,041 |
| 4:35 PM | 0 | 0 | 83 | 12 | 0 | 0 | 58 | 0 | 0 | 8 | 0 | 13 | 0 | 0 | 0 | 0 | 174 | 2,054 |
| 4:40 PM | 0 | 0 | 92 | 6 | 0 | 0 | 51 | 0 | 0 | 4 | 0 | 12 | 0 | 0 | 0 | 0 | 165 | 2,084 |
| 4:45 PM | 0 | 0 | 82 | 9 | 0 | 0 | 39 | 0 | 0 | 6 | 0 | 11 | 0 | 0 | 0 | 0 | 147 | 2,081 |
| 4:50 PM | 0 | 0 | 95 | 9 | 0 | 0 | 50 | 0 | 0 | 3 | 0 | 8 | 0 | 0 | 0 | 0 | 165 | 2,090 |
| 4:55 PM | 0 | 0 | 99 | 7 | 0 | 0 | 33 | 0 | 0 | 9 | 0 | 6 | 0 | 0 | 0 | 0 | 154 | 2,068 |
| 5:00 PM | 0 | 0 | 119 | 9 | 0 | 0 | 59 | 0 | 0 | 4 | 0 | 8 | 0 | 0 | 0 | 0 | 199 | 2,062 |
| 5:05 PM | 0 | 0 | 96 | 8 | 0 | 0 | 59 | 0 | 0 | 8 | 0 | 12 | 0 | 0 | 0 | 0 | 183 | |
| 5:10 PM | 0 | 0 | 96 | 11 | 0 | 0 | 48 | 0 | 0 | 9 | 0 | 10 | 0 | 0 | 0 | 0 | 174 | |
| 5:15 PM | 0 | 0 | 104 | 9 | 0 | 0 | 57 | 0 | 0 | 5 | 0 | 5 | 0 | 0 | 0 | 0 | 180 | |
| 5:20 PM | 0 | 0 | 93 | 11 | 0 | 0 | 43 | 0 | 0 | 9 | 0 | 6 | 0 | 0 | 0 | 0 | 162 | |
| 5:25 PM | 0 | 0 | 93 | 23 | 0 | 0 | 39 | 0 | 0 | 10 | 0 | 5 | 0 | 0 | 0 | 0 | 170 | |
| 5:30 PM | 0 | 0 | 94 | 10 | 0 | 0 | 65 | 0 | 0 | 2 | 0 | 10 | 0 | 0 | 0 | 0 | 181 | |
| 5:35 PM | 0 | 0 | 110 | 13 | 0 | 0 | 72 | 0 | 0 | 6 | 0 | 3 | 0 | 0 | 0 | 0 | 204 | |
| 5:40 PM | 0 | 0 | 80 | 14 | 0 | 0 | 57 | 0 | 0 | 7 | 0 | 4 | 0 | 0 | 0 | 0 | 162 | |
| 5:45 PM | 0 | 0 | 77 | 9 | 0 | 0 | 56 | 0 | 0 | 10 | 0 | 4 | 0 | 0 | 0 | 0 | 156 | |
| 5:50 PM | 0 | 0 | 66 | 10 | 0 | 0 | 58 | 0 | 0 | 4 | 0 | 5 | 0 | 0 | 0 | 0 | 143 | |
| 5:55 PM | 0 | 0 | 69 | 11 | 0 | 0 | 52 | 0 | 0 | 10 | 0 | 6 | 0 | 0 | 0 | 0 | 148 | |
| Count Total | 0 | 0 | 2,223 | 249 | 0 | 0 | 1,233 | 0 | 0 | 156 | 0 | 194 | 0 | 0 | 0 | 0 | 4,055 | |
| Peak Hour | 0 | 0 | 1,156 | 133 | 0 | 0 | 638 | 0 | 0 | 82 | 0 | 81 | 0 | 0 | 0 | 0 | 2,090 | |

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

| Interval Start Time | Heavy Vehicles | | | | | Interval Start Time | Bicycles on Roadway | | | | | Interval Start Time | Pedestrians/Bicycles on Crosswalk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | EB | NB | WB | SB | Total | | EB | NB | WB | SB | Total | | EB | NB | WB | SB | Total |
| 4:00 PM | 3 | 0 | 0 | 0 | 3 | 4:00 PM | 0 | 0 | 0 | 0 | 0 | 4:00 PM | 0 | 1 | 0 | 3 | 4 |
| 4:05 PM | 5 | 0 | 2 | 0 | 7 | 4:05 PM | 1 | 0 | 0 | 0 | 1 | 4:05 PM | 0 | 0 | 0 | 0 | 0 |
| 4:10 PM | 1 | 0 | 0 | 0 | 1 | 4:10 PM | 1 | 0 | 0 | 0 | 1 | 4:10 PM | 0 | 0 | 0 | 0 | 0 |
| 4:15 PM | 1 | 1 | 0 | 0 | 2 | 4:15 PM | 0 | 0 | 0 | 0 | 0 | 4:15 PM | 0 | 2 | 0 | 0 | 2 |
| 4:20 PM | 1 | 0 | 1 | 0 | 2 | 4:20 PM | 0 | 0 | 1 | 0 | 1 | 4:20 PM | 0 | 0 | 0 | 0 | 0 |
| 4:25 PM | 1 | 0 | 0 | 0 | 1 | 4:25 PM | 0 | 0 | 0 | 0 | 0 | 4:25 PM | 0 | 0 | 0 | 1 | 1 |
| 4:30 PM | 2 | 1 | 2 | 0 | 5 | 4:30 PM | 0 | 0 | 0 | 0 | 0 | 4:30 PM | 0 | 0 | 0 | 0 | 0 |
| 4:35 PM | 1 | 0 | 0 | 0 | 1 | 4:35 PM | 0 | 0 | 0 | 0 | 0 | 4:35 PM | 0 | 0 | 0 | 0 | 0 |
| 4:40 PM | 3 | 0 | 0 | 0 | 3 | 4:40 PM | 1 | 0 | 0 | 0 | 1 | 4:40 PM | 0 | 0 | 0 | 1 | 1 |
| 4:45 PM | 2 | 0 | 0 | 0 | 2 | 4:45 PM | 0 | 0 | 0 | 0 | 0 | 4:45 PM | 0 | 1 | 0 | 0 | 1 |
| 4:50 PM | 1 | 0 | 0 | 0 | 1 | 4:50 PM | 0 | 0 | 0 | 0 | 0 | 4:50 PM | 0 | 0 | 0 | 2 | 2 |
| 4:55 PM | 1 | 1 | 0 | 0 | 2 | 4:55 PM | 0 | 0 | 1 | 0 | 1 | 4:55 PM | 0 | 0 | 0 | 0 | 0 |
| 5:00 PM | 0 | 1 | 0 | 0 | 1 | 5:00 PM | 0 | 0 | 0 | 0 | 0 | 5:00 PM | 0 | 0 | 0 | 0 | 0 |
| 5:05 PM | 2 | 0 | 0 | 0 | 2 | 5:05 PM | 0 | 0 | 0 | 0 | 0 | 5:05 PM | 0 | 1 | 0 | 0 | 1 |
| 5:10 PM | 2 | 0 | 0 | 0 | 2 | 5:10 PM | 1 | 0 | 0 | 0 | 1 | 5:10 PM | 0 | 1 | 0 | 0 | 1 |
| 5:15 PM | 3 | 0 | 0 | 0 | 3 | 5:15 PM | 1 | 0 | 0 | 0 | 1 | 5:15 PM | 0 | 0 | 0 | 0 | 0 |
| 5:20 PM | 2 | 0 | 1 | 0 | 3 | 5:20 PM | 0 | 0 | 1 | 0 | 1 | 5:20 PM | 0 | 0 | 0 | 0 | 0 |
| 5:25 PM | 1 | 0 | 0 | 0 | 1 | 5:25 PM | 0 | 0 | 0 | 0 | 0 | 5:25 PM | 0 | 2 | 0 | 0 | 2 |
| 5:30 PM | 1 | 0 | 0 | 0 | 1 | 5:30 PM | 2 | 0 | 0 | 0 | 2 | 5:30 PM | 0 | 0 | 0 | 1 | 1 |
| 5:35 PM | 1 | 0 | 1 | 0 | 2 | 5:35 PM | 0 | 0 | 0 | 0 | 0 | 5:35 PM | 0 | 0 | 0 | 0 | 0 |
| 5:40 PM | 3 | 0 | 0 | 0 | 3 | 5:40 PM | 0 | 0 | 0 | 0 | 0 | 5:40 PM | 0 | 0 | 0 | 0 | 0 |
| 5:45 PM | 1 | 0 | 0 | 0 | 1 | 5:45 PM | 0 | 0 | 0 | 0 | 0 | 5:45 PM | 0 | 0 | 0 | 0 | 0 |
| 5:50 PM | 1 | 1 | 1 | 0 | 3 | 5:50 PM | 0 | 0 | 0 | 0 | 0 | 5:50 PM | 0 | 0 | 0 | 3 | 3 |
| 5:55 PM | 3 | 0 | 0 | 0 | 3 | 5:55 PM | 0 | 0 | 0 | 0 | 0 | 5:55 PM | 0 | 0 | 0 | 0 | 0 |
| Count Total | 42 | 5 | 8 | 0 | 55 | Count Total | 7 | 0 | 3 | 0 | 10 | Count Total | 0 | 8 | 0 | 11 | 19 |
| Peak Hour | 18 | 2 | 2 | 0 | 22 | Peak Hour | 4 | 0 | 2 | 0 | 6 | Peak Hour | 0 | 4 | 0 | 3 | 7 |

ALL TRAFFIC DATA SERVICES
(303) 216-2439
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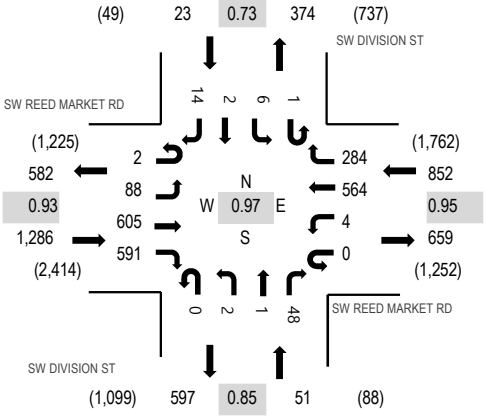
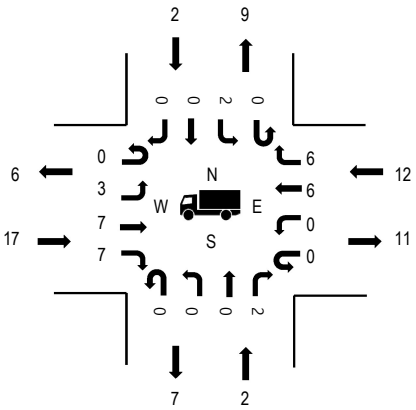
**Location:** 4 SW DIVISION ST & SW REED MARKET RD PM
**Date:** Wednesday, August 3, 2022
**Peak Hour:** 04:10 PM - 05:10 PM
**Peak 15-Minutes:** 04:10 PM - 04:25 PM

## Peak Hour

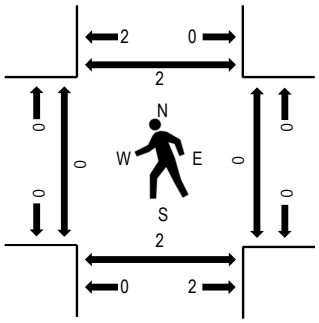
### Motorized Vehicles




### Heavy Vehicles




### Pedestrians




Note: Total study counts contained in parentheses.

| | HV% | PHF |
|---|---|---|
| EB | 1.3% | 0.93 |
| WB | 1.4% | 0.95 |
| NB | 3.9% | 0.85 |
| SB | 8.7% | 0.73 |
| All | 1.5% | 0.97 |

## Traffic Counts - Motorized Vehicles

| Interval Start Time | SW REED MARKET RD Eastbound | | | | SW REED MARKET RD Westbound | | | | SW DIVISION ST Northbound | | | | SW DIVISION ST Southbound | | | | | Rolling Hour |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | Total | |
| 4:00 PM | 0 | 3 | 36 | 44 | 0 | 0 | 50 | 19 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 155 | 2,155 |
| 4:05 PM | 1 | 6 | 53 | 42 | 0 | 0 | 50 | 26 | 0 | 0 | 0 | 3 | 0 | 0 | 1 | 2 | 184 | 2,195 |
| 4:10 PM | 0 | 4 | 55 | 59 | 0 | 0 | 44 | 26 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 1 | 194 | 2,212 |
| 4:15 PM | 0 | 4 | 58 | 61 | 0 | 0 | 44 | 25 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 1 | 195 | 2,207 |
| 4:20 PM | 0 | 6 | 50 | 47 | 0 | 0 | 49 | 26 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 1 | 183 | 2,198 |
| 4:25 PM | 0 | 5 | 55 | 45 | 0 | 1 | 53 | 22 | 0 | 0 | 0 | 6 | 0 | 0 | 1 | 0 | 188 | 2,197 |
| 4:30 PM | 0 | 4 | 56 | 45 | 0 | 1 | 50 | 24 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 1 | 184 | 2,181 |
| 4:35 PM | 0 | 10 | 41 | 37 | 0 | 1 | 53 | 24 | 0 | 1 | 1 | 4 | 0 | 2 | 0 | 3 | 177 | 2,171 |
| 4:40 PM | 1 | 7 | 52 | 47 | 0 | 0 | 46 | 22 | 0 | 0 | 0 | 3 | 0 | 1 | 0 | 2 | 181 | 2,210 |
| 4:45 PM | 1 | 5 | 46 | 43 | 0 | 0 | 40 | 27 | 0 | 1 | 0 | 5 | 0 | 1 | 0 | 1 | 170 | 2,193 |
| 4:50 PM | 0 | 8 | 42 | 53 | 0 | 0 | 48 | 28 | 0 | 0 | 0 | 5 | 1 | 0 | 1 | 1 | 187 | 2,194 |
| 4:55 PM | 0 | 8 | 45 | 54 | 0 | 0 | 29 | 16 | 0 | 0 | 0 | 3 | 0 | 2 | 0 | 0 | 157 | 2,170 |
| 5:00 PM | 0 | 7 | 50 | 54 | 0 | 0 | 57 | 23 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 1 | 195 | 2,158 |
| 5:05 PM | 0 | 20 | 55 | 46 | 0 | 1 | 51 | 21 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 2 | 201 | |
| 5:10 PM | 0 | 11 | 49 | 48 | 0 | 0 | 44 | 31 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 2 | 189 | |
| 5:15 PM | 0 | 8 | 51 | 41 | 0 | 0 | 50 | 29 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 4 | 186 | |
| 5:20 PM | 0 | 3 | 51 | 55 | 0 | 0 | 44 | 25 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 1 | 182 | |
| 5:25 PM | 1 | 9 | 45 | 48 | 0 | 0 | 38 | 26 | 0 | 0 | 0 | 3 | 0 | 2 | 0 | 0 | 172 | |
| 5:30 PM | 0 | 7 | 48 | 36 | 0 | 0 | 58 | 19 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 2 | 174 | |
| 5:35 PM | 1 | 8 | 54 | 58 | 0 | 0 | 68 | 22 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 2 | 216 | |
| 5:40 PM | 0 | 5 | 42 | 37 | 0 | 0 | 53 | 21 | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 3 | 164 | |
| 5:45 PM | 1 | 2 | 47 | 38 | 0 | 0 | 53 | 23 | 0 | 0 | 0 | 3 | 0 | 2 | 0 | 2 | 171 | |
| 5:50 PM | 0 | 3 | 37 | 29 | 0 | 0 | 59 | 31 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 1 | 163 | |
| 5:55 PM | 0 | 7 | 38 | 25 | 0 | 0 | 52 | 19 | 0 | 0 | 0 | 2 | 0 | 2 | 0 | 0 | 145 | |
| Count Total | 6 | 160 | 1,156 | 1,092 | 0 | 4 | 1,183 | 575 | 0 | 3 | 1 | 84 | 1 | 12 | 3 | 33 | 4,313 | |
| Peak Hour | 2 | 88 | 605 | 591 | 0 | 4 | 564 | 284 | 0 | 2 | 1 | 48 | 1 | 6 | 2 | 14 | 2,212 | |

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

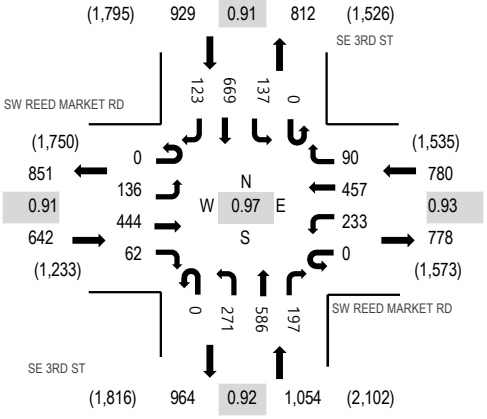
| Interval Start Time | Heavy Vehicles | | | | | Interval Start Time | Bicycles on Roadway | | | | | Interval Start Time | Pedestrians/Bicycles on Crosswalk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | EB | NB | WB | SB | Total | | EB | NB | WB | SB | Total | | EB | NB | WB | SB | Total |
| 4:00 PM | 1 | 0 | 1 | 0 | 2 | 4:00 PM | 0 | 0 | 0 | 0 | 0 | 4:00 PM | 0 | 0 | 0 | 3 | 3 |
| 4:05 PM | 5 | 0 | 2 | 0 | 7 | 4:05 PM | 0 | 0 | 0 | 0 | 0 | 4:05 PM | 0 | 0 | 0 | 0 | 0 |
| 4:10 PM | 1 | 0 | 1 | 0 | 2 | 4:10 PM | 2 | 0 | 0 | 0 | 2 | 4:10 PM | 0 | 0 | 0 | 0 | 0 |
| 4:15 PM | 2 | 1 | 1 | 0 | 4 | 4:15 PM | 0 | 0 | 0 | 0 | 0 | 4:15 PM | 0 | 1 | 0 | 0 | 1 |
| 4:20 PM | 1 | 0 | 1 | 0 | 2 | 4:20 PM | 1 | 0 | 0 | 0 | 1 | 4:20 PM | 0 | 0 | 0 | 0 | 0 |
| 4:25 PM | 2 | 0 | 0 | 0 | 2 | 4:25 PM | 0 | 0 | 1 | 0 | 1 | 4:25 PM | 0 | 0 | 0 | 0 | 0 |
| 4:30 PM | 2 | 0 | 4 | 0 | 6 | 4:30 PM | 0 | 0 | 0 | 0 | 0 | 4:30 PM | 1 | 0 | 0 | 0 | 1 |
| 4:35 PM | 0 | 0 | 1 | 1 | 2 | 4:35 PM | 0 | 0 | 1 | 0 | 1 | 4:35 PM | 0 | 0 | 0 | 0 | 0 |
| 4:40 PM | 2 | 0 | 0 | 1 | 3 | 4:40 PM | 0 | 0 | 0 | 0 | 0 | 4:40 PM | 0 | 0 | 0 | 1 | 1 |
| 4:45 PM | 1 | 1 | 1 | 0 | 3 | 4:45 PM | 0 | 0 | 0 | 0 | 0 | 4:45 PM | 0 | 0 | 0 | 0 | 0 |
| 4:50 PM | 1 | 0 | 1 | 0 | 2 | 4:50 PM | 0 | 0 | 0 | 0 | 0 | 4:50 PM | 0 | 1 | 0 | 1 | 2 |
| 4:55 PM | 2 | 0 | 0 | 0 | 2 | 4:55 PM | 0 | 0 | 0 | 1 | 1 | 4:55 PM | 0 | 0 | 0 | 0 | 0 |
| 5:00 PM | 1 | 0 | 2 | 0 | 3 | 5:00 PM | 0 | 0 | 0 | 0 | 0 | 5:00 PM | 0 | 0 | 0 | 0 | 0 |
| 5:05 PM | 2 | 0 | 0 | 0 | 2 | 5:05 PM | 0 | 0 | 0 | 0 | 0 | 5:05 PM | 0 | 0 | 0 | 0 | 0 |
| 5:10 PM | 3 | 0 | 1 | 0 | 4 | 5:10 PM | 1 | 1 | 0 | 0 | 2 | 5:10 PM | 0 | 0 | 0 | 0 | 0 |
| 5:15 PM | 4 | 0 | 0 | 0 | 4 | 5:15 PM | 1 | 0 | 0 | 0 | 1 | 5:15 PM | 0 | 1 | 0 | 0 | 1 |
| 5:20 PM | 2 | 0 | 3 | 0 | 5 | 5:20 PM | 0 | 0 | 0 | 0 | 0 | 5:20 PM | 0 | 0 | 0 | 0 | 0 |
| 5:25 PM | 1 | 0 | 0 | 0 | 1 | 5:25 PM | 0 | 0 | 0 | 0 | 0 | 5:25 PM | 0 | 0 | 0 | 0 | 0 |
| 5:30 PM | 0 | 0 | 0 | 0 | 0 | 5:30 PM | 2 | 0 | 2 | 0 | 4 | 5:30 PM | 0 | 2 | 0 | 0 | 2 |
| 5:35 PM | 1 | 0 | 1 | 0 | 2 | 5:35 PM | 0 | 0 | 0 | 0 | 0 | 5:35 PM | 0 | 0 | 0 | 2 | 2 |
| 5:40 PM | 3 | 0 | 0 | 0 | 3 | 5:40 PM | 0 | 0 | 0 | 0 | 0 | 5:40 PM | 0 | 0 | 0 | 0 | 0 |
| 5:45 PM | 1 | 0 | 1 | 0 | 2 | 5:45 PM | 0 | 0 | 0 | 0 | 0 | 5:45 PM | 0 | 0 | 0 | 3 | 3 |
| 5:50 PM | 2 | 0 | 2 | 0 | 4 | 5:50 PM | 0 | 0 | 2 | 0 | 2 | 5:50 PM | 0 | 0 | 0 | 1 | 1 |
| 5:55 PM | 2 | 0 | 0 | 0 | 2 | 5:55 PM | 0 | 0 | 0 | 0 | 0 | 5:55 PM | 0 | 0 | 0 | 1 | 1 |
| Count Total | 42 | 2 | 23 | 2 | 69 | Count Total | 7 | 1 | 6 | 1 | 15 | Count Total | 1 | 5 | 0 | 12 | 18 |
| Peak Hour | 17 | 2 | 12 | 2 | 33 | Peak Hour | 3 | 0 | 2 | 1 | 6 | Peak Hour | 1 | 2 | 0 | 2 | 5 |

ALL TRAFFIC DATA SERVICES
(303) 216-2439
www.alltrafficdata.net

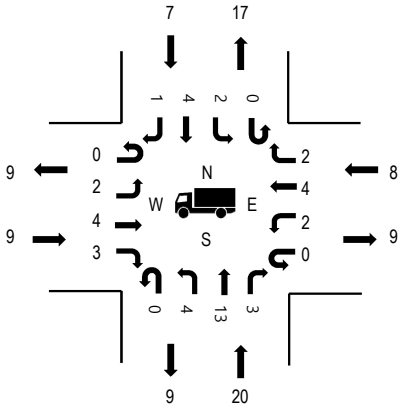
**Location:** 5 SE 3RD ST & SW REED MARKET RD PM
**Date:** Wednesday, August 3, 2022
**Peak Hour:** 04:15 PM - 05:15 PM
**Peak 15-Minutes:** 04:40 PM - 04:55 PM

## Peak Hour

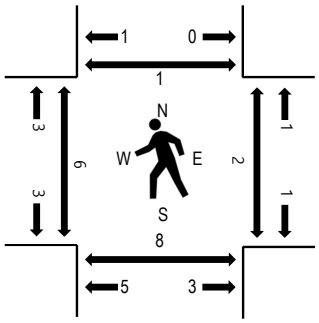
### Motorized Vehicles




### Heavy Vehicles




### Pedestrians




Note: Total study counts contained in parentheses.

| | HV% | PHF |
|---|---|---|
| EB | 1.4% | 0.91 |
| WB | 1.0% | 0.93 |
| NB | 1.9% | 0.92 |
| SB | 0.8% | 0.91 |
| All | 1.3% | 0.97 |

## Traffic Counts - Motorized Vehicles

| Interval Start Time | SW REED MARKET RD Eastbound | | | | SW REED MARKET RD Westbound | | | | SE 3RD ST Northbound | | | | SE 3RD ST Southbound | | | | | Rolling Hour |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | Total | |
| 4:00 PM | 0 | 5 | 26 | 3 | 0 | 21 | 30 | 8 | 0 | 27 | 54 | 28 | 0 | 7 | 68 | 11 | 288 | 3,376 |
| 4:05 PM | 0 | 4 | 47 | 5 | 0 | 18 | 42 | 7 | 0 | 25 | 51 | 15 | 0 | 12 | 43 | 10 | 279 | 3,363 |
| 4:10 PM | 0 | 6 | 53 | 3 | 0 | 11 | 38 | 7 | 0 | 21 | 49 | 21 | 0 | 4 | 51 | 8 | 272 | 3,389 |
| 4:15 PM | 0 | 7 | 47 | 5 | 0 | 18 | 38 | 8 | 0 | 23 | 48 | 16 | 0 | 12 | 51 | 7 | 280 | 3,405 |
| 4:20 PM | 0 | 15 | 34 | 8 | 0 | 21 | 38 | 6 | 0 | 26 | 44 | 17 | 0 | 10 | 54 | 10 | 283 | 3,405 |
| 4:25 PM | 0 | 14 | 37 | 7 | 0 | 21 | 40 | 7 | 0 | 26 | 46 | 22 | 0 | 7 | 51 | 8 | 286 | 3,394 |
| 4:30 PM | 0 | 15 | 37 | 3 | 0 | 23 | 37 | 10 | 0 | 20 | 53 | 12 | 0 | 11 | 54 | 15 | 290 | 3,403 |
| 4:35 PM | 0 | 7 | 33 | 7 | 0 | 19 | 48 | 4 | 0 | 23 | 43 | 12 | 0 | 11 | 59 | 7 | 273 | 3,374 |
| 4:40 PM | 0 | 15 | 38 | 6 | 0 | 18 | 48 | 5 | 0 | 24 | 53 | 19 | 0 | 13 | 50 | 4 | 293 | 3,392 |
| 4:45 PM | 0 | 20 | 26 | 4 | 0 | 21 | 41 | 8 | 0 | 18 | 49 | 18 | 0 | 13 | 62 | 9 | 289 | 3,370 |
| 4:50 PM | 0 | 10 | 29 | 6 | 0 | 22 | 38 | 11 | 0 | 26 | 52 | 19 | 0 | 14 | 62 | 11 | 300 | 3,343 |
| 4:55 PM | 0 | 6 | 36 | 6 | 0 | 6 | 14 | 13 | 0 | 16 | 41 | 14 | 0 | 14 | 64 | 13 | 243 | 3,313 |
| 5:00 PM | 0 | 7 | 38 | 5 | 0 | 14 | 37 | 4 | 0 | 24 | 55 | 14 | 0 | 12 | 52 | 13 | 275 | 3,289 |
| 5:05 PM | 0 | 8 | 50 | 1 | 0 | 28 | 35 | 7 | 0 | 24 | 56 | 18 | 0 | 11 | 55 | 12 | 305 | |
| 5:10 PM | 0 | 12 | 39 | 4 | 0 | 22 | 43 | 7 | 0 | 21 | 46 | 16 | 0 | 9 | 55 | 14 | 288 | |
| 5:15 PM | 0 | 13 | 31 | 4 | 0 | 19 | 48 | 3 | 0 | 24 | 53 | 14 | 0 | 12 | 48 | 11 | 280 | |
| 5:20 PM | 0 | 10 | 37 | 4 | 0 | 11 | 38 | 4 | 0 | 26 | 47 | 15 | 0 | 13 | 61 | 6 | 272 | |
| 5:25 PM | 0 | 5 | 44 | 4 | 0 | 25 | 30 | 7 | 0 | 25 | 47 | 23 | 0 | 14 | 63 | 8 | 295 | |
| 5:30 PM | 0 | 14 | 27 | 3 | 0 | 15 | 40 | 9 | 0 | 24 | 37 | 14 | 0 | 8 | 53 | 17 | 261 | |
| 5:35 PM | 0 | 11 | 41 | 6 | 0 | 12 | 52 | 6 | 0 | 23 | 34 | 25 | 0 | 12 | 59 | 10 | 291 | |
| 5:40 PM | 0 | 4 | 49 | 3 | 0 | 12 | 48 | 8 | 0 | 17 | 46 | 16 | 0 | 7 | 51 | 10 | 271 | |
| 5:45 PM | 0 | 11 | 29 | 3 | 0 | 14 | 40 | 11 | 0 | 24 | 45 | 16 | 0 | 12 | 47 | 10 | 262 | |
| 5:50 PM | 0 | 5 | 38 | 6 | 0 | 10 | 43 | 7 | 0 | 25 | 42 | 26 | 0 | 12 | 36 | 20 | 270 | |
| 5:55 PM | 0 | 5 | 28 | 4 | 0 | 15 | 43 | 3 | 0 | 20 | 36 | 13 | 0 | 6 | 41 | 5 | 219 | |
| Count Total | 0 | 229 | 894 | 110 | 0 | 416 | 949 | 170 | 0 | 552 | 1,127 | 423 | 0 | 256 | 1,290 | 249 | 6,665 | |
| Peak Hour | 0 | 136 | 444 | 62 | 0 | 233 | 457 | 90 | 0 | 271 | 586 | 197 | 0 | 137 | 669 | 123 | 3,405 | |

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

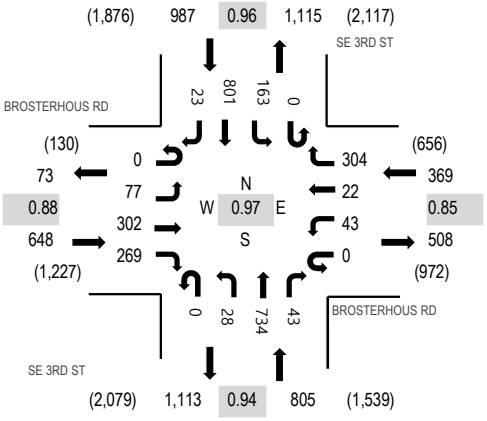
| Interval Start Time | Heavy Vehicles | | | | | Interval Start Time | Bicycles on Roadway | | | | | Interval Start Time | Pedestrians/Bicycles on Crosswalk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | EB | NB | WB | SB | Total | | EB | NB | WB | SB | Total | | EB | NB | WB | SB | Total |
| 4:00 PM | 2 | 1 | 1 | 1 | 5 | 4:00 PM | 0 | 0 | 0 | 0 | 0 | 4:00 PM | 1 | 0 | 0 | 0 | 1 |
| 4:05 PM | 2 | 2 | 1 | 1 | 6 | 4:05 PM | 0 | 1 | 0 | 1 | 2 | 4:05 PM | 0 | 0 | 0 | 0 | 0 |
| 4:10 PM | 3 | 1 | 3 | 0 | 7 | 4:10 PM | 1 | 1 | 0 | 0 | 2 | 4:10 PM | 1 | 0 | 2 | 1 | 4 |
| 4:15 PM | 1 | 2 | 0 | 0 | 3 | 4:15 PM | 0 | 0 | 0 | 0 | 0 | 4:15 PM | 1 | 1 | 0 | 0 | 2 |
| 4:20 PM | 1 | 1 | 1 | 1 | 4 | 4:20 PM | 0 | 1 | 0 | 1 | 2 | 4:20 PM | 0 | 3 | 3 | 1 | 7 |
| 4:25 PM | 2 | 1 | 1 | 0 | 4 | 4:25 PM | 1 | 0 | 1 | 0 | 2 | 4:25 PM | 2 | 1 | 1 | 0 | 4 |
| 4:30 PM | 0 | 3 | 2 | 3 | 8 | 4:30 PM | 0 | 0 | 0 | 0 | 0 | 4:30 PM | 1 | 1 | 0 | 0 | 2 |
| 4:35 PM | 0 | 2 | 3 | 0 | 5 | 4:35 PM | 0 | 0 | 0 | 0 | 0 | 4:35 PM | 0 | 0 | 2 | 0 | 2 |
| 4:40 PM | 1 | 1 | 0 | 1 | 3 | 4:40 PM | 0 | 2 | 0 | 0 | 2 | 4:40 PM | 3 | 1 | 0 | 0 | 4 |
| 4:45 PM | 2 | 2 | 0 | 0 | 4 | 4:45 PM | 0 | 2 | 0 | 0 | 2 | 4:45 PM | 0 | 0 | 1 | 1 | 2 |
| 4:50 PM | 1 | 3 | 0 | 1 | 5 | 4:50 PM | 0 | 0 | 1 | 0 | 1 | 4:50 PM | 0 | 0 | 0 | 0 | 0 |
| 4:55 PM | 0 | 1 | 0 | 0 | 1 | 4:55 PM | 0 | 0 | 0 | 0 | 0 | 4:55 PM | 0 | 1 | 0 | 0 | 1 |
| 5:00 PM | 0 | 1 | 1 | 0 | 2 | 5:00 PM | 0 | 1 | 0 | 0 | 1 | 5:00 PM | 0 | 1 | 0 | 0 | 1 |
| 5:05 PM | 0 | 1 | 0 | 1 | 2 | 5:05 PM | 0 | 2 | 0 | 0 | 2 | 5:05 PM | 0 | 1 | 0 | 0 | 1 |
| 5:10 PM | 1 | 2 | 0 | 0 | 3 | 5:10 PM | 2 | 1 | 0 | 0 | 3 | 5:10 PM | 1 | 1 | 0 | 0 | 2 |
| 5:15 PM | 0 | 0 | 0 | 1 | 1 | 5:15 PM | 0 | 0 | 0 | 1 | 1 | 5:15 PM | 0 | 1 | 1 | 0 | 2 |
| 5:20 PM | 3 | 1 | 2 | 0 | 6 | 5:20 PM | 1 | 0 | 0 | 0 | 1 | 5:20 PM | 0 | 0 | 0 | 0 | 0 |
| 5:25 PM | 0 | 1 | 0 | 1 | 2 | 5:25 PM | 0 | 0 | 0 | 0 | 0 | 5:25 PM | 0 | 0 | 0 | 0 | 0 |
| 5:30 PM | 0 | 1 | 0 | 1 | 2 | 5:30 PM | 0 | 1 | 0 | 0 | 1 | 5:30 PM | 2 | 2 | 0 | 0 | 4 |
| 5:35 PM | 1 | 0 | 1 | 3 | 5 | 5:35 PM | 1 | 0 | 0 | 0 | 1 | 5:35 PM | 0 | 0 | 0 | 0 | 0 |
| 5:40 PM | 1 | 1 | 1 | 2 | 5 | 5:40 PM | 0 | 0 | 0 | 2 | 2 | 5:40 PM | 0 | 0 | 0 | 1 | 1 |
| 5:45 PM | 0 | 1 | 0 | 0 | 1 | 5:45 PM | 0 | 0 | 0 | 0 | 0 | 5:45 PM | 2 | 0 | 0 | 0 | 2 |
| 5:50 PM | 1 | 0 | 1 | 1 | 3 | 5:50 PM | 0 | 1 | 0 | 1 | 2 | 5:50 PM | 1 | 1 | 1 | 2 | 5 |
| 5:55 PM | 1 | 0 | 0 | 0 | 1 | 5:55 PM | 0 | 0 | 0 | 0 | 0 | 5:55 PM | 0 | 0 | 0 | 0 | 0 |
| Count Total | 23 | 29 | 18 | 18 | 88 | Count Total | 6 | 13 | 2 | 6 | 27 | Count Total | 15 | 15 | 11 | 6 | 47 |
| Peak Hour | 9 | 20 | 8 | 7 | 44 | Peak Hour | 3 | 9 | 2 | 1 | 15 | Peak Hour | 8 | 11 | 7 | 2 | 28 |

ALL TRAFFIC DATA SERVICES
(303) 216-2439
www.alltrafficdata.net

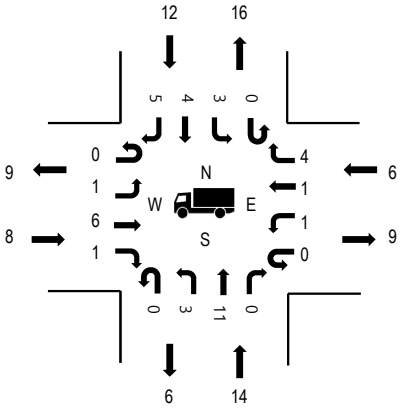
**Location:** 6 SE 3RD ST & BROSTERHOUS RD PM
**Date:** Wednesday, August 3, 2022
**Peak Hour:** 04:10 PM - 05:10 PM
**Peak 15-Minutes:** 04:40 PM - 04:55 PM

## Peak Hour

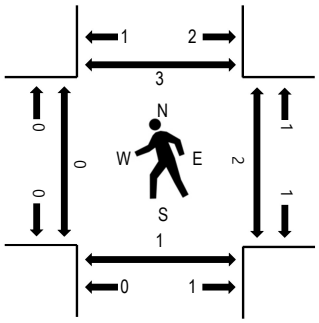
### Motorized Vehicles




### Heavy Vehicles




### Pedestrians




Note: Total study counts contained in parentheses.

| | HV% | PHF |
|---|---|---|
| EB | 1.2% | 0.88 |
| WB | 1.6% | 0.85 |
| NB | 1.7% | 0.94 |
| SB | 1.2% | 0.96 |
| All | 1.4% | 0.97 |

## Traffic Counts - Motorized Vehicles

| Interval Start Time | BROSTERHOUS RD Eastbound | | | | BROSTERHOUS RD Westbound | | | | SE 3RD ST Northbound | | | | SE 3RD ST Southbound | | | | | Rolling Hour |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | Total | |
| 4:00 PM | 0 | 7 | 22 | 18 | 0 | 3 | 3 | 23 | 0 | 2 | 61 | 7 | 0 | 7 | 86 | 0 | 239 | 2,765 |
| 4:05 PM | 0 | 23 | 21 | 29 | 0 | 4 | 0 | 16 | 0 | 4 | 48 | 2 | 0 | 15 | 55 | 2 | 219 | 2,785 |
| 4:10 PM | 0 | 4 | 21 | 35 | 0 | 2 | 1 | 26 | 0 | 2 | 66 | 2 | 0 | 12 | 56 | 4 | 231 | 2,809 |
| 4:15 PM | 0 | 9 | 21 | 23 | 0 | 3 | 1 | 24 | 0 | 4 | 59 | 4 | 0 | 12 | 59 | 4 | 223 | 2,784 |
| 4:20 PM | 0 | 6 | 28 | 23 | 0 | 2 | 1 | 26 | 0 | 2 | 71 | 4 | 0 | 18 | 68 | 2 | 251 | 2,777 |
| 4:25 PM | 0 | 10 | 21 | 17 | 0 | 2 | 2 | 20 | 0 | 3 | 64 | 4 | 0 | 8 | 72 | 1 | 224 | 2,740 |
| 4:30 PM | 0 | 5 | 28 | 24 | 0 | 5 | 3 | 23 | 0 | 2 | 55 | 4 | 0 | 14 | 64 | 2 | 229 | 2,744 |
| 4:35 PM | 0 | 3 | 20 | 15 | 0 | 1 | 2 | 24 | 0 | 1 | 61 | 2 | 0 | 17 | 83 | 0 | 229 | 2,723 |
| 4:40 PM | 0 | 5 | 18 | 16 | 0 | 3 | 1 | 31 | 0 | 0 | 70 | 7 | 0 | 14 | 57 | 1 | 223 | 2,706 |
| 4:45 PM | 0 | 6 | 25 | 20 | 0 | 8 | 5 | 34 | 0 | 4 | 56 | 2 | 0 | 14 | 66 | 3 | 243 | 2,687 |
| 4:50 PM | 0 | 3 | 34 | 23 | 0 | 1 | 1 | 18 | 0 | 2 | 70 | 2 | 0 | 10 | 90 | 4 | 258 | 2,653 |
| 4:55 PM | 0 | 6 | 27 | 21 | 0 | 5 | 2 | 18 | 0 | 6 | 42 | 3 | 0 | 16 | 49 | 1 | 196 | 2,561 |
| 5:00 PM | 0 | 11 | 35 | 28 | 0 | 5 | 2 | 24 | 0 | 0 | 65 | 4 | 0 | 17 | 68 | 0 | 259 | 2,533 |
| 5:05 PM | 0 | 9 | 24 | 24 | 0 | 6 | 1 | 36 | 0 | 2 | 55 | 5 | 0 | 11 | 69 | 1 | 243 | |
| 5:10 PM | 0 | 3 | 23 | 17 | 0 | 0 | 1 | 17 | 0 | 0 | 56 | 3 | 0 | 15 | 70 | 1 | 206 | |
| 5:15 PM | 0 | 6 | 30 | 15 | 0 | 3 | 0 | 26 | 0 | 3 | 57 | 2 | 0 | 7 | 64 | 3 | 216 | |
| 5:20 PM | 0 | 5 | 28 | 16 | 0 | 1 | 1 | 25 | 0 | 2 | 62 | 0 | 0 | 18 | 55 | 1 | 214 | |
| 5:25 PM | 0 | 3 | 23 | 26 | 0 | 2 | 0 | 21 | 0 | 2 | 61 | 7 | 0 | 12 | 68 | 3 | 228 | |
| 5:30 PM | 0 | 6 | 21 | 20 | 0 | 1 | 1 | 22 | 0 | 7 | 47 | 3 | 0 | 15 | 64 | 1 | 208 | |
| 5:35 PM | 0 | 6 | 29 | 22 | 0 | 1 | 1 | 16 | 0 | 0 | 57 | 3 | 0 | 16 | 58 | 3 | 212 | |
| 5:40 PM | 0 | 6 | 17 | 17 | 0 | 2 | 2 | 20 | 0 | 2 | 62 | 1 | 0 | 17 | 57 | 1 | 204 | |
| 5:45 PM | 0 | 7 | 27 | 13 | 0 | 3 | 1 | 31 | 0 | 3 | 59 | 5 | 0 | 7 | 52 | 1 | 209 | |
| 5:50 PM | 0 | 9 | 17 | 15 | 0 | 3 | 0 | 21 | 0 | 2 | 46 | 3 | 0 | 11 | 38 | 1 | 166 | |
| 5:55 PM | 0 | 2 | 15 | 15 | 0 | 2 | 1 | 13 | 0 | 1 | 52 | 2 | 0 | 13 | 51 | 1 | 168 | |
| Count Total | 0 | 160 | 575 | 492 | 0 | 68 | 33 | 555 | 0 | 56 | 1,402 | 81 | 0 | 316 | 1,519 | 41 | 5,298 | |
| Peak Hour | 0 | 77 | 302 | 269 | 0 | 43 | 22 | 304 | 0 | 28 | 734 | 43 | 0 | 163 | 801 | 23 | 2,809 | |

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

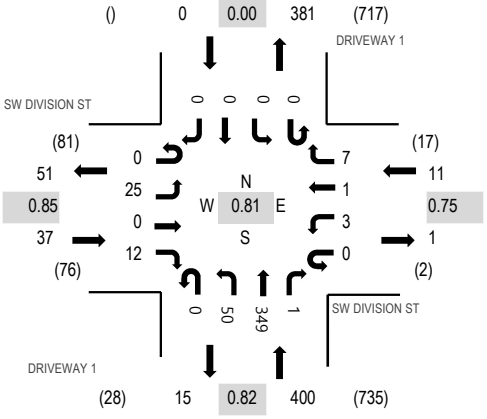
| Interval Start Time | Heavy Vehicles | | | | | Interval Start Time | Bicycles on Roadway | | | | | Interval Start Time | Pedestrians/Bicycles on Crosswalk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | EB | NB | WB | SB | Total | | EB | NB | WB | SB | Total | | EB | NB | WB | SB | Total |
| 4:00 PM | 1 | 2 | 0 | 0 | 3 | 4:00 PM | 0 | 0 | 0 | 0 | 0 | 4:00 PM | 1 | 0 | 0 | 1 | 2 |
| 4:05 PM | 1 | 2 | 0 | 2 | 5 | 4:05 PM | 0 | 0 | 0 | 0 | 0 | 4:05 PM | 1 | 1 | 0 | 1 | 3 |
| 4:10 PM | 0 | 2 | 1 | 1 | 4 | 4:10 PM | 1 | 0 | 0 | 0 | 1 | 4:10 PM | 0 | 0 | 0 | 0 | 0 |
| 4:15 PM | 0 | 1 | 0 | 2 | 3 | 4:15 PM | 0 | 0 | 0 | 0 | 0 | 4:15 PM | 0 | 0 | 0 | 0 | 0 |
| 4:20 PM | 0 | 1 | 0 | 1 | 2 | 4:20 PM | 0 | 0 | 0 | 0 | 0 | 4:20 PM | 0 | 0 | 0 | 1 | 1 |
| 4:25 PM | 1 | 1 | 1 | 0 | 3 | 4:25 PM | 0 | 0 | 1 | 0 | 1 | 4:25 PM | 0 | 0 | 0 | 0 | 0 |
| 4:30 PM | 1 | 2 | 1 | 1 | 5 | 4:30 PM | 0 | 0 | 0 | 0 | 0 | 4:30 PM | 1 | 0 | 0 | 0 | 1 |
| 4:35 PM | 1 | 2 | 1 | 3 | 7 | 4:35 PM | 0 | 0 | 0 | 0 | 0 | 4:35 PM | 0 | 0 | 0 | 0 | 0 |
| 4:40 PM | 1 | 1 | 1 | 1 | 4 | 4:40 PM | 0 | 0 | 0 | 0 | 0 | 4:40 PM | 1 | 1 | 0 | 0 | 2 |
| 4:45 PM | 0 | 1 | 0 | 1 | 2 | 4:45 PM | 0 | 0 | 0 | 2 | 2 | 4:45 PM | 1 | 0 | 0 | 0 | 1 |
| 4:50 PM | 1 | 1 | 0 | 0 | 2 | 4:50 PM | 0 | 0 | 1 | 0 | 1 | 4:50 PM | 0 | 0 | 1 | 1 | 2 |
| 4:55 PM | 1 | 1 | 0 | 1 | 3 | 4:55 PM | 0 | 0 | 0 | 0 | 0 | 4:55 PM | 0 | 0 | 1 | 1 | 2 |
| 5:00 PM | 1 | 1 | 1 | 0 | 3 | 5:00 PM | 0 | 0 | 0 | 0 | 0 | 5:00 PM | 0 | 0 | 0 | 0 | 0 |
| 5:05 PM | 1 | 0 | 0 | 1 | 2 | 5:05 PM | 0 | 0 | 1 | 1 | 2 | 5:05 PM | 0 | 1 | 0 | 1 | 2 |
| 5:10 PM | 0 | 1 | 0 | 0 | 1 | 5:10 PM | 1 | 0 | 0 | 0 | 1 | 5:10 PM | 0 | 1 | 1 | 2 | 4 |
| 5:15 PM | 0 | 0 | 0 | 0 | 0 | 5:15 PM | 0 | 0 | 0 | 1 | 1 | 5:15 PM | 1 | 0 | 1 | 2 | 4 |
| 5:20 PM | 0 | 0 | 0 | 0 | 0 | 5:20 PM | 0 | 0 | 0 | 0 | 0 | 5:20 PM | 0 | 0 | 0 | 0 | 0 |
| 5:25 PM | 0 | 1 | 0 | 2 | 3 | 5:25 PM | 0 | 0 | 0 | 1 | 1 | 5:25 PM | 0 | 0 | 0 | 1 | 1 |
| 5:30 PM | 0 | 1 | 0 | 1 | 2 | 5:30 PM | 0 | 0 | 0 | 0 | 0 | 5:30 PM | 1 | 1 | 0 | 0 | 2 |
| 5:35 PM | 1 | 0 | 0 | 4 | 5 | 5:35 PM | 0 | 0 | 0 | 0 | 0 | 5:35 PM | 0 | 0 | 0 | 0 | 0 |
| 5:40 PM | 1 | 0 | 0 | 3 | 4 | 5:40 PM | 0 | 0 | 0 | 0 | 0 | 5:40 PM | 0 | 0 | 2 | 0 | 2 |
| 5:45 PM | 0 | 1 | 1 | 0 | 2 | 5:45 PM | 0 | 0 | 0 | 0 | 0 | 5:45 PM | 1 | 0 | 0 | 0 | 1 |
| 5:50 PM | 0 | 0 | 0 | 1 | 1 | 5:50 PM | 0 | 0 | 0 | 1 | 1 | 5:50 PM | 0 | 0 | 0 | 0 | 0 |
| 5:55 PM | 0 | 0 | 0 | 0 | 0 | 5:55 PM | 0 | 0 | 0 | 0 | 0 | 5:55 PM | 0 | 0 | 1 | 0 | 1 |
| Count Total | 12 | 22 | 7 | 25 | 66 | Count Total | 2 | 0 | 3 | 6 | 11 | Count Total | 8 | 5 | 7 | 11 | 31 |
| Peak Hour | 8 | 14 | 6 | 12 | 40 | Peak Hour | 1 | 0 | 3 | 3 | 7 | Peak Hour | 3 | 2 | 2 | 4 | 11 |

ALL TRAFFIC DATA SERVICES
(303) 216-2439
www.alltrafficdata.net

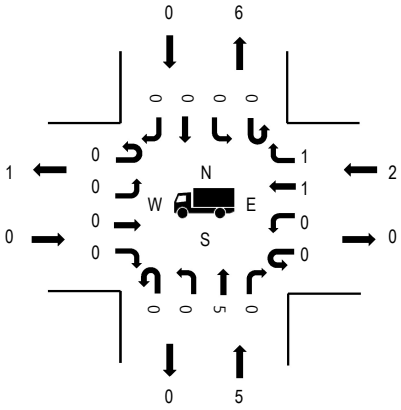
**Location:** 7 DRIVEWAY 1 & SW DIVISION ST PM
**Date:** Wednesday, August 3, 2022
**Peak Hour:** 04:35 PM - 05:35 PM
**Peak 15-Minutes:** 05:05 PM - 05:20 PM

## Peak Hour

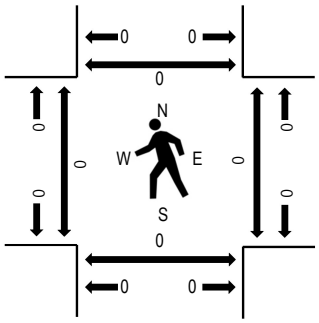
### Motorized Vehicles




### Heavy Vehicles




### Pedestrians




Note: Total study counts contained in parentheses.

| | HV% | PHF |
|---|---|---|
| EB | 0.0% | 0.85 |
| WB | 18.2% | 0.75 |
| NB | 1.3% | 0.82 |
| SB | 0.0% | 0.00 |
| All | 1.6% | 0.81 |

## Traffic Counts - Motorized Vehicles

| Interval Start Time | SW DIVISION ST Eastbound | | | | SW DIVISION ST Westbound | | | | DRIVEWAY 1 Northbound | | | | DRIVEWAY 1 Southbound | | | | | Rolling Hour |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | Total | |
| 4:00 PM | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 22 | 0 | 0 | 0 | 0 | 0 | 27 | 405 |
| 4:05 PM | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 2 | 28 | 0 | 0 | 0 | 0 | 0 | 32 | 410 |
| 4:10 PM | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 28 | 0 | 0 | 0 | 0 | 0 | 31 | 422 |
| 4:15 PM | 0 | 5 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 30 | 0 | 0 | 0 | 0 | 0 | 38 | 441 |
| 4:20 PM | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 3 | 29 | 0 | 0 | 0 | 0 | 0 | 34 | 447 |
| 4:25 PM | 0 | 2 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 2 | 24 | 0 | 0 | 0 | 0 | 0 | 30 | 445 |
| 4:30 PM | 0 | 2 | 1 | 2 | 0 | 0 | 0 | 1 | 0 | 1 | 23 | 0 | 0 | 0 | 0 | 0 | 30 | 447 |
| 4:35 PM | 0 | 2 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 4 | 30 | 0 | 0 | 0 | 0 | 0 | 39 | 448 |
| 4:40 PM | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 3 | 27 | 0 | 0 | 0 | 0 | 0 | 33 | 436 |
| 4:45 PM | 0 | 5 | 0 | 2 | 0 | 0 | 0 | 2 | 0 | 2 | 28 | 1 | 0 | 0 | 0 | 0 | 40 | 432 |
| 4:50 PM | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 5 | 31 | 0 | 0 | 0 | 0 | 0 | 38 | 425 |
| 4:55 PM | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 5 | 25 | 0 | 0 | 0 | 0 | 0 | 33 | 423 |
| 5:00 PM | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 6 | 22 | 0 | 0 | 0 | 0 | 0 | 32 | 423 |
| 5:05 PM | 0 | 3 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 9 | 31 | 0 | 0 | 0 | 0 | 0 | 44 | |
| 5:10 PM | 0 | 4 | 0 | 1 | 0 | 0 | 0 | 2 | 0 | 6 | 37 | 0 | 0 | 0 | 0 | 0 | 50 | |
| 5:15 PM | 0 | 1 | 0 | 3 | 0 | 1 | 0 | 0 | 0 | 2 | 37 | 0 | 0 | 0 | 0 | 0 | 44 | |
| 5:20 PM | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 30 | 0 | 0 | 0 | 0 | 0 | 32 | |
| 5:25 PM | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 28 | 0 | 0 | 0 | 0 | 0 | 32 | |
| 5:30 PM | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 6 | 23 | 0 | 0 | 0 | 0 | 0 | 31 | |
| 5:35 PM | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 4 | 21 | 0 | 0 | 0 | 0 | 0 | 27 | |
| 5:40 PM | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 5 | 22 | 0 | 0 | 0 | 0 | 0 | 29 | |
| 5:45 PM | 0 | 4 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 26 | 0 | 0 | 0 | 0 | 0 | 33 | |
| 5:50 PM | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 31 | 0 | 0 | 0 | 0 | 0 | 36 | |
| 5:55 PM | 0 | 3 | 0 | 1 | 0 | 0 | 0 | 2 | 0 | 5 | 22 | 0 | 0 | 0 | 0 | 0 | 33 | |
| Count Total | 0 | 50 | 1 | 25 | 0 | 3 | 2 | 12 | 0 | 79 | 655 | 1 | 0 | 0 | 0 | 0 | 828 | |
| Peak Hour | 0 | 25 | 0 | 12 | 0 | 3 | 1 | 7 | 0 | 50 | 349 | 1 | 0 | 0 | 0 | 0 | 448 | |

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

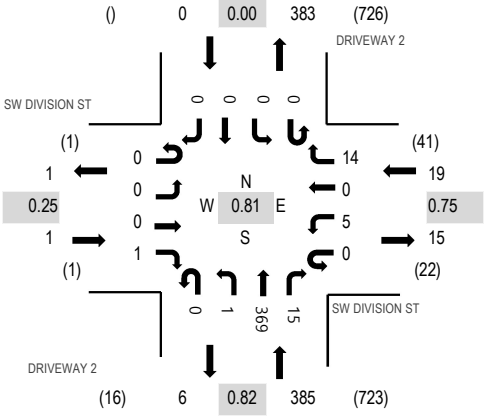
| Interval Start Time | Heavy Vehicles | | | | | Interval Start Time | Bicycles on Roadway | | | | | Interval Start Time | Pedestrians/Bicycles on Crosswalk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | EB | NB | WB | SB | Total | | EB | NB | WB | SB | Total | | EB | NB | WB | SB | Total |
| 4:00 PM | 0 | 0 | 0 | 0 | 0 | 4:00 PM | 0 | 0 | 0 | 0 | 0 | 4:00 PM | 0 | 0 | 0 | 0 | 0 |
| 4:05 PM | 0 | 1 | 0 | 0 | 1 | 4:05 PM | 0 | 0 | 0 | 0 | 0 | 4:05 PM | 0 | 0 | 0 | 0 | 0 |
| 4:10 PM | 0 | 1 | 0 | 0 | 1 | 4:10 PM | 0 | 0 | 0 | 0 | 0 | 4:10 PM | 0 | 0 | 0 | 0 | 0 |
| 4:15 PM | 0 | 0 | 1 | 0 | 1 | 4:15 PM | 0 | 0 | 0 | 0 | 0 | 4:15 PM | 0 | 0 | 0 | 0 | 0 |
| 4:20 PM | 0 | 0 | 0 | 0 | 0 | 4:20 PM | 0 | 0 | 0 | 0 | 0 | 4:20 PM | 0 | 0 | 0 | 0 | 0 |
| 4:25 PM | 0 | 0 | 0 | 0 | 0 | 4:25 PM | 0 | 0 | 0 | 0 | 0 | 4:25 PM | 0 | 0 | 0 | 0 | 0 |
| 4:30 PM | 0 | 0 | 0 | 0 | 0 | 4:30 PM | 0 | 0 | 0 | 0 | 0 | 4:30 PM | 0 | 0 | 0 | 0 | 0 |
| 4:35 PM | 0 | 1 | 0 | 0 | 1 | 4:35 PM | 0 | 0 | 0 | 0 | 0 | 4:35 PM | 0 | 0 | 0 | 0 | 0 |
| 4:40 PM | 0 | 0 | 0 | 0 | 0 | 4:40 PM | 0 | 0 | 0 | 0 | 0 | 4:40 PM | 0 | 0 | 0 | 0 | 0 |
| 4:45 PM | 0 | 1 | 1 | 0 | 2 | 4:45 PM | 0 | 0 | 0 | 0 | 0 | 4:45 PM | 0 | 0 | 0 | 0 | 0 |
| 4:50 PM | 0 | 0 | 0 | 0 | 0 | 4:50 PM | 0 | 0 | 0 | 0 | 0 | 4:50 PM | 0 | 0 | 0 | 0 | 0 |
| 4:55 PM | 0 | 0 | 0 | 0 | 0 | 4:55 PM | 0 | 0 | 0 | 0 | 0 | 4:55 PM | 0 | 0 | 1 | 0 | 1 |
| 5:00 PM | 0 | 1 | 0 | 0 | 1 | 5:00 PM | 0 | 0 | 0 | 0 | 0 | 5:00 PM | 0 | 0 | 0 | 0 | 0 |
| 5:05 PM | 0 | 1 | 0 | 0 | 1 | 5:05 PM | 0 | 0 | 0 | 0 | 0 | 5:05 PM | 0 | 0 | 0 | 0 | 0 |
| 5:10 PM | 0 | 0 | 0 | 0 | 0 | 5:10 PM | 0 | 0 | 0 | 0 | 0 | 5:10 PM | 0 | 0 | 0 | 0 | 0 |
| 5:15 PM | 0 | 0 | 0 | 0 | 0 | 5:15 PM | 0 | 0 | 0 | 0 | 0 | 5:15 PM | 0 | 0 | 0 | 0 | 0 |
| 5:20 PM | 0 | 1 | 0 | 0 | 1 | 5:20 PM | 0 | 0 | 0 | 0 | 0 | 5:20 PM | 0 | 0 | 0 | 0 | 0 |
| 5:25 PM | 0 | 0 | 0 | 0 | 0 | 5:25 PM | 0 | 0 | 0 | 0 | 0 | 5:25 PM | 0 | 0 | 0 | 0 | 0 |
| 5:30 PM | 0 | 0 | 1 | 0 | 1 | 5:30 PM | 0 | 0 | 0 | 0 | 0 | 5:30 PM | 0 | 0 | 0 | 0 | 0 |
| 5:35 PM | 0 | 0 | 0 | 0 | 0 | 5:35 PM | 1 | 0 | 0 | 0 | 1 | 5:35 PM | 0 | 0 | 4 | 0 | 4 |
| 5:40 PM | 0 | 0 | 0 | 0 | 0 | 5:40 PM | 0 | 0 | 0 | 0 | 0 | 5:40 PM | 0 | 0 | 0 | 0 | 0 |
| 5:45 PM | 0 | 0 | 0 | 0 | 0 | 5:45 PM | 0 | 0 | 0 | 0 | 0 | 5:45 PM | 0 | 0 | 1 | 0 | 1 |
| 5:50 PM | 0 | 0 | 0 | 0 | 0 | 5:50 PM | 0 | 0 | 0 | 0 | 0 | 5:50 PM | 0 | 0 | 0 | 0 | 0 |
| 5:55 PM | 0 | 0 | 1 | 0 | 1 | 5:55 PM | 0 | 0 | 0 | 0 | 0 | 5:55 PM | 0 | 0 | 0 | 0 | 0 |
| Count Total | 0 | 7 | 4 | 0 | 11 | Count Total | 1 | 0 | 0 | 0 | 1 | Count Total | 0 | 0 | 6 | 0 | 6 |
| Peak Hour | 0 | 5 | 2 | 0 | 7 | Peak Hour | 0 | 0 | 0 | 0 | 0 | Peak Hour | 0 | 0 | 1 | 0 | 1 |

ALL TRAFFIC DATA SERVICES
(303) 216-2439
www.alltrafficdata.net

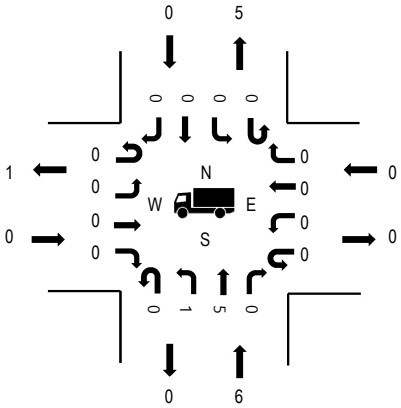
**Location:** 8 DRIVEWAY 2 & SW DIVISION ST PM
**Date:** Wednesday, August 3, 2022
**Peak Hour:** 04:15 PM - 05:15 PM
**Peak 15-Minutes:** 05:00 PM - 05:15 PM

## Peak Hour

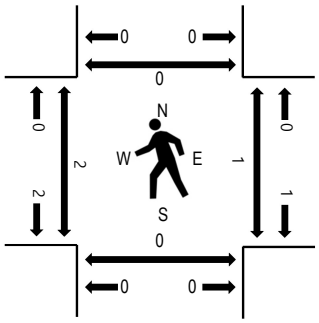
### Motorized Vehicles




### Heavy Vehicles



### Pedestrians



Note: Total study counts contained in parentheses.

| | HV% | PHF |
|---|---|---|
| EB | 0.0% | 0.25 |
| WB | 0.0% | 0.75 |
| NB | 1.6% | 0.82 |
| SB | 0.0% | 0.00 |
| All | 1.5% | 0.81 |

## Traffic Counts - Motorized Vehicles

| Interval Start Time | SW DIVISION ST Eastbound | | | | SW DIVISION ST Westbound | | | | DRIVEWAY 2 Northbound | | | | DRIVEWAY 2 Southbound | | | | | Rolling Hour |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | Total | |
| 4:00 PM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 34 | 0 | 0 | 0 | 0 | 0 | 37 | 373 |
| 4:05 PM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 23 | 1 | 0 | 0 | 0 | 0 | 25 | 375 |
| 4:10 PM | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 29 | 1 | 0 | 0 | 0 | 0 | 31 | 390 |
| 4:15 PM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 31 | 0 | 0 | 0 | 0 | 0 | 32 | 405 |
| 4:20 PM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 29 | 2 | 0 | 0 | 0 | 0 | 31 | 404 |
| 4:25 PM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 28 | 1 | 0 | 0 | 0 | 0 | 29 | 404 |
| 4:30 PM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 28 | 2 | 0 | 0 | 0 | 0 | 30 | 402 |
| 4:35 PM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 30 | 2 | 0 | 0 | 0 | 0 | 34 | 404 |
| 4:40 PM | 0 | 0 | 0 | 1 | 0 | 3 | 0 | 1 | 0 | 0 | 35 | 0 | 0 | 0 | 0 | 0 | 40 | 394 |
| 4:45 PM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 28 | 0 | 0 | 0 | 0 | 0 | 29 | 382 |
| 4:50 PM | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 29 | 0 | 0 | 0 | 0 | 0 | 31 | 378 |
| 4:55 PM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 22 | 1 | 0 | 0 | 0 | 0 | 24 | 381 |
| 5:00 PM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 31 | 4 | 0 | 0 | 0 | 0 | 39 | 392 |
| 5:05 PM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 36 | 1 | 0 | 0 | 0 | 0 | 40 | |
| 5:10 PM | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 42 | 2 | 0 | 0 | 0 | 0 | 46 | |
| 5:15 PM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 31 | 0 | 0 | 0 | 0 | 0 | 31 | |
| 5:20 PM | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 29 | 0 | 0 | 0 | 0 | 0 | 31 | |
| 5:25 PM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 26 | 0 | 0 | 0 | 0 | 0 | 27 | |
| 5:30 PM | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 2 | 0 | 0 | 26 | 1 | 0 | 0 | 0 | 0 | 32 | |
| 5:35 PM | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 0 | 0 | 20 | 1 | 0 | 0 | 0 | 0 | 24 | |
| 5:40 PM | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 26 | 0 | 0 | 0 | 0 | 0 | 28 | |
| 5:45 PM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 24 | 1 | 0 | 0 | 0 | 0 | 25 | |
| 5:50 PM | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 2 | 0 | 0 | 29 | 1 | 0 | 0 | 0 | 0 | 34 | |
| 5:55 PM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 34 | 1 | 0 | 0 | 0 | 0 | 35 | |
| Count Total | 0 | 0 | 0 | 1 | 0 | 15 | 0 | 26 | 0 | 1 | 700 | 22 | 0 | 0 | 0 | 0 | 765 | |
| Peak Hour | 0 | 0 | 0 | 1 | 0 | 5 | 0 | 14 | 0 | 1 | 369 | 15 | 0 | 0 | 0 | 0 | 405 | |

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

| Interval Start Time | Heavy Vehicles | | | | | Interval Start Time | Bicycles on Roadway | | | | | Interval Start Time | Pedestrians/Bicycles on Crosswalk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | EB | NB | WB | SB | Total | | EB | NB | WB | SB | Total | | EB | NB | WB | SB | Total |
| 4:00 PM | 0 | 1 | 0 | 0 | 1 | 4:00 PM | 0 | 0 | 0 | 0 | 0 | 4:00 PM | 0 | 0 | 0 | 0 | 0 |
| 4:05 PM | 0 | 0 | 0 | 0 | 0 | 4:05 PM | 0 | 0 | 0 | 0 | 0 | 4:05 PM | 0 | 0 | 0 | 0 | 0 |
| 4:10 PM | 0 | 1 | 0 | 0 | 1 | 4:10 PM | 0 | 0 | 0 | 0 | 0 | 4:10 PM | 0 | 0 | 0 | 0 | 0 |
| 4:15 PM | 0 | 1 | 0 | 0 | 1 | 4:15 PM | 0 | 0 | 0 | 0 | 0 | 4:15 PM | 0 | 0 | 0 | 0 | 0 |
| 4:20 PM | 0 | 0 | 0 | 0 | 0 | 4:20 PM | 0 | 0 | 0 | 0 | 0 | 4:20 PM | 0 | 0 | 0 | 0 | 0 |
| 4:25 PM | 0 | 0 | 0 | 0 | 0 | 4:25 PM | 0 | 0 | 1 | 0 | 1 | 4:25 PM | 0 | 0 | 0 | 0 | 0 |
| 4:30 PM | 0 | 1 | 0 | 0 | 1 | 4:30 PM | 0 | 0 | 0 | 0 | 0 | 4:30 PM | 0 | 0 | 0 | 0 | 0 |
| 4:35 PM | 0 | 0 | 0 | 0 | 0 | 4:35 PM | 0 | 0 | 0 | 0 | 0 | 4:35 PM | 0 | 0 | 0 | 0 | 0 |
| 4:40 PM | 0 | 1 | 0 | 0 | 1 | 4:40 PM | 0 | 0 | 0 | 0 | 0 | 4:40 PM | 0 | 0 | 0 | 0 | 0 |
| 4:45 PM | 0 | 1 | 0 | 0 | 1 | 4:45 PM | 0 | 0 | 0 | 0 | 0 | 4:45 PM | 0 | 0 | 0 | 0 | 0 |
| 4:50 PM | 0 | 0 | 0 | 0 | 0 | 4:50 PM | 0 | 0 | 0 | 0 | 0 | 4:50 PM | 0 | 0 | 0 | 0 | 0 |
| 4:55 PM | 0 | 1 | 0 | 0 | 1 | 4:55 PM | 0 | 0 | 0 | 0 | 0 | 4:55 PM | 0 | 0 | 1 | 0 | 1 |
| 5:00 PM | 0 | 0 | 0 | 0 | 0 | 5:00 PM | 0 | 0 | 0 | 0 | 0 | 5:00 PM | 0 | 0 | 0 | 0 | 0 |
| 5:05 PM | 0 | 1 | 0 | 0 | 1 | 5:05 PM | 0 | 0 | 0 | 0 | 0 | 5:05 PM | 0 | 0 | 0 | 0 | 0 |
| 5:10 PM | 0 | 0 | 0 | 0 | 0 | 5:10 PM | 0 | 0 | 0 | 0 | 0 | 5:10 PM | 2 | 0 | 0 | 0 | 2 |
| 5:15 PM | 0 | 0 | 0 | 0 | 0 | 5:15 PM | 0 | 0 | 0 | 0 | 0 | 5:15 PM | 0 | 0 | 0 | 0 | 0 |
| 5:20 PM | 0 | 0 | 0 | 0 | 0 | 5:20 PM | 0 | 0 | 0 | 0 | 0 | 5:20 PM | 0 | 0 | 0 | 0 | 0 |
| 5:25 PM | 0 | 0 | 0 | 0 | 0 | 5:25 PM | 0 | 0 | 0 | 0 | 0 | 5:25 PM | 0 | 0 | 0 | 0 | 0 |
| 5:30 PM | 0 | 0 | 0 | 0 | 0 | 5:30 PM | 0 | 0 | 0 | 0 | 0 | 5:30 PM | 0 | 0 | 0 | 0 | 0 |
| 5:35 PM | 0 | 1 | 0 | 0 | 1 | 5:35 PM | 0 | 0 | 0 | 0 | 0 | 5:35 PM | 0 | 0 | 0 | 0 | 0 |
| 5:40 PM | 0 | 0 | 0 | 0 | 0 | 5:40 PM | 0 | 0 | 0 | 0 | 0 | 5:40 PM | 0 | 0 | 0 | 0 | 0 |
| 5:45 PM | 0 | 1 | 0 | 0 | 1 | 5:45 PM | 0 | 0 | 0 | 0 | 0 | 5:45 PM | 0 | 0 | 0 | 0 | 0 |
| 5:50 PM | 0 | 0 | 0 | 0 | 0 | 5:50 PM | 0 | 0 | 0 | 0 | 0 | 5:50 PM | 0 | 0 | 0 | 0 | 0 |
| 5:55 PM | 0 | 1 | 0 | 0 | 1 | 5:55 PM | 0 | 0 | 0 | 0 | 0 | 5:55 PM | 0 | 0 | 0 | 0 | 0 |
| Count Total | 0 | 11 | 0 | 0 | 11 | Count Total | 0 | 0 | 1 | 0 | 1 | Count Total | 2 | 0 | 1 | 0 | 3 |
| Peak Hour | 0 | 6 | 0 | 0 | 6 | Peak Hour | 0 | 0 | 1 | 0 | 1 | Peak Hour | 2 | 0 | 1 | 0 | 3 |

# APPENDIX B: US 97 PARKWAY PLAN TRAFFIC VOLUME

# TRAFFIC VOLUME

This section describes motor vehicle traffic volume characteristics along US 97 under existing conditions (2017).

## Seasonal Variability

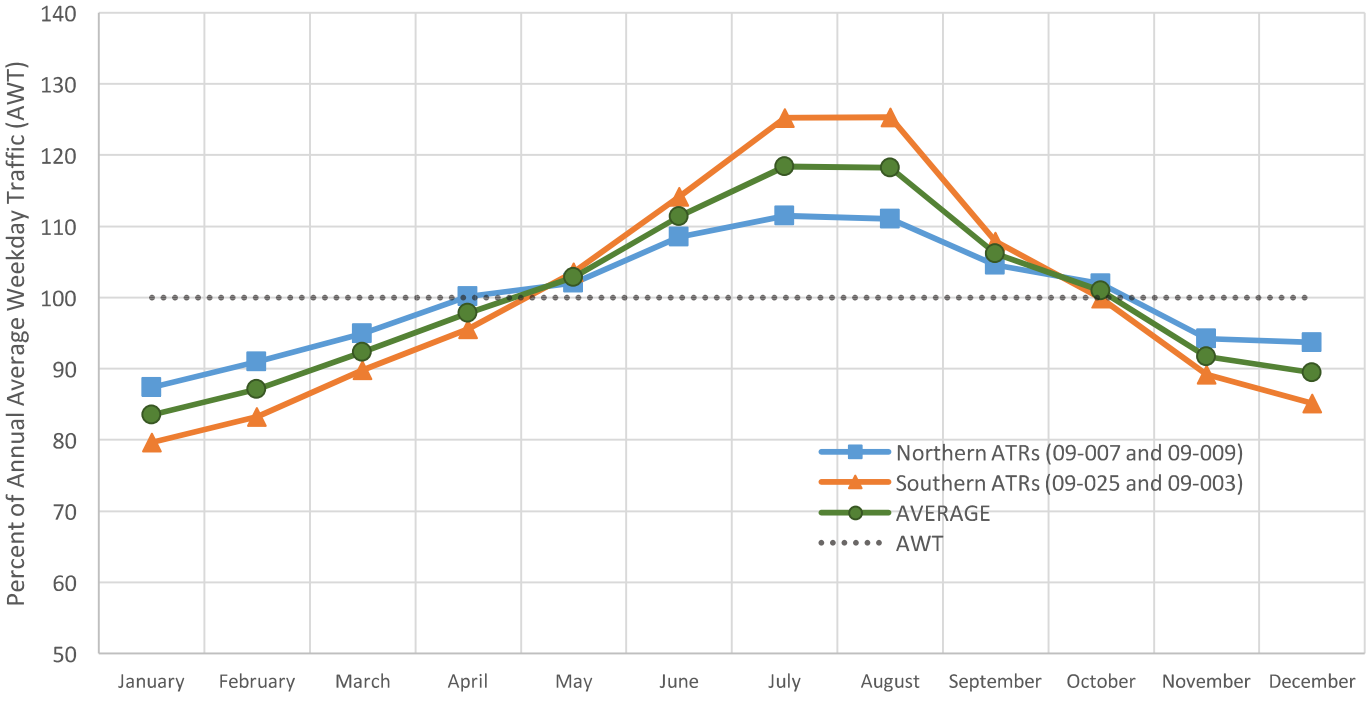
Seasonal adjustments to measured traffic volumes help account for the variation in traffic during the year. The 30th highest annual hour traffic volumes (30 HV) will be used for analysis and design purposes. To estimate conditions for the 30 HV period, seasonal adjustments to obtained traffic counts were made using the methodology from ODOT's Analysis Procedures Manual (APM)[6], as detailed in the Traffic Analysis Methodology Memorandum for this project.[7]

There are four Automatic Traffic Recorder stations (ATRs) within the project study area; two north of US 20 (at Empire Boulevard and at Revere Avenue) and two south of US 20 (at Pinebrook Boulevard and at China Hat Rd). These ATRs collect traffic volume data continuously throughout the year and reveal some key trends pertaining to traffic composition on US 97. Both northern ATRs (09-007 and 09-009) have closely correlated seasonal trends. The two southern ATRs are also closely correlated to each other but have significantly more seasonal variability with a steeper summer peak than the northern ATRs, as shown in Figure 15.

The steeper increase in summer traffic volumes compared to winter at the southern ATRs likely indicates a higher recreational proportion of traffic compared to the more commuter-oriented traffic profile of the northern ATRs. All four ATR counts indicated that July conditions best represent the 30 HV. However, the traffic counts for the study area were collected the week of April 10. To adjust these counts to represent July conditions, two different seasonal factors were applied to the north and south ends of the corridor. As a result, all counts collected from Truman Road to the north were increased by 11 percent. All counts collected south of Pinebrook Boulevard were increased by 31 percent. Counts between Truman Road and Pinebrook Boulevard were gradually increased by 11 to 31 percent, maintaining balanced volumes along the corridor.

[6] ODOT Analysis Procedures Manual, Version 2.
[7] US 97 Parkway Plan [Traffic Analysis] Methodology Memorandum, March 7, 2017.

**Figure 15: US 97 ATR Average Weekday Traffic Seasonal Trends through Bend**



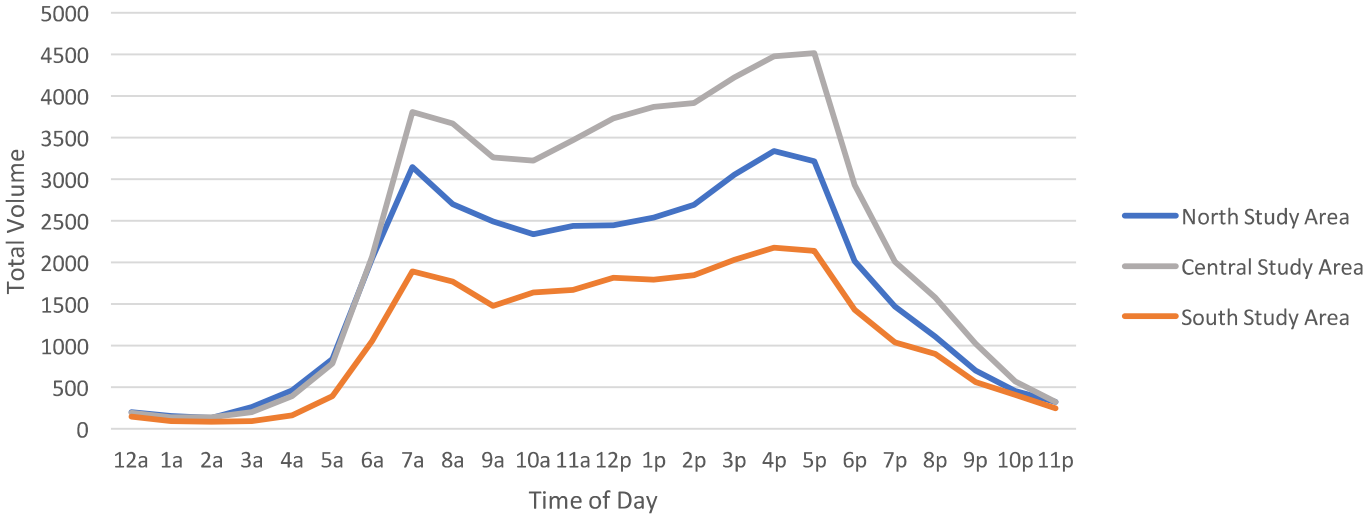

## Average Weekday Traffic Volume Profile

Changes in traffic volumes on US 97 throughout an average weekday were studied by creating a daily traffic volume profile using 24-hour counts collected in April 2017 at the following four locations.

- North of Clausen Road
- Between Butler Market Road and Empire Avenue
- Between Reed Market Road and Truman Avenue
- Between Knott Road and China Hat Road

These locations represent the North, Central, and South Study Areas. For the profile presented below, the second and third locations were averaged to create the Central Study Area profile.

**Figure 16: Average Weekday Traffic Volume Profile by Study Area**




As shown in, Figure 16 traffic peaks sharply in the morning around 7:00 AM, decreases until about 10:00 AM, then gradually increases and peaks again around 5:00 PM. PM peak traffic volumes are significantly higher than those in the AM peak. The Central Study Area experiences the greatest traffic volumes, while the South Study Area experiences the lowest. Though the magnitude varies along the corridor, the pattern over the day is similar for each study area. These trends informed the selection of a single system peak hour for use in the analysis.

## Peak Hour Traffic Volumes

Motor vehicle turning movement counts were collected at each of the 29 study intersections during the weekday evening peak period[8] (4:00 PM to 6:00 PM). All traffic counts were collected in the same week. The peak hour of traffic occurs from about 4:30 PM to 5:30 PM.

Figures 17-19 summarize existing lane configurations, traffic control, and weekday PM peak hour turning movement traffic volumes for each study intersection, as well as Average Daily Traffic (ADT) volumes with heavy vehicle (e.g., trucks, RVs) percentages at select locations on US 97. Detailed traffic count data, including PM peak period turn movement counts at the study intersections and 24-hour vehicle classification counts, are attached to this memorandum. As shown, average daily traffic volumes range from nearly 49,000 vehicles per day in the Central Study Area to about 19,000 vehicles per day in the South Study Area. Heavy vehicle percentages vary only slightly and average around nine percent.

[8] Count data collected on Tuesday, April 11th, 2017; Wednesday, April 12th, 2017; and Thursday, April 13th, 2017.

**Figure 17**

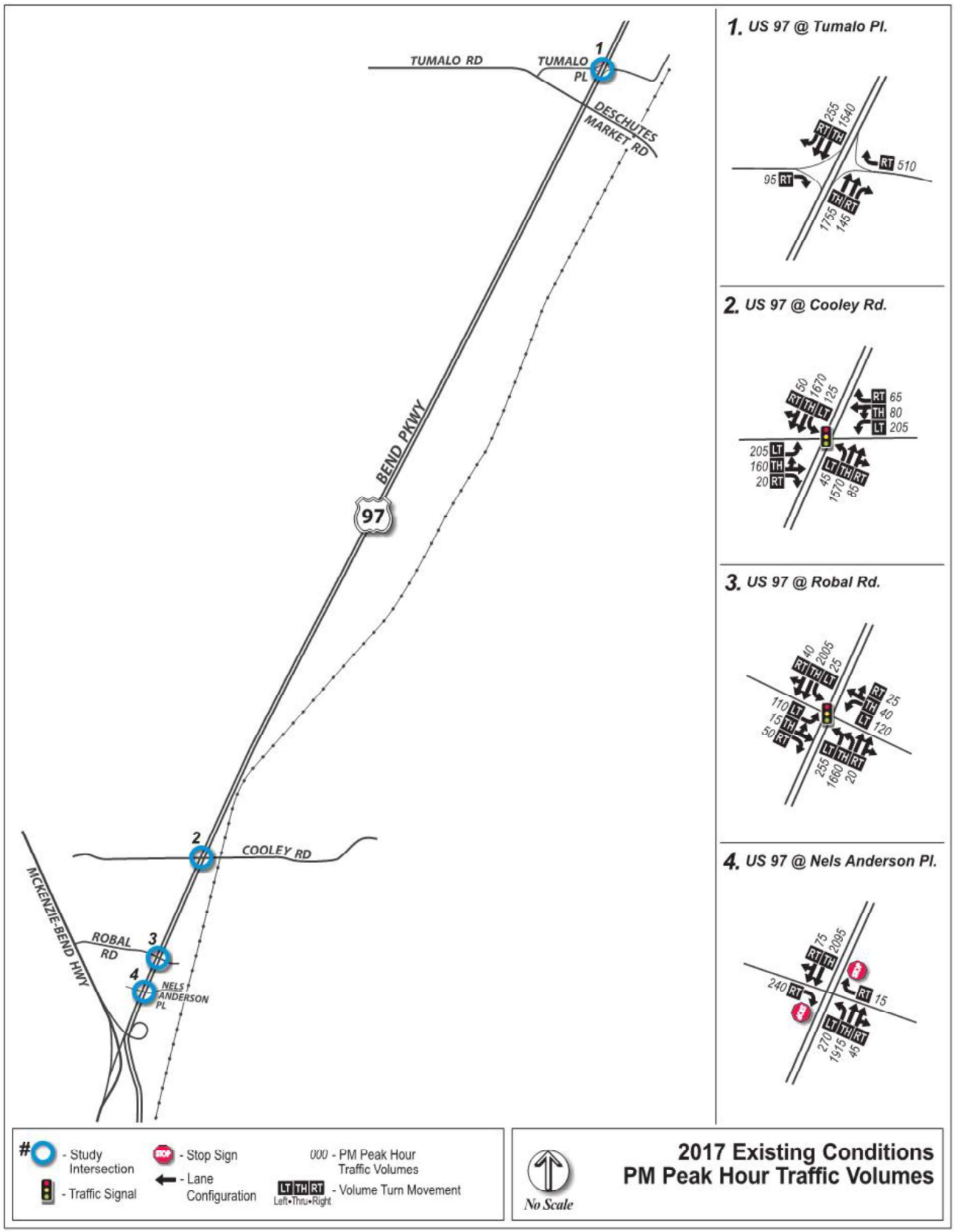

TUMALO RD
TUMALO PL
1
DESCHUTES MARKET RD
BEND PKWY
97
2
COOLEY RD
MCKENZIE-BEND HWY
ROBAL RD
3
4
NELS ANDERSON PL
1. US 97 @ Tumalo Pl.
2. US 97 @ Cooley Rd.
3. US 97 @ Robal Rd.
4. US 97 @ Nels Anderson Pl.
# - Study Intersection
- Traffic Signal
- Stop Sign
- Lane Configuration
000 - PM Peak Hour Traffic Volumes
LT TH RT - Volume Turn Movement
Left•Thru•Right
No Scale
2017 Existing Conditions
PM Peak Hour Traffic Volumes

**Figure 18**

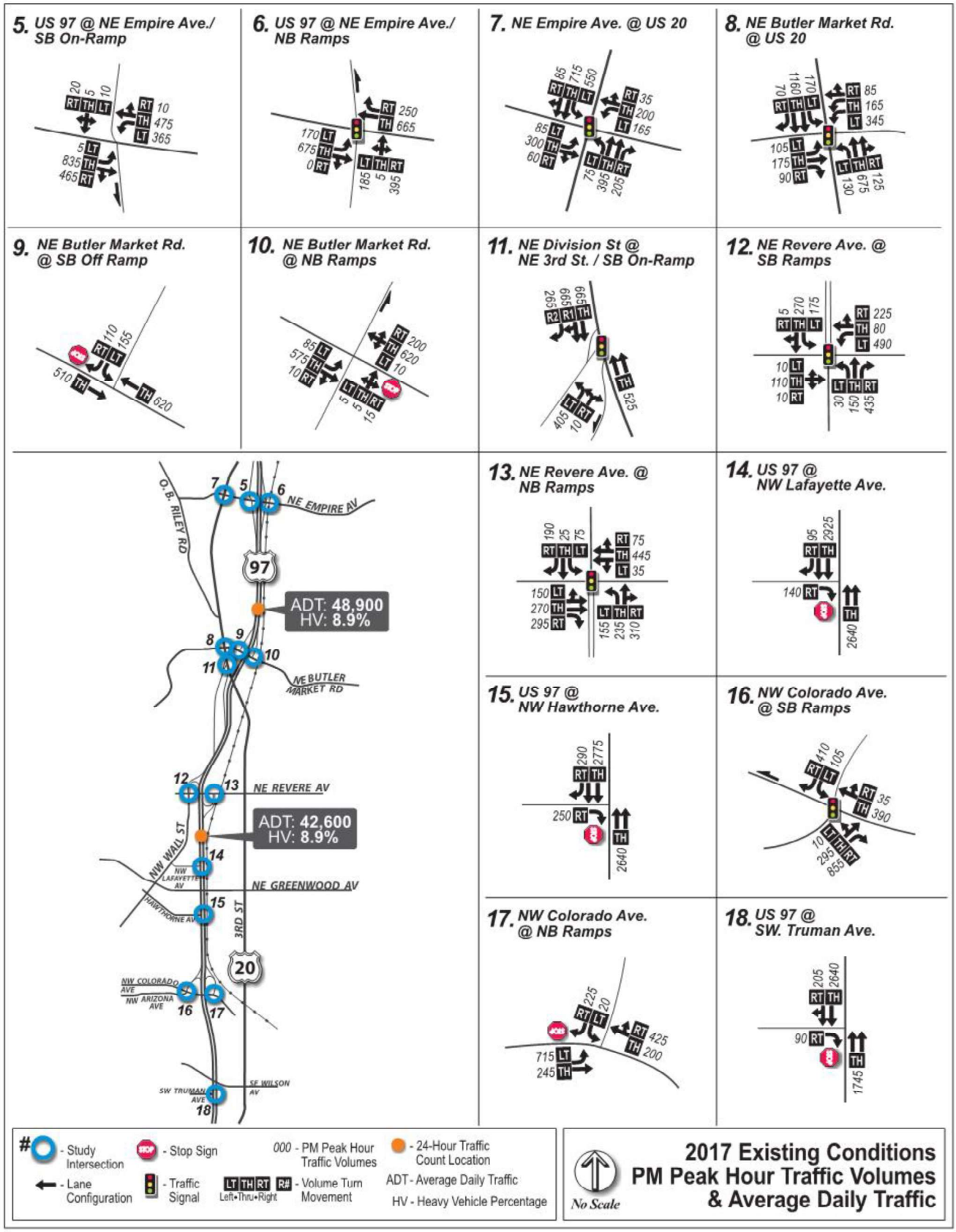
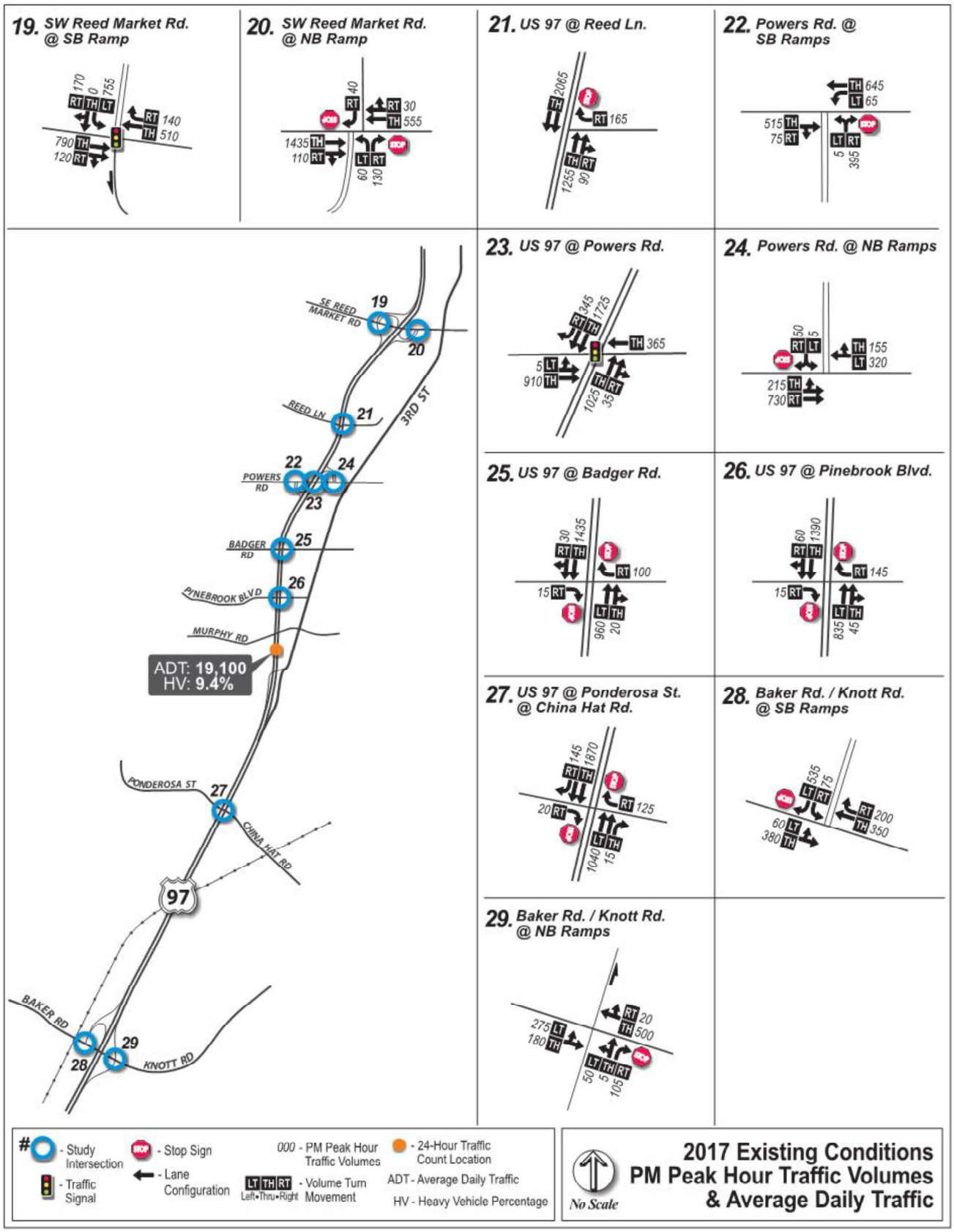

5. US 97 @ NE Empire Ave./ SB On-Ramp
6. US 97 @ NE Empire Ave./ NB Ramps
7. NE Empire Ave. @ US 20
8. NE Butler Market Rd. @ US 20
9. NE Butler Market Rd. @ SB Off Ramp
10. NE Butler Market Rd. @ NB Ramps
11. NE Division St @ NE 3rd St. / SB On-Ramp
12. NE Revere Ave. @ SB Ramps
13. NE Revere Ave. @ NB Ramps
14. US 97 @ NW Lafayette Ave.
15. US 97 @ NW Hawthorne Ave.
16. NW Colorado Ave. @ SB Ramps
17. NW Colorado Ave. @ NB Ramps
18. US 97 @ SW. Truman Ave.
O.B. RILEY RD
NE EMPIRE AV
NE BUTLER MARKET RD
NE REVERE AV
NE GREENWOOD AV
NW WALL ST
NW LAFAYETTE AV
HAWTHORNE AV
3RD ST
NW COLORADO AVE
NW ARIZONA AVE
SW TRUMAN AVE
SE WILSON AV
97
20
ADT: 48,900
HV: 8.9%
ADT: 42,600
HV: 8.9%
# - Study Intersection
- Stop Sign
000 - PM Peak Hour Traffic Volumes
- 24-Hour Traffic Count Location
- Lane Configuration
- Traffic Signal
LT TH RT R# - Volume Turn Movement
Left-Thru-Right
ADT - Average Daily Traffic
HV - Heavy Vehicle Percentage
No Scale
2017 Existing Conditions
PM Peak Hour Traffic Volumes
& Average Daily Traffic

**Figure 19**


19. SW Reed Market Rd. @ SB Ramp
20. SW Reed Market Rd. @ NB Ramp
21. US 97 @ Reed Ln.
22. Powers Rd. @ SB Ramps
23. US 97 @ Powers Rd.
24. Powers Rd. @ NB Ramps
25. US 97 @ Badger Rd.
26. US 97 @ Pinebrook Blvd.
27. US 97 @ Ponderosa St. @ China Hat Rd.
28. Baker Rd. / Knott Rd. @ SB Ramps
29. Baker Rd. / Knott Rd. @ NB Ramps
SE REED MARKET RD
REED LN
3RD ST
POWERS RD
BADGER RD
PINEBROOK BLVD
MURPHY RD
PONDEROSA ST
CHINA HAT RD
BAKER RD
KNOTT RD
97
ADT: 19,100
HV: 9.4%
# - Study Intersection
- Traffic Signal
- Stop Sign
- Lane Configuration
000 - PM Peak Hour Traffic Volumes
LT TH RT Left•Thru•Right - Volume Turn Movement
- 24-Hour Traffic Count Location
ADT - Average Daily Traffic
HV - Heavy Vehicle Percentage
No Scale
2017 Existing Conditions
PM Peak Hour Traffic Volumes
& Average Daily Traffic

# ATTACHMENT D: TECHNICAL MEMORANDUM #3

## FUTURE BASELINE (NO-BUILD) TRANSPORTATION SYSTEM CONDITIONS

DKS 720 SW WASHINGTON STREET, SUITE 500, PORTLAND, OR 97205 • 503.243.3500 • DKSASSOCIATES.COM

# TECHNICAL MEMORANDUM 3

DATE: November 15, 2022

TO: Project Team

FROM: Eileen Chai, EIT; Kayla Fleskes-Lane, PE; John Bosket, PE | DKS Associates

SUBJECT: US 97 at Reed Market Road Operations and Safety Study
Future Baseline (No-Build) Transportation System Conditions

Project #22129-001

This memorandum documents future baseline (No-Build) system conditions for the US 97 at Reed Market Road study area, including documentation of future No-Build traffic operations, walking, biking, and transit conditions. The information provided in this memorandum, in combination with *Technical Memorandum #2: Existing Conditions,* will help provide an understanding of the "No-Build" condition and will be used to identify deficiencies and inform the development of solutions for the Reed Market Road study corridor.

## TRAFFIC OPERATIONS

The evaluation includes the same study area as described in *Technical Memorandum #2: Existing Conditions*. Six study intersections (shown in Figure 1) are included in this study to analyze the operational and safety improvements for the study corridor. The following section discusses the process for developing future (Year 2040) traffic volumes and the results of the intersection operations analysis.

### FUTURE VOLUME DEVELOPMENT

Future traffic volumes were forecast for Year 2040 at the study intersections using the Bend-Redmond Regional Travel Demand Model (BRM). The BRM transportation network included financially constrained projects listed in the Statewide Transportation Improvement Program, Bend Transportation GO Bond project list, and the Capital Improvement Program (CIP) project list, as noted in *Technical Memorandum #1, Appendix A: Methodology Memorandum.* In addition to the financially constrained projects, the closure of right-on, right-off access on US 97 is assumed, as that planned project[1] has a noticeable impact on the volume of traffic at the interchange. Note that improvements identified in the GO Bond project list along the Reed Market Road corridor (intersection capacity improvement at 3rd Street, the US 97 interchange, and Brookswood

[1] Project included in the Bend Transportation System Plan (C-42) and identified in the US 97 Parkway Plan.

Boulevard/Bond Street) are not included, as these improvements will be tested as part of the build alternatives for this study. Key financially constrained projects in the area included in the modeling are:

- The Chase Road connection
- The Reed Market Road railroad overcrossing (including a removal of access at 9th Street)[2]
- US 97/Murphy Road interchange ramps
- US 97 Frontage Road near Murphy Road (between Badger Road and Ponderosa Street)
- The closure of US 97 right-on, right-off access (e.g., Reed Lane access to the south and Truman Avenue to the north)

Several projects that are included in the City of Bend Transportation System Plan (TSP) project list are not financially constrained (i.e., funding has not been committed for these projects); therefore, these projects are excluded from the 2040 No-Build scenario. This includes the following projects near the study area:

- Ramp metering of US 97 (C-42, Bend TSP Mid-Term project list)
- Powers Road interchange (C-41, Bend TSP Mid-Term project list)

Regarding future transportation projects, there are already projects listed in the Bend TSP/MTP to address the major bottlenecks in the Reed Market Road study corridor. This study intends to refine those concepts and complement them with further operational or safety enhancement projects where feasible. Therefore, no major updates to the TSP/MTP are anticipated and the new state requirements through OAR 660-012-0830 for an enhanced review of select roadway projects would not apply unless this study recommends to advance a new capacity building project that meets the criteria of that rule.

The BRM scenario uses the 2040 land use assumptions developed for the most recent TSP update, with the addition of recent refinements associated with the Stevens Road Tract[3] and Stevens Ranch Tract[4] developments located east of 27th Street between Ferguson Road and Reed Market Road. The scenario was used as the basis to estimate Year 2040 traffic growth at all study intersections, using the base year (2019) scenario and 2040 scenario. Raw link level volumes from the BRM were post-processed using methods consistent with the Oregon Department of Transportation (ODOT) Analysis Procedures Manual (APM). This approach was derived from methodologies outlined in the National Cooperative Highway Research Program (NCHRP) Report 765, *Analytical Travel Forecasting Approaches for Project-Level Planning and Design*.

Figure 1 shows the 2040 traffic volumes under No-Build conditions at the study intersections during the design hour (future equivalent of the 30th highest hour [30th HV] at ODOT intersections and

[2] Depending on the design of a Reed Market Road overcrossing of the railroad, it is possible that access to 9th Street could be maintained. It is not expected that maintaining that access would significantly influence operations at the study intersections.

[3] Stevens Road Tract Concept Plan, June 2022

[4] Stevens Ranch Major Community Master Plan, October 2021

average weekday [AWD] at City of Bend intersections). The volumes shown include seasonal factoring using guidance from the APM. In general, future traffic volumes along Reed Market Road are expected to grow by approximately 20 percent over the next 18 years. On the east side of the interchange, traffic travelling through the 3rd Street/Brosterhous Road intersection is expected to increase by approximately 50 percent on the westbound approach and 15 percent on other approaches over the next 18 years.

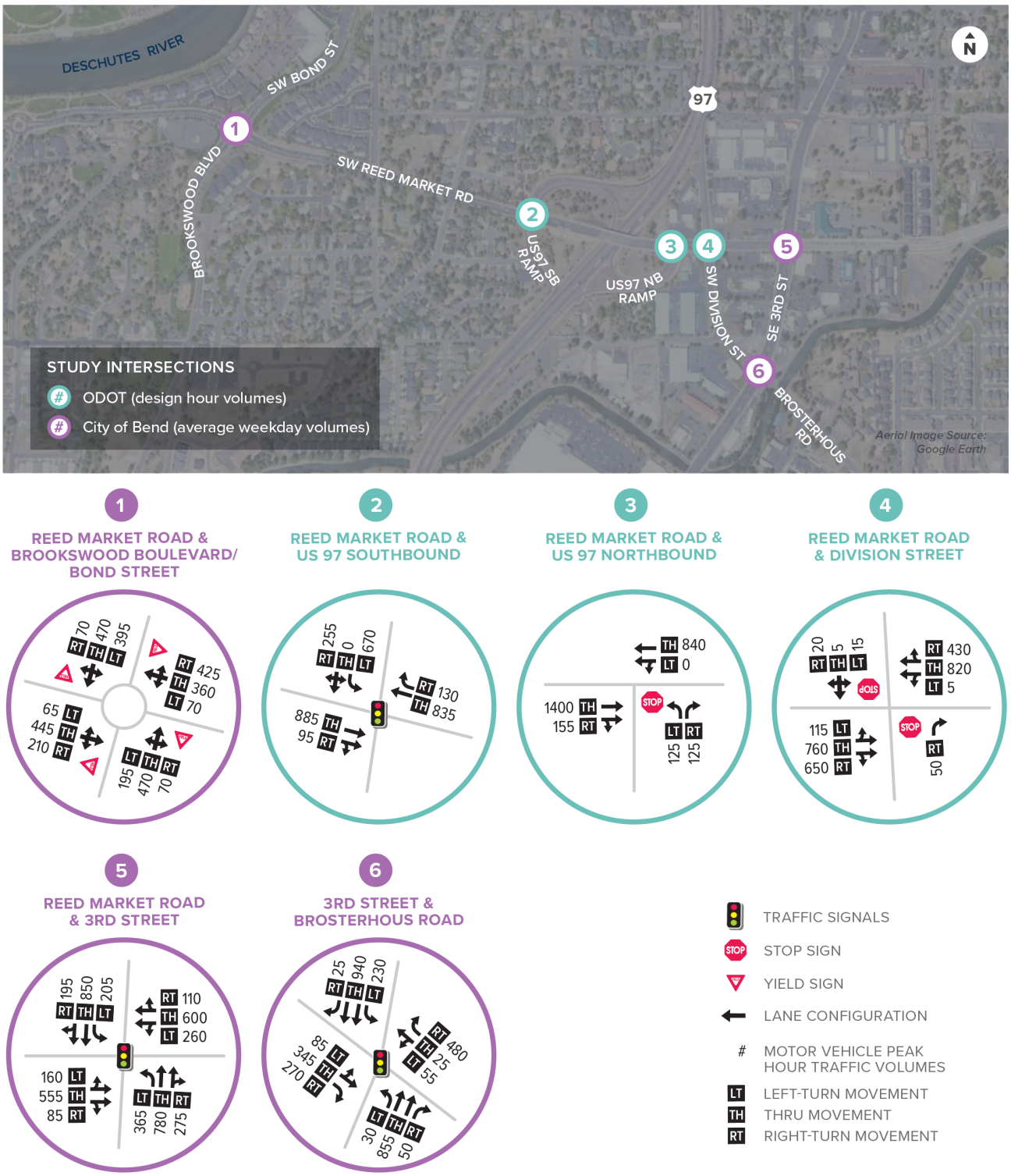



**FIGURE 1. FUTURE (YEAR 2040) MOTOR VEHICLE PM PEAK HOUR TRAFFIC VOLUMES**

## FUTURE MOTOR VEHICLE INTERSECTION OPERATIONS

Intersection operations are reported at the study intersections for the 2040 No-Build scenario using Highway Capacity Manual (6th Edition) methodology. Software reports are included in Appendix A for reference. Table 1 compares each intersection's performance against the adopted mobility target and the results from existing conditions analysis completed for the US 97 Parkway Plan and Bend's TSP, while Figure 2 illustrates the approximate areas impacted by congestion and highlights key findings at major congested intersections:

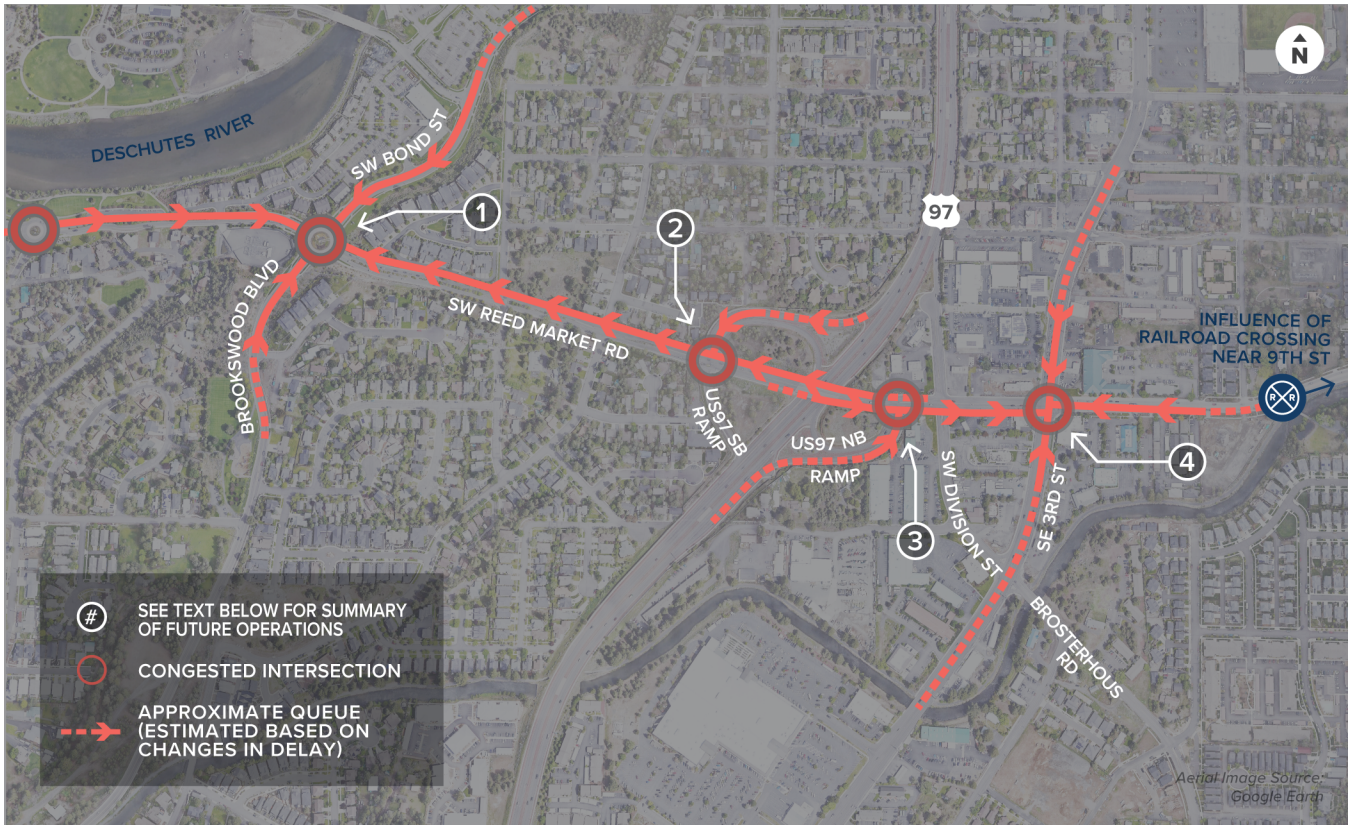



**FIGURE 2. FUTURE (YEAR 2040) REED MARKET ROAD CORRIDOR CONGESTION**

*Notes corresponding with annotations in Figure 2:*

1. Reed Market Road/Brookswood Boulevard – All four legs of the roundabout fail in the future, with v/c ratios greater than 1.09, leading to queues spilling back to nearby major intersections, including the US 97 southbound and US 97 northbound ramp terminals.
2. US 97 southbound ramp terminal – This intersection fails to meet mobility targets in the future, and given the queue spillback from the Brookswood Boulevard intersection, it is likely that queues will extend beyond the safe stopping distance on the ramp.
3. US 97 northbound ramp terminal – This intersection continues to fail to meet mobility targets in the future as an unsignalized intersection. It is likely that queues would extend towards the US 97 mainline, well beyond the safe stopping distance on the ramp as drivers struggle to find safe gaps to make a northbound left turn onto Reed Market Road and as queues from the Brookswood Boulevard roundabout and 3rd Street spill back into the intersection.

4. Reed Market Road/3rd Street – This intersection fails to meet mobility targets in the future, with a v/c ratio of 1.26. Northbound queues are expected to spill back beyond the intersection of 3rd Street/Brosterhous Road while eastbound queues are expected to spill back beyond the US 97 northbound ramp terminal.

**TABLE 1: FUTURE 2040 DESIGN HOUR NO-BUILD TRAFFIC OPERATIONS AT STUDY INTERSECTIONS**

| INTERSECTION | JURISDICTION | CONTROL | MOBILITY TARGET | EXISTING [A] | | | FUTURE (2040) | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | V/C[B] | LOS[C] | DELAY[D] (SEC) | V/C | LOS | DELAY (SEC) |
| **REED MARKET RD & BROOKSWOOD BLVD** | City (AWD) | Roundabout | ≤ 1.00 | **1.14** | F | 61 | **1.16** | F | >150 |
| **REED MARKET RD & US 97 SB** | ODOT (30HV) | Signalized | ≤ 0.90[E] | **0.95** | C | 34 | **0.94** | C | 26 |
| **REED MARKET RD & US 97 NB** | ODOT (30HV) | TWSC | ≤ 0.85 (ramp)<br>≤ 0.85 (Reed Market Rd) | NA/**1.53** | NA/F | NA/>100 | NA/**2.56** | NA/F | NA/ >150 |
| **REED MARKET RD & DIVISION ST** | ODOT (30HV) | TWSC | ≤ 1.00 | 0.14/ 0.12 | B/C | 13/17 | 0.46/ 0.14 | B/C | 14/17 |
| **REED MARKET RD & 3RD ST** | City (AWD) | Signalized | ≤ 1.00 | **1.05** | F | 92 | **1.26** | F | >150 |
| **3RD ST & BROSTERHOUS RD** | City (AWD) | Signalized | ≤ 1.00 | - | - | - | 0.89 | C | 21 |

**Bold and red** indicate a failure to meet the mobility target.

30HV=30th Highest Hour, AWD = Average Weekday, LOS=Level of Service, TWSC=Two-Way Stop-Controlled, V/C=Volume-to-Capacity

[A] Existing conditions are results from the US 97 Parkway Plan using 30HV conditions at all intersections. Future condition results represent 30HV operations for ODOT intersections and average weekday operations for City intersections, consistent with mobility targets.

[B] V/C ratio reported as the overall intersection V/C ratio at signalized intersections, worse case approach V/C at roundabouts, and V/C ratio for Major Street/Minor Street at TWSC intersections.

[C] LOS reported as the worst major street LOS/minor street LOS for TWSC intersections, worst case approach LOS for roundabouts, and overall intersection LOS for signalized intersections.

[D] Control delay reported for worst case major street/minor street for TWSC intersections, worst case approach delay for roundabouts, and overall intersection delay for signalized intersections.

[E] ODOT adopted an alternative mobility target for this intersection as part of the US 97 Parkway Plan, which assumed a 0.90 V/C ratio during 30 HV and ensuring 95th percentile queues do not extend into the portion of the exit ramp needed for deceleration.

As shown in the table, only the Reed Market Road/Division Street and 3rd Street/Brosterhous Road intersections meet mobility targets under future conditions. Additionally, most of the study intersections have higher volume-to-capacity (V/C) ratios and delays compared to the existing conditions (except Reed Market Road/US 97 southbound), indicating operational performance is expected to worsen in the future under No-Build conditions as Bend continues to grow.

At Reed Market Road/US 97 southbound, future operations appear better than the existing conditions operations in Table 1. However, this is due in large part to a change in southbound lane configuration assumptions. Since the completion of the US 97 Parkway Plan existing conditions analysis, the lane configuration at the US 97 southbound ramp terminal was modified to include a southbound left and shared left-through-right turn lane. This results in less delay in the future compared to the existing conditions analysis. It should be noted that the US 97 southbound ramp terminal is expected to operate worse than the recently adopted alternative mobility target of v/c $\leq$ 0.90. The analysis supporting the adoption of the alternative mobility target assumed mitigated conditions at the ramp terminal, which included signal timing modifications (increased cycle length) that were not included in this No-Build analysis, as these improvements will be tested as part of the study alternatives.

Heavy congestion and queue spillback affecting multiple intersections along the study corridor were observed under existing conditions, with many intersections failing to meet the adopted mobility targets. Considering the worsening intersection operations in the future, near-term improvements are needed to improve the current issues and better prepare for the traffic growth. Phasing of the improvements will be critical. For example, queueing from the roundabout at Reed Market Road/Brookswood Boulevard was observed to be spilling back to the US 97 southbound ramp terminal in August 2022. The US 97 southbound ramp terminal will likely continue to operate inefficiently until improvements are made at the roundabout. In addition, given the level of delay and high v/c at 3rd Street/Reed Market Road, it is expected that the northbound queue will extend beyond 3rd Street/Brosterhous Road.

Additionally, the City is implementing several construction projects over the next few years that will influence operations on Reed Market Road. For instance, the Reed Market Road railroad overcrossing project is estimated to be implemented within the next 10 years, which will close Reed Market Road near 9th Street for an extended period of time, affecting east-west travel along the road. Traffic along 3rd Street and west of 3rd Street along Reed Market Road is expected to increase during the closure, especially eastbound left, northbound left, and southbound right movements at the intersection. Future improvements along Reed Market Road should be phased to support long-term mobility needs as well as short-term needs during construction closures.

## CONDITIONS FOR PEOPLE WALKING, BICYCLING, AND TAKING TRANSIT

As discussed in *Technical Memorandum #2: Existing Conditions,* walking and bicycling facilities (primarily sidewalks and on-street bike lanes) are consistently provided within the study area, including marked pedestrian crossings primarily existing at the intersections of major streets, and bicycle facilities generally consisting of on-street bike lanes in various forms. However, bike lanes through the study area are generally narrow and unbuffered and contribute to an existing high

stress environment for people biking. Curb-tight sidewalks and narrow bike lanes contribute to a high stress pedestrian environment on Reed Market Road and 3rd Street (Pedestrian Level of Traffic Stress 3). Improvements will be needed within the study area to complete the City's key walking and biking routes, reduce the levels of traffic stress, and address the City's and the project's goals.

The first goal in the City's TSP is to increase system capacity, quality, and connectivity for all users. In particular, policies are included in the TSP to improve safety and usability of facilities for people walking and biking and for micromobility. Policy 40 from the City's TSP mentions all streets should be "complete streets" to allow everyone to travel safely and comfortably along and across the street by all travel modes. The transportation system is intended to increase connectivity, safety and travel time reliability while encouraging walking, biking, and opportunities for using transit and other transportation options. In addition, Policy 59 states the City will consider the environmental impacts of the overall transportation system and act to mitigate negative effects and enhance positive features. The intention of the policy is to reduce greenhouse gases and vehicle miles traveled (VMT) by encouraging bicycling, walking, transit, and electric or other alternately fueled vehicles. The City's TSP focuses on improving multi-modal facilities and adding micromobility options to encourage more people to walk and bike. The increase of congestion and the reductions in parking for new development are likely to further increase the number of people walking and biking. To implement these goals and policies within the study area, improvements will be needed to the active transportation facilities along Reed Market Road and 3rd Street.

Bend's TSP lists several planned projects to improve conditions for people walking and bicycling in the future. Specifically, within the study area, the planned key walking and biking route project (R9-A) on the east leg of the 3rd Street and Brosterhous Road intersection will close a sidewalk gap between 3rd Street and Parrell Road along Brosterhous Road and create a low-stress bikeway on both sides of the street.

Regarding transit conditions, there are two routes currently operating within the study area, including Route 1 (South 3rd Street) and Route 2 (Brookswood Boulevard). The Cascades East Transit (CET) 2040 Transit Master Plan (TMP)[5] identifies several future transit service needs in Bend, including increasing route frequency and service coverage, improving bus on-time arrival and reliability, enhancing services to transit-underserved areas, expanding connections to other transportation modes, and expanding accessibility. This would include the following changes within the study area:

- More frequent service for Route 2, resulting in more buses utilizing Brookswood Boulevard through the study area.
- Combining Routes 1 and 4 to extend transit farther along 3rd Street without requiring a transfer, potentially resulting in more transit trips along 3rd Street.
- Modification of Route 6 to serve downtown and the Oregon State University Cascades Campus by traveling along Reed Market Road between 3rd Street and Brookswood Boulevard.

[5] Cascades East Transit 2040 Transit Master Plan, Cascades East Transit, August 2020.

# APPENDIX A: SOFTWARE REPORTS

# MOVEMENT SUMMARY

## Site: 101 [Reed Market Road/Brookswood Boulevard - 2040NB (Site Folder: General)]

New Site
Site Category: (None)
Roundabout

**Vehicle Movement Performance**

| Mov ID | Turn | INPUT VOLUMES [ Total veh/h | HV ] % | DEMAND FLOWS [ Total veh/h | HV ] % | Deg. Satn v/c | Aver. Delay sec | Level of Service | 95% BACK OF QUEUE [ Veh. veh | Dist ] m | Prop. Que | Effective Stop Rate | Aver. No. Cycles | Aver. Speed km/h |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| South: Brookswood Boulevard | | | | | | | | | | | | | | |
| 1 | L2 | 195 | 1.0 | 201 | 1.0 | 1.093 | 134.8 | LOS F | 60.9 | 430.2 | 1.00 | 5.25 | 10.77 | 16.9 |
| 2 | T1 | 470 | 1.0 | 485 | 1.0 | 1.093 | 134.8 | LOS F | 60.9 | 430.2 | 1.00 | 5.25 | 10.77 | 16.4 |
| 3 | R2 | 70 | 2.0 | 72 | 2.0 | 1.093 | 134.8 | LOS F | 60.9 | 430.2 | 1.00 | 5.25 | 10.77 | 16.5 |
| Approach | | 735 | 1.1 | 758 | 1.1 | 1.093 | 134.8 | LOS F | 60.9 | 430.2 | 1.00 | 5.25 | 10.77 | 16.6 |
| East: Reed Market Road | | | | | | | | | | | | | | |
| 4 | L2 | 70 | 0.0 | 74 | 0.0 | 1.144 | 168.6 | LOS F | 92.8 | 649.5 | 1.00 | 6.61 | 13.12 | 14.6 |
| 5 | T1 | 360 | 0.0 | 379 | 0.0 | 1.144 | 168.6 | LOS F | 92.8 | 649.5 | 1.00 | 6.61 | 13.12 | 14.2 |
| 6 | R2 | 425 | 0.0 | 447 | 0.0 | 1.144 | 168.6 | LOS F | 92.8 | 649.5 | 1.00 | 6.61 | 13.12 | 14.3 |
| Approach | | 855 | 0.0 | 900 | 0.0 | 1.144 | 168.6 | LOS F | 92.8 | 649.5 | 1.00 | 6.61 | 13.12 | 14.3 |
| North: Bond Street | | | | | | | | | | | | | | |
| 7 | L2 | 395 | 1.0 | 416 | 1.0 | 1.156 | 176.3 | LOS F | 108.5 | 762.5 | 1.00 | 6.99 | 13.15 | 14.3 |
| 8 | T1 | 470 | 0.0 | 495 | 0.0 | 1.156 | 176.3 | LOS F | 108.5 | 762.5 | 1.00 | 6.99 | 13.15 | 13.9 |
| 9 | R2 | 70 | 0.0 | 74 | 0.0 | 1.156 | 176.3 | LOS F | 108.5 | 762.5 | 1.00 | 6.99 | 13.15 | 14.0 |
| Approach | | 935 | 0.4 | 984 | 0.4 | 1.156 | 176.3 | LOS F | 108.5 | 762.5 | 1.00 | 6.99 | 13.15 | 14.1 |
| West: Reed Market Road | | | | | | | | | | | | | | |
| 10 | L2 | 65 | 0.0 | 68 | 0.0 | 1.104 | 142.9 | LOS F | 64.3 | 454.7 | 1.00 | 5.51 | 11.38 | 16.3 |
| 11 | T1 | 445 | 1.0 | 468 | 1.0 | 1.104 | 143.0 | LOS F | 64.3 | 454.7 | 1.00 | 5.51 | 11.38 | 15.8 |
| 12 | R2 | 210 | 2.0 | 221 | 2.0 | 1.104 | 143.0 | LOS F | 64.3 | 454.7 | 1.00 | 5.51 | 11.38 | 15.9 |
| Approach | | 720 | 1.2 | 758 | 1.2 | 1.104 | 143.0 | LOS F | 64.3 | 454.7 | 1.00 | 5.51 | 11.38 | 15.9 |
| All Vehicles | | 3245 | 0.6 | 3400 | 0.6 | 1.156 | 157.6 | LOS F | 108.5 | 762.5 | 1.00 | 6.17 | 12.22 | 15.0 |

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

# HCM 6th Signalized Intersection Summary
## 2: US 97 SB & SW Reed Market Rd

10/20/2022

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 0 | 885 | 95 | 0 | 835 | 130 | 0 | 0 | 0 | 670 | 0 | 255 |
| Future Volume (veh/h) | 0 | 885 | 95 | 0 | 835 | 130 | 0 | 0 | 0 | 670 | 0 | 255 |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | | | | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | 1.00 | | 0.98 | 1.00 | | 0.98 | | | | 1.00 | | 0.98 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | | 1.00 | 1.00 | 1.00 |
| Work Zone On Approach | | No | | | No | | | | | | No | |
| Adj Sat Flow, veh/h/ln | 0 | 1736 | 1736 | 0 | 1750 | 1750 | | | | 1736 | 1750 | 1750 |
| Adj Flow Rate, veh/h | 0 | 922 | 88 | 0 | 870 | 66 | | | | 447 | 351 | 196 |
| Peak Hour Factor | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | | | | 0.96 | 0.96 | 0.96 |
| Percent Heavy Veh, % | 0 | 1 | 1 | 0 | 0 | 0 | | | | 1 | 0 | 0 |
| Cap, veh/h | 0 | 1559 | 149 | 0 | 899 | 743 | | | | 610 | 385 | 215 |
| Arrive On Green | 0.00 | 0.51 | 0.50 | 0.00 | 0.51 | 0.51 | | | | 0.37 | 0.37 | 0.35 |
| Sat Flow, veh/h | 0 | 3123 | 290 | 0 | 1750 | 1447 | | | | 1654 | 1045 | 583 |
| Grp Volume(v), veh/h | 0 | 501 | 509 | 0 | 870 | 66 | | | | 447 | 0 | 547 |
| Grp Sat Flow(s),veh/h/ln | 0 | 1650 | 1676 | 0 | 1750 | 1447 | | | | 1654 | 0 | 1628 |
| Q Serve(g_s), s | 0.0 | 14.5 | 14.5 | 0.0 | 32.8 | 1.6 | | | | 15.9 | 0.0 | 21.8 |
| Cycle Q Clear(g_c), s | 0.0 | 14.5 | 14.5 | 0.0 | 32.8 | 1.6 | | | | 15.9 | 0.0 | 21.8 |
| Prop In Lane | 0.00 | | 0.17 | 0.00 | | 1.00 | | | | 1.00 | | 0.36 |
| Lane Grp Cap(c), veh/h | 0 | 847 | 861 | 0 | 899 | 743 | | | | 610 | 0 | 601 |
| V/C Ratio(X) | 0.00 | 0.59 | 0.59 | 0.00 | 0.97 | 0.09 | | | | 0.73 | 0.00 | 0.91 |
| Avail Cap(c_a), veh/h | 0 | 847 | 861 | 0 | 899 | 743 | | | | 655 | 0 | 645 |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | | 1.00 | 1.00 | 1.00 |
| Upstream Filter(I) | 0.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | | | | 1.00 | 0.00 | 1.00 |
| Uniform Delay (d), s/veh | 0.0 | 11.6 | 11.6 | 0.0 | 16.0 | 8.4 | | | | 18.6 | 0.0 | 20.6 |
| Incr Delay (d2), s/veh | 0.0 | 1.2 | 1.2 | 0.0 | 22.6 | 0.1 | | | | 3.9 | 0.0 | 16.5 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 0.0 | 5.0 | 5.1 | 0.0 | 17.0 | 0.5 | | | | 6.2 | 0.0 | 10.3 |
| Unsig. Movement Delay, s/veh | | | | | | | | | | | | |
| LnGrp Delay(d),s/veh | 0.0 | 12.8 | 12.8 | 0.0 | 38.6 | 8.5 | | | | 22.5 | 0.0 | 37.1 |
| LnGrp LOS | A | B | B | A | D | A | | | | C | A | D |
| Approach Vol, veh/h | | 1010 | | | 936 | | | | | | 994 | |
| Approach Delay, s/veh | | 12.8 | | | 36.5 | | | | | | 30.6 | |
| Approach LOS | | B | | | D | | | | | | C | |

| Timer - Assigned Phs | 2 | 4 | 6 |
|---|---|---|---|
| Phs Duration (G+Y+Rc), s | 39.0 | 29.1 | 39.0 |
| Change Period (Y+Rc), s | 5.0 | 5.0 | 5.0 |
| Max Green Setting (Gmax), s | 34.0 | 26.0 | 34.0 |
| Max Q Clear Time (g_c+I1), s | 16.5 | 23.8 | 34.8 |
| Green Ext Time (p_c), s | 7.8 | 0.4 | 0.0 |

| Intersection Summary | |
|---|---|
| HCM 6th Ctrl Delay | 26.3 |
| HCM 6th LOS | C |

**Notes**

User approved volume balancing among the lanes for turning movement.

| Intersection | |
|---|---|
| Int Delay, s/veh | 42.5 |

| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Vol, veh/h | 1400 | 155 | 0 | 840 | 125 | 125 |
| Future Vol, veh/h | 1400 | 155 | 0 | 840 | 125 | 125 |
| Conflicting Peds, #/hr | 0 | 1 | 1 | 0 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Stop | Stop |
| RT Channelized | - | None | - | None | - | None |
| Storage Length | - | - | - | - | 0 | 240 |
| Veh in Median Storage, # | 0 | - | - | 0 | 0 | - |
| Grade, % | 0 | - | - | 0 | 0 | - |
| Peak Hour Factor | 94 | 94 | 94 | 94 | 94 | 94 |
| Heavy Vehicles, % | 1 | 1 | 0 | 0 | 0 | 2 |
| Mvmt Flow | 1489 | 165 | 0 | 894 | 133 | 133 |

| Major/Minor | Major1 | | Major2 | | Minor1 | |
|---|---|---|---|---|---|---|
| Conflicting Flow All | 0 | 0 | - | - | 2020 | 828 |
| Stage 1 | - | - | - | - | 1573 | - |
| Stage 2 | - | - | - | - | 447 | - |
| Critical Hdwy | - | - | - | - | 6.8 | 6.94 |
| Critical Hdwy Stg 1 | - | - | - | - | 5.8 | - |
| Critical Hdwy Stg 2 | - | - | - | - | 5.8 | - |
| Follow-up Hdwy | - | - | - | - | 3.5 | 3.32 |
| Pot Cap-1 Maneuver | - | - | 0 | - | ~ 52 | 314 |
| Stage 1 | - | - | 0 | - | 159 | - |
| Stage 2 | - | - | 0 | - | 617 | - |
| Platoon blocked, % | - | - | | - | | |
| Mov Cap-1 Maneuver | - | - | - | - | ~ 52 | 314 |
| Mov Cap-2 Maneuver | - | - | - | - | ~ 52 | - |
| Stage 1 | - | - | - | - | 159 | - |
| Stage 2 | - | - | - | - | 617 | - |

| Approach | EB | WB | NB |
|---|---|---|---|
| HCM Control Delay, s | 0 | 0 | $ 449.6 |
| HCM LOS | | | F |

| Minor Lane/Major Mvmt | NBLn1 | NBLn2 | EBT | EBR | WBT |
|---|---|---|---|---|---|
| Capacity (veh/h) | 52 | 314 | - | - | - |
| HCM Lane V/C Ratio | 2.557 | 0.423 | - | - | - |
| HCM Control Delay (s) | $ 874.6 | 24.6 | - | - | - |
| HCM Lane LOS | F | C | - | - | - |
| HCM 95th %tile Q(veh) | 13.7 | 2 | - | - | - |

| Notes | | | |
|---|---|---|---|
| ~: Volume exceeds capacity | $: Delay exceeds 300s | +: Computation Not Defined | *: All major volume in platoon |

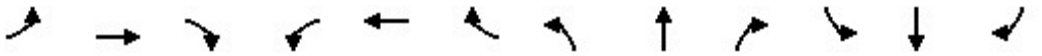
| Intersection | |
|---|---|
| Int Delay, s/veh | 2.3 |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 115 | 760 | 650 | 5 | 820 | 430 | 0 | 0 | 50 | 15 | 5 | 20 |
| Future Vol, veh/h | 115 | 760 | 650 | 5 | 820 | 430 | 0 | 0 | 50 | 15 | 5 | 20 |
| Conflicting Peds, #/hr | 2 | 0 | 2 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Free | Free | Stop | Stop | Stop | Stop | Stop | Stop |
| RT Channelized | - | - | None | - | - | None | - | - | Stop | - | - | None |
| Storage Length | - | - | - | - | - | - | - | - | 0 | - | - | - |
| Veh in Median Storage, # | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Grade, % | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Peak Hour Factor | 97 | 97 | 97 | 97 | 97 | 97 | 97 | 97 | 97 | 97 | 97 | 97 |
| Heavy Vehicles, % | 3 | 1 | 1 | 0 | 1 | 2 | 0 | 0 | 4 | 33 | 0 | 0 |
| Mvmt Flow | 119 | 784 | 670 | 5 | 845 | 443 | 0 | 0 | 52 | 15 | 5 | 21 |

| Major/Minor | Major1 | | | Major2 | | | Minor1 | | | Minor2 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Conflicting Flow All | 1290 | 0 | 0 | 1456 | 0 | 0 | - | - | 729 | 1709 | 2773 | 646 |
| Stage 1 | - | - | - | - | - | - | - | - | - | 1079 | 1079 | - |
| Stage 2 | - | - | - | - | - | - | - | - | - | 630 | 1694 | - |
| Critical Hdwy | 4.16 | - | - | 4.1 | - | - | - | - | 6.98 | 8.16 | 6.5 | 6.9 |
| Critical Hdwy Stg 1 | - | - | - | - | - | - | - | - | - | 7.16 | 5.5 | - |
| Critical Hdwy Stg 2 | - | - | - | - | - | - | - | - | - | 7.16 | 5.5 | - |
| Follow-up Hdwy | 2.23 | - | - | 2.2 | - | - | - | - | 3.34 | 3.83 | 4 | 3.3 |
| Pot Cap-1 Maneuver | 528 | - | - | 471 | - | - | 0 | 0 | 361 | 42 | 19 | 419 |
| Stage 1 | - | - | - | - | - | - | 0 | 0 | - | 185 | 297 | - |
| Stage 2 | - | - | - | - | - | - | 0 | 0 | - | 368 | 150 | - |
| Platoon blocked, % | | - | - | | - | - | | | | | | |
| Mov Cap-1 Maneuver | 527 | - | - | 470 | - | - | - | - | 360 | - | 0 | 418 |
| Mov Cap-2 Maneuver | - | - | - | - | - | - | - | - | - | - | 0 | - |
| Stage 1 | - | - | - | - | - | - | - | - | - | 185 | 283 | - |
| Stage 2 | - | - | - | - | - | - | - | - | - | - | 0 | - |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| HCM Control Delay, s | 3.7 | 0.2 | 16.7 | |
| HCM LOS | | | C | - |

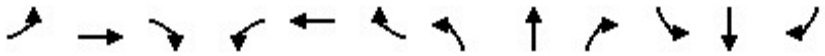
| Minor Lane/Major Mvmt | NBLn1 | EBL | EBT | EBR | WBL | WBT | WBR | SBLn1 |
|---|---|---|---|---|---|---|---|---|
| Capacity (veh/h) | 360 | 527 | - | - | 470 | - | - | - |
| HCM Lane V/C Ratio | 0.143 | 0.225 | - | - | 0.011 | - | - | - |
| HCM Control Delay (s) | 16.7 | 13.8 | 5.3 | - | 12.7 | 0.3 | - | - |
| HCM Lane LOS | C | B | A | - | B | A | - | - |
| HCM 95th %tile Q(veh) | 0.5 | 0.9 | - | - | 0 | - | - | - |



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 160 | 555 | 85 | 260 | 600 | 110 | 365 | 780 | 275 | 205 | 850 | 195 |
| Future Volume (veh/h) | 160 | 555 | 85 | 260 | 600 | 110 | 365 | 780 | 275 | 205 | 850 | 195 |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | 1.00 | | 0.97 | 1.00 | | 0.97 | 1.00 | | 0.97 | 1.00 | | 0.98 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Work Zone On Approach | | No | | | No | | | No | | | No | |
| Adj Sat Flow, veh/h/ln | 1736 | 1736 | 1682 | 1736 | 1736 | 1723 | 1736 | 1723 | 1723 | 1736 | 1736 | 1736 |
| Adj Flow Rate, veh/h | 165 | 572 | 88 | 268 | 619 | 113 | 376 | 804 | 284 | 211 | 876 | 201 |
| Peak Hour Factor | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 |
| Percent Heavy Veh, % | 1 | 1 | 5 | 1 | 1 | 2 | 1 | 2 | 2 | 1 | 1 | 1 |
| Cap, veh/h | 167 | 609 | 98 | 223 | 544 | 103 | 254 | 643 | 227 | 165 | 583 | 134 |
| Arrive On Green | 0.25 | 0.26 | 0.25 | 0.25 | 0.26 | 0.25 | 0.15 | 0.27 | 0.27 | 0.10 | 0.22 | 0.21 |
| Sat Flow, veh/h | 643 | 2342 | 376 | 857 | 2092 | 397 | 1654 | 2351 | 830 | 1654 | 2652 | 608 |
| Grp Volume(v), veh/h | 438 | 0 | 387 | 530 | 0 | 470 | 376 | 559 | 529 | 211 | 545 | 532 |
| Grp Sat Flow(s),veh/h/ln | 1704 | 0 | 1657 | 1694 | 0 | 1652 | 1654 | 1637 | 1545 | 1654 | 1650 | 1610 |
| Q Serve(g_s), s | 38.4 | 0.0 | 33.9 | 39.0 | 0.0 | 39.0 | 23.0 | 41.0 | 41.0 | 15.0 | 33.0 | 33.0 |
| Cycle Q Clear(g_c), s | 38.4 | 0.0 | 33.9 | 39.0 | 0.0 | 39.0 | 23.0 | 41.0 | 41.0 | 15.0 | 33.0 | 33.0 |
| Prop In Lane | 0.38 | | 0.23 | 0.51 | | 0.24 | 1.00 | | 0.54 | 1.00 | | 0.38 |
| Lane Grp Cap(c), veh/h | 443 | 0 | 431 | 440 | 0 | 429 | 254 | 447 | 422 | 165 | 363 | 354 |
| V/C Ratio(X) | 0.99 | 0.00 | 0.90 | 1.20 | 0.00 | 1.09 | 1.48 | 1.25 | 1.25 | 1.28 | 1.50 | 1.50 |
| Avail Cap(c_a), veh/h | 443 | 0 | 431 | 440 | 0 | 429 | 254 | 447 | 422 | 165 | 363 | 354 |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Upstream Filter(I) | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 | 1.00 | 0.46 | 0.46 | 0.46 | 1.00 | 1.00 | 1.00 |
| Uniform Delay (d), s/veh | 55.4 | 0.0 | 53.7 | 55.8 | 0.0 | 55.6 | 63.5 | 54.5 | 54.8 | 67.5 | 58.5 | 58.7 |
| Incr Delay (d2), s/veh | 39.8 | 0.0 | 24.3 | 111.3 | 0.0 | 71.6 | 226.9 | 121.3 | 122.5 | 162.6 | 239.5 | 240.3 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 21.4 | 0.0 | 17.0 | 30.4 | 0.0 | 24.9 | 25.7 | 31.9 | 30.3 | 13.8 | 37.9 | 37.1 |
| Unsig. Movement Delay, s/veh | | | | | | | | | | | | |
| LnGrp Delay(d),s/veh | 95.2 | 0.0 | 78.0 | 167.1 | 0.0 | 127.2 | 290.4 | 175.8 | 177.3 | 230.1 | 298.0 | 299.0 |
| LnGrp LOS | F | A | E | F | A | F | F | F | F | F | F | F |
| Approach Vol, veh/h | | 825 | | | 1000 | | | 1464 | | | 1288 | |
| Approach Delay, s/veh | | 87.1 | | | 148.3 | | | 205.7 | | | 287.3 | |
| Approach LOS | | F | | | F | | | F | | | F | |

| Timer - Assigned Phs | 1 | 2 | | 4 | 5 | 6 | | 8 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Phs Duration (G+Y+Rc), s | 19.0 | 45.0 | | 43.0 | 27.0 | 37.0 | | 43.0 | | | | |
| Change Period (Y+Rc), s | 5.0 | 5.0 | | 5.0 | 5.0 | 5.0 | | 5.0 | | | | |
| Max Green Setting (Gmax), s | 14.0 | 40.0 | | 38.0 | 22.0 | 32.0 | | 38.0 | | | | |
| Max Q Clear Time (g_c+I1), s | 17.0 | 0.0 | | 0.0 | 25.0 | 0.0 | | 0.0 | | | | |
| Green Ext Time (p_c), s | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | | 0.0 | | | | |

| Intersection Summary | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HCM 6th Ctrl Delay | | | 194.8 | | | | | | | | | |
| HCM 6th LOS | | | F | | | | | | | | | |



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 85 | 345 | 270 | 55 | 25 | 480 | 30 | 855 | 50 | 230 | 940 | 25 |
| Future Volume (veh/h) | 85 | 345 | 270 | 55 | 25 | 480 | 30 | 855 | 50 | 230 | 940 | 25 |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | 1.00 | | 0.98 | 1.00 | | 0.98 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Work Zone On Approach | | No | | | No | | | No | | | No | |
| Adj Sat Flow, veh/h/ln | 1736 | 1723 | 1750 | 1723 | 1682 | 1736 | 1600 | 1736 | 1750 | 1723 | 1750 | 1450 |
| Adj Flow Rate, veh/h | 88 | 356 | 133 | 57 | 26 | 304 | 31 | 881 | 0 | 237 | 969 | 0 |
| Peak Hour Factor | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 |
| Percent Heavy Veh, % | 1 | 2 | 0 | 2 | 5 | 1 | 11 | 1 | 0 | 2 | 0 | 22 |
| Cap, veh/h | 143 | 375 | 391 | 224 | 81 | 388 | 51 | 1093 | | 286 | 1571 | |
| Arrive On Green | 0.27 | 0.27 | 0.27 | 0.27 | 0.27 | 0.27 | 0.03 | 0.33 | 0.00 | 0.17 | 0.47 | 0.00 |
| Sat Flow, veh/h | 265 | 1398 | 1456 | 456 | 303 | 1445 | 1524 | 3299 | 1483 | 1641 | 3325 | 1229 |
| Grp Volume(v), veh/h | 444 | 0 | 133 | 83 | 0 | 304 | 31 | 881 | 0 | 237 | 969 | 0 |
| Grp Sat Flow(s),veh/h/ln | 1663 | 0 | 1456 | 759 | 0 | 1445 | 1524 | 1650 | 1483 | 1641 | 1663 | 1229 |
| Q Serve(g_s), s | 11.5 | 0.0 | 4.4 | 0.0 | 0.0 | 11.7 | 1.2 | 14.6 | 0.0 | 8.3 | 13.0 | 0.0 |
| Cycle Q Clear(g_c), s | 16.0 | 0.0 | 4.4 | 4.4 | 0.0 | 11.7 | 1.2 | 14.6 | 0.0 | 8.3 | 13.0 | 0.0 |
| Prop In Lane | 0.20 | | 1.00 | 0.69 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Lane Grp Cap(c), veh/h | 518 | 0 | 391 | 305 | 0 | 388 | 51 | 1093 | | 286 | 1571 | |
| V/C Ratio(X) | 0.86 | 0.00 | 0.34 | 0.27 | 0.00 | 0.78 | 0.60 | 0.81 | | 0.83 | 0.62 | |
| Avail Cap(c_a), veh/h | 873 | 0 | 705 | 552 | 0 | 700 | 127 | 1157 | | 315 | 1571 | |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Upstream Filter(I) | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 |
| Uniform Delay (d), s/veh | 21.8 | 0.0 | 17.6 | 17.3 | 0.0 | 20.3 | 28.5 | 18.3 | 0.0 | 23.8 | 11.8 | 0.0 |
| Incr Delay (d2), s/veh | 3.4 | 0.0 | 0.4 | 0.4 | 0.0 | 2.6 | 8.2 | 4.5 | 0.0 | 14.8 | 0.9 | 0.0 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 6.1 | 0.0 | 1.4 | 0.9 | 0.0 | 3.9 | 0.5 | 5.6 | 0.0 | 4.2 | 4.2 | 0.0 |
| Unsig. Movement Delay, s/veh | | | | | | | | | | | | |
| LnGrp Delay(d),s/veh | 25.2 | 0.0 | 18.0 | 17.7 | 0.0 | 22.9 | 36.8 | 22.7 | 0.0 | 38.6 | 12.7 | 0.0 |
| LnGrp LOS | C | A | B | B | A | C | D | C | | D | B | |
| Approach Vol, veh/h | | 577 | | | 387 | | | 912 | | | 1206 | |
| Approach Delay, s/veh | | 23.6 | | | 21.8 | | | 23.2 | | | 17.8 | |
| Approach LOS | | C | | | C | | | C | | | B | |

| Timer - Assigned Phs | 1 | 2 | | 4 | 5 | 6 | | 8 |
|---|---|---|---|---|---|---|---|---|
| Phs Duration (G+Y+Rc), s | 15.0 | 24.3 | | 20.6 | 6.5 | 32.8 | | 20.6 |
| Change Period (Y+Rc), s | 4.5 | 4.5 | | 4.5 | 4.5 | 4.5 | | 4.5 |
| Max Green Setting (Gmax), s | 10.5 | 21.0 | | 29.0 | 5.0 | 27.5 | | 29.0 |
| Max Q Clear Time (g_c+I1), s | 10.3 | 16.6 | | 13.7 | 3.2 | 15.0 | | 6.4 |
| Green Ext Time (p_c), s | 0.1 | 3.3 | | 1.7 | 0.0 | 8.6 | | 0.1 |

| Intersection Summary | |
|---|---|
| HCM 6th Ctrl Delay | 21.0 |
| HCM 6th LOS | C |

**Notes**

Unsignalized Delay for [NBR, SBR] is excluded from calculations of the approach delay and intersection delay.

# APPENDIX A: SOFTWARE REPORTS

# MOVEMENT SUMMARY

## Site: 101 [Reed Market Road/Brookswood Boulevard - 2040NB (Site Folder: General)]

New Site
Site Category: (None)
Roundabout

**Vehicle Movement Performance**

| Mov ID | Turn | INPUT VOLUMES [ Total veh/h | HV ] % | DEMAND FLOWS [ Total veh/h | HV ] % | Deg. Satn v/c | Aver. Delay sec | Level of Service | 95% BACK OF QUEUE [ Veh. veh | Dist ] m | Prop. Que | Effective Stop Rate | Aver. No. Cycles | Aver. Speed km/h |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| South: Brookswood Boulevard | | | | | | | | | | | | | | |
| 1 | L2 | 195 | 1.0 | 201 | 1.0 | 1.093 | 134.8 | LOS F | 60.9 | 430.2 | 1.00 | 5.25 | 10.77 | 16.9 |
| 2 | T1 | 470 | 1.0 | 485 | 1.0 | 1.093 | 134.8 | LOS F | 60.9 | 430.2 | 1.00 | 5.25 | 10.77 | 16.4 |
| 3 | R2 | 70 | 2.0 | 72 | 2.0 | 1.093 | 134.8 | LOS F | 60.9 | 430.2 | 1.00 | 5.25 | 10.77 | 16.5 |
| Approach | | 735 | 1.1 | 758 | 1.1 | 1.093 | 134.8 | LOS F | 60.9 | 430.2 | 1.00 | 5.25 | 10.77 | 16.6 |
| East: Reed Market Road | | | | | | | | | | | | | | |
| 4 | L2 | 70 | 0.0 | 74 | 0.0 | 1.144 | 168.6 | LOS F | 92.8 | 649.5 | 1.00 | 6.61 | 13.12 | 14.6 |
| 5 | T1 | 360 | 0.0 | 379 | 0.0 | 1.144 | 168.6 | LOS F | 92.8 | 649.5 | 1.00 | 6.61 | 13.12 | 14.2 |
| 6 | R2 | 425 | 0.0 | 447 | 0.0 | 1.144 | 168.6 | LOS F | 92.8 | 649.5 | 1.00 | 6.61 | 13.12 | 14.3 |
| Approach | | 855 | 0.0 | 900 | 0.0 | 1.144 | 168.6 | LOS F | 92.8 | 649.5 | 1.00 | 6.61 | 13.12 | 14.3 |
| North: Bond Street | | | | | | | | | | | | | | |
| 7 | L2 | 395 | 1.0 | 416 | 1.0 | 1.156 | 176.3 | LOS F | 108.5 | 762.5 | 1.00 | 6.99 | 13.15 | 14.3 |
| 8 | T1 | 470 | 0.0 | 495 | 0.0 | 1.156 | 176.3 | LOS F | 108.5 | 762.5 | 1.00 | 6.99 | 13.15 | 13.9 |
| 9 | R2 | 70 | 0.0 | 74 | 0.0 | 1.156 | 176.3 | LOS F | 108.5 | 762.5 | 1.00 | 6.99 | 13.15 | 14.0 |
| Approach | | 935 | 0.4 | 984 | 0.4 | 1.156 | 176.3 | LOS F | 108.5 | 762.5 | 1.00 | 6.99 | 13.15 | 14.1 |
| West: Reed Market Road | | | | | | | | | | | | | | |
| 10 | L2 | 65 | 0.0 | 68 | 0.0 | 1.104 | 142.9 | LOS F | 64.3 | 454.7 | 1.00 | 5.51 | 11.38 | 16.3 |
| 11 | T1 | 445 | 1.0 | 468 | 1.0 | 1.104 | 143.0 | LOS F | 64.3 | 454.7 | 1.00 | 5.51 | 11.38 | 15.8 |
| 12 | R2 | 210 | 2.0 | 221 | 2.0 | 1.104 | 143.0 | LOS F | 64.3 | 454.7 | 1.00 | 5.51 | 11.38 | 15.9 |
| Approach | | 720 | 1.2 | 758 | 1.2 | 1.104 | 143.0 | LOS F | 64.3 | 454.7 | 1.00 | 5.51 | 11.38 | 15.9 |
| All Vehicles | | 3245 | 0.6 | 3400 | 0.6 | 1.156 | 157.6 | LOS F | 108.5 | 762.5 | 1.00 | 6.17 | 12.22 | 15.0 |

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

# HCM 6th Signalized Intersection Summary
## 2: US 97 SB & SW Reed Market Rd

10/20/2022

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 0 | 885 | 95 | 0 | 835 | 130 | 0 | 0 | 0 | 670 | 0 | 255 |
| Future Volume (veh/h) | 0 | 885 | 95 | 0 | 835 | 130 | 0 | 0 | 0 | 670 | 0 | 255 |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | | | | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | 1.00 | | 0.98 | 1.00 | | 0.98 | | | | 1.00 | | 0.98 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | | 1.00 | 1.00 | 1.00 |
| Work Zone On Approach | | No | | | No | | | | | | No | |
| Adj Sat Flow, veh/h/ln | 0 | 1736 | 1736 | 0 | 1750 | 1750 | | | | 1736 | 1750 | 1750 |
| Adj Flow Rate, veh/h | 0 | 922 | 88 | 0 | 870 | 66 | | | | 447 | 351 | 196 |
| Peak Hour Factor | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | | | | 0.96 | 0.96 | 0.96 |
| Percent Heavy Veh, % | 0 | 1 | 1 | 0 | 0 | 0 | | | | 1 | 0 | 0 |
| Cap, veh/h | 0 | 1559 | 149 | 0 | 899 | 743 | | | | 610 | 385 | 215 |
| Arrive On Green | 0.00 | 0.51 | 0.50 | 0.00 | 0.51 | 0.51 | | | | 0.37 | 0.37 | 0.35 |
| Sat Flow, veh/h | 0 | 3123 | 290 | 0 | 1750 | 1447 | | | | 1654 | 1045 | 583 |
| Grp Volume(v), veh/h | 0 | 501 | 509 | 0 | 870 | 66 | | | | 447 | 0 | 547 |
| Grp Sat Flow(s),veh/h/ln | 0 | 1650 | 1676 | 0 | 1750 | 1447 | | | | 1654 | 0 | 1628 |
| Q Serve(g_s), s | 0.0 | 14.5 | 14.5 | 0.0 | 32.8 | 1.6 | | | | 15.9 | 0.0 | 21.8 |
| Cycle Q Clear(g_c), s | 0.0 | 14.5 | 14.5 | 0.0 | 32.8 | 1.6 | | | | 15.9 | 0.0 | 21.8 |
| Prop In Lane | 0.00 | | 0.17 | 0.00 | | 1.00 | | | | 1.00 | | 0.36 |
| Lane Grp Cap(c), veh/h | 0 | 847 | 861 | 0 | 899 | 743 | | | | 610 | 0 | 601 |
| V/C Ratio(X) | 0.00 | 0.59 | 0.59 | 0.00 | 0.97 | 0.09 | | | | 0.73 | 0.00 | 0.91 |
| Avail Cap(c_a), veh/h | 0 | 847 | 861 | 0 | 899 | 743 | | | | 655 | 0 | 645 |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | | 1.00 | 1.00 | 1.00 |
| Upstream Filter(I) | 0.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | | | | 1.00 | 0.00 | 1.00 |
| Uniform Delay (d), s/veh | 0.0 | 11.6 | 11.6 | 0.0 | 16.0 | 8.4 | | | | 18.6 | 0.0 | 20.6 |
| Incr Delay (d2), s/veh | 0.0 | 1.2 | 1.2 | 0.0 | 22.6 | 0.1 | | | | 3.9 | 0.0 | 16.5 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 0.0 | 5.0 | 5.1 | 0.0 | 17.0 | 0.5 | | | | 6.2 | 0.0 | 10.3 |
| Unsig. Movement Delay, s/veh | | | | | | | | | | | | |
| LnGrp Delay(d),s/veh | 0.0 | 12.8 | 12.8 | 0.0 | 38.6 | 8.5 | | | | 22.5 | 0.0 | 37.1 |
| LnGrp LOS | A | B | B | A | D | A | | | | C | A | D |
| Approach Vol, veh/h | | 1010 | | | 936 | | | | | | 994 | |
| Approach Delay, s/veh | | 12.8 | | | 36.5 | | | | | | 30.6 | |
| Approach LOS | | B | | | D | | | | | | C | |

| Timer - Assigned Phs | 2 | 4 | 6 |
|---|---|---|---|
| Phs Duration (G+Y+Rc), s | 39.0 | 29.1 | 39.0 |
| Change Period (Y+Rc), s | 5.0 | 5.0 | 5.0 |
| Max Green Setting (Gmax), s | 34.0 | 26.0 | 34.0 |
| Max Q Clear Time (g_c+I1), s | 16.5 | 23.8 | 34.8 |
| Green Ext Time (p_c), s | 7.8 | 0.4 | 0.0 |

| Intersection Summary | |
|---|---|
| HCM 6th Ctrl Delay | 26.3 |
| HCM 6th LOS | C |

**Notes**

User approved volume balancing among the lanes for turning movement.

| Intersection | |
|---|---|
| Int Delay, s/veh | 42.5 |

| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Vol, veh/h | 1400 | 155 | 0 | 840 | 125 | 125 |
| Future Vol, veh/h | 1400 | 155 | 0 | 840 | 125 | 125 |
| Conflicting Peds, #/hr | 0 | 1 | 1 | 0 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Stop | Stop |
| RT Channelized | - | None | - | None | - | None |
| Storage Length | - | - | - | - | 0 | 240 |
| Veh in Median Storage, # | 0 | - | - | 0 | 0 | - |
| Grade, % | 0 | - | - | 0 | 0 | - |
| Peak Hour Factor | 94 | 94 | 94 | 94 | 94 | 94 |
| Heavy Vehicles, % | 1 | 1 | 0 | 0 | 0 | 2 |
| Mvmt Flow | 1489 | 165 | 0 | 894 | 133 | 133 |

| Major/Minor | Major1 | | Major2 | | Minor1 | |
|---|---|---|---|---|---|---|
| Conflicting Flow All | 0 | 0 | - | - | 2020 | 828 |
| Stage 1 | - | - | - | - | 1573 | - |
| Stage 2 | - | - | - | - | 447 | - |
| Critical Hdwy | - | - | - | - | 6.8 | 6.94 |
| Critical Hdwy Stg 1 | - | - | - | - | 5.8 | - |
| Critical Hdwy Stg 2 | - | - | - | - | 5.8 | - |
| Follow-up Hdwy | - | - | - | - | 3.5 | 3.32 |
| Pot Cap-1 Maneuver | - | - | 0 | - | ~ 52 | 314 |
| Stage 1 | - | - | 0 | - | 159 | - |
| Stage 2 | - | - | 0 | - | 617 | - |
| Platoon blocked, % | - | - | | - | | |
| Mov Cap-1 Maneuver | - | - | - | - | ~ 52 | 314 |
| Mov Cap-2 Maneuver | - | - | - | - | ~ 52 | - |
| Stage 1 | - | - | - | - | 159 | - |
| Stage 2 | - | - | - | - | 617 | - |

| Approach | EB | WB | NB |
|---|---|---|---|
| HCM Control Delay, s | 0 | 0 | $ 449.6 |
| HCM LOS | | | F |

| Minor Lane/Major Mvmt | NBLn1 | NBLn2 | EBT | EBR | WBT |
|---|---|---|---|---|---|
| Capacity (veh/h) | 52 | 314 | - | - | - |
| HCM Lane V/C Ratio | 2.557 | 0.423 | - | - | - |
| HCM Control Delay (s) | $ 874.6 | 24.6 | - | - | - |
| HCM Lane LOS | F | C | - | - | - |
| HCM 95th %tile Q(veh) | 13.7 | 2 | - | - | - |

| Notes | | | |
|---|---|---|---|
| ~: Volume exceeds capacity | $: Delay exceeds 300s | +: Computation Not Defined | *: All major volume in platoon |

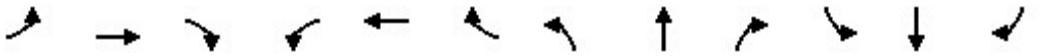
| Intersection | |
|---|---|
| Int Delay, s/veh | 2.3 |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 115 | 760 | 650 | 5 | 820 | 430 | 0 | 0 | 50 | 15 | 5 | 20 |
| Future Vol, veh/h | 115 | 760 | 650 | 5 | 820 | 430 | 0 | 0 | 50 | 15 | 5 | 20 |
| Conflicting Peds, #/hr | 2 | 0 | 2 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Free | Free | Stop | Stop | Stop | Stop | Stop | Stop |
| RT Channelized | - | - | None | - | - | None | - | - | Stop | - | - | None |
| Storage Length | - | - | - | - | - | - | - | - | 0 | - | - | - |
| Veh in Median Storage, # | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Grade, % | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Peak Hour Factor | 97 | 97 | 97 | 97 | 97 | 97 | 97 | 97 | 97 | 97 | 97 | 97 |
| Heavy Vehicles, % | 3 | 1 | 1 | 0 | 1 | 2 | 0 | 0 | 4 | 33 | 0 | 0 |
| Mvmt Flow | 119 | 784 | 670 | 5 | 845 | 443 | 0 | 0 | 52 | 15 | 5 | 21 |

| Major/Minor | Major1 | | | Major2 | | | Minor1 | | | Minor2 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Conflicting Flow All | 1290 | 0 | 0 | 1456 | 0 | 0 | - | - | 729 | 1709 | 2773 | 646 |
| Stage 1 | - | - | - | - | - | - | - | - | - | 1079 | 1079 | - |
| Stage 2 | - | - | - | - | - | - | - | - | - | 630 | 1694 | - |
| Critical Hdwy | 4.16 | - | - | 4.1 | - | - | - | - | 6.98 | 8.16 | 6.5 | 6.9 |
| Critical Hdwy Stg 1 | - | - | - | - | - | - | - | - | - | 7.16 | 5.5 | - |
| Critical Hdwy Stg 2 | - | - | - | - | - | - | - | - | - | 7.16 | 5.5 | - |
| Follow-up Hdwy | 2.23 | - | - | 2.2 | - | - | - | - | 3.34 | 3.83 | 4 | 3.3 |
| Pot Cap-1 Maneuver | 528 | - | - | 471 | - | - | 0 | 0 | 361 | 42 | 19 | 419 |
| Stage 1 | - | - | - | - | - | - | 0 | 0 | - | 185 | 297 | - |
| Stage 2 | - | - | - | - | - | - | 0 | 0 | - | 368 | 150 | - |
| Platoon blocked, % | | - | - | | - | - | | | | | | |
| Mov Cap-1 Maneuver | 527 | - | - | 470 | - | - | - | - | 360 | - | 0 | 418 |
| Mov Cap-2 Maneuver | - | - | - | - | - | - | - | - | - | - | 0 | - |
| Stage 1 | - | - | - | - | - | - | - | - | - | 185 | 283 | - |
| Stage 2 | - | - | - | - | - | - | - | - | - | - | 0 | - |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| HCM Control Delay, s | 3.7 | 0.2 | 16.7 | |
| HCM LOS | | | C | - |

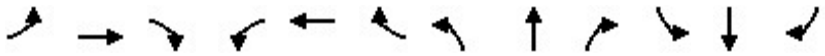
| Minor Lane/Major Mvmt | NBLn1 | EBL | EBT | EBR | WBL | WBT | WBR | SBLn1 |
|---|---|---|---|---|---|---|---|---|
| Capacity (veh/h) | 360 | 527 | - | - | 470 | - | - | - |
| HCM Lane V/C Ratio | 0.143 | 0.225 | - | - | 0.011 | - | - | - |
| HCM Control Delay (s) | 16.7 | 13.8 | 5.3 | - | 12.7 | 0.3 | - | - |
| HCM Lane LOS | C | B | A | - | B | A | - | - |
| HCM 95th %tile Q(veh) | 0.5 | 0.9 | - | - | 0 | - | - | - |



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 160 | 555 | 85 | 260 | 600 | 110 | 365 | 780 | 275 | 205 | 850 | 195 |
| Future Volume (veh/h) | 160 | 555 | 85 | 260 | 600 | 110 | 365 | 780 | 275 | 205 | 850 | 195 |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | 1.00 | | 0.97 | 1.00 | | 0.97 | 1.00 | | 0.97 | 1.00 | | 0.98 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Work Zone On Approach | | No | | | No | | | No | | | No | |
| Adj Sat Flow, veh/h/ln | 1736 | 1736 | 1682 | 1736 | 1736 | 1723 | 1736 | 1723 | 1723 | 1736 | 1736 | 1736 |
| Adj Flow Rate, veh/h | 165 | 572 | 88 | 268 | 619 | 113 | 376 | 804 | 284 | 211 | 876 | 201 |
| Peak Hour Factor | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 |
| Percent Heavy Veh, % | 1 | 1 | 5 | 1 | 1 | 2 | 1 | 2 | 2 | 1 | 1 | 1 |
| Cap, veh/h | 167 | 609 | 98 | 223 | 544 | 103 | 254 | 643 | 227 | 165 | 583 | 134 |
| Arrive On Green | 0.25 | 0.26 | 0.25 | 0.25 | 0.26 | 0.25 | 0.15 | 0.27 | 0.27 | 0.10 | 0.22 | 0.21 |
| Sat Flow, veh/h | 643 | 2342 | 376 | 857 | 2092 | 397 | 1654 | 2351 | 830 | 1654 | 2652 | 608 |
| Grp Volume(v), veh/h | 438 | 0 | 387 | 530 | 0 | 470 | 376 | 559 | 529 | 211 | 545 | 532 |
| Grp Sat Flow(s),veh/h/ln | 1704 | 0 | 1657 | 1694 | 0 | 1652 | 1654 | 1637 | 1545 | 1654 | 1650 | 1610 |
| Q Serve(g_s), s | 38.4 | 0.0 | 33.9 | 39.0 | 0.0 | 39.0 | 23.0 | 41.0 | 41.0 | 15.0 | 33.0 | 33.0 |
| Cycle Q Clear(g_c), s | 38.4 | 0.0 | 33.9 | 39.0 | 0.0 | 39.0 | 23.0 | 41.0 | 41.0 | 15.0 | 33.0 | 33.0 |
| Prop In Lane | 0.38 | | 0.23 | 0.51 | | 0.24 | 1.00 | | 0.54 | 1.00 | | 0.38 |
| Lane Grp Cap(c), veh/h | 443 | 0 | 431 | 440 | 0 | 429 | 254 | 447 | 422 | 165 | 363 | 354 |
| V/C Ratio(X) | 0.99 | 0.00 | 0.90 | 1.20 | 0.00 | 1.09 | 1.48 | 1.25 | 1.25 | 1.28 | 1.50 | 1.50 |
| Avail Cap(c_a), veh/h | 443 | 0 | 431 | 440 | 0 | 429 | 254 | 447 | 422 | 165 | 363 | 354 |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Upstream Filter(I) | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 | 1.00 | 0.46 | 0.46 | 0.46 | 1.00 | 1.00 | 1.00 |
| Uniform Delay (d), s/veh | 55.4 | 0.0 | 53.7 | 55.8 | 0.0 | 55.6 | 63.5 | 54.5 | 54.8 | 67.5 | 58.5 | 58.7 |
| Incr Delay (d2), s/veh | 39.8 | 0.0 | 24.3 | 111.3 | 0.0 | 71.6 | 226.9 | 121.3 | 122.5 | 162.6 | 239.5 | 240.3 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 21.4 | 0.0 | 17.0 | 30.4 | 0.0 | 24.9 | 25.7 | 31.9 | 30.3 | 13.8 | 37.9 | 37.1 |
| Unsig. Movement Delay, s/veh | | | | | | | | | | | | |
| LnGrp Delay(d),s/veh | 95.2 | 0.0 | 78.0 | 167.1 | 0.0 | 127.2 | 290.4 | 175.8 | 177.3 | 230.1 | 298.0 | 299.0 |
| LnGrp LOS | F | A | E | F | A | F | F | F | F | F | F | F |
| Approach Vol, veh/h | | 825 | | | 1000 | | | 1464 | | | 1288 | |
| Approach Delay, s/veh | | 87.1 | | | 148.3 | | | 205.7 | | | 287.3 | |
| Approach LOS | | F | | | F | | | F | | | F | |

| Timer - Assigned Phs | 1 | 2 | | 4 | 5 | 6 | | 8 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Phs Duration (G+Y+Rc), s | 19.0 | 45.0 | | 43.0 | 27.0 | 37.0 | | 43.0 | | | | |
| Change Period (Y+Rc), s | 5.0 | 5.0 | | 5.0 | 5.0 | 5.0 | | 5.0 | | | | |
| Max Green Setting (Gmax), s | 14.0 | 40.0 | | 38.0 | 22.0 | 32.0 | | 38.0 | | | | |
| Max Q Clear Time (g_c+I1), s | 17.0 | 0.0 | | 0.0 | 25.0 | 0.0 | | 0.0 | | | | |
| Green Ext Time (p_c), s | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | | 0.0 | | | | |

| Intersection Summary | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HCM 6th Ctrl Delay | | | 194.8 | | | | | | | | | |
| HCM 6th LOS | | | F | | | | | | | | | |



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 85 | 345 | 270 | 55 | 25 | 480 | 30 | 855 | 50 | 230 | 940 | 25 |
| Future Volume (veh/h) | 85 | 345 | 270 | 55 | 25 | 480 | 30 | 855 | 50 | 230 | 940 | 25 |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | 1.00 | | 0.98 | 1.00 | | 0.98 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Work Zone On Approach | | No | | | No | | | No | | | No | |
| Adj Sat Flow, veh/h/ln | 1736 | 1723 | 1750 | 1723 | 1682 | 1736 | 1600 | 1736 | 1750 | 1723 | 1750 | 1450 |
| Adj Flow Rate, veh/h | 88 | 356 | 133 | 57 | 26 | 304 | 31 | 881 | 0 | 237 | 969 | 0 |
| Peak Hour Factor | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 |
| Percent Heavy Veh, % | 1 | 2 | 0 | 2 | 5 | 1 | 11 | 1 | 0 | 2 | 0 | 22 |
| Cap, veh/h | 143 | 375 | 391 | 224 | 81 | 388 | 51 | 1093 | | 286 | 1571 | |
| Arrive On Green | 0.27 | 0.27 | 0.27 | 0.27 | 0.27 | 0.27 | 0.03 | 0.33 | 0.00 | 0.17 | 0.47 | 0.00 |
| Sat Flow, veh/h | 265 | 1398 | 1456 | 456 | 303 | 1445 | 1524 | 3299 | 1483 | 1641 | 3325 | 1229 |
| Grp Volume(v), veh/h | 444 | 0 | 133 | 83 | 0 | 304 | 31 | 881 | 0 | 237 | 969 | 0 |
| Grp Sat Flow(s),veh/h/ln | 1663 | 0 | 1456 | 759 | 0 | 1445 | 1524 | 1650 | 1483 | 1641 | 1663 | 1229 |
| Q Serve(g_s), s | 11.5 | 0.0 | 4.4 | 0.0 | 0.0 | 11.7 | 1.2 | 14.6 | 0.0 | 8.3 | 13.0 | 0.0 |
| Cycle Q Clear(g_c), s | 16.0 | 0.0 | 4.4 | 4.4 | 0.0 | 11.7 | 1.2 | 14.6 | 0.0 | 8.3 | 13.0 | 0.0 |
| Prop In Lane | 0.20 | | 1.00 | 0.69 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Lane Grp Cap(c), veh/h | 518 | 0 | 391 | 305 | 0 | 388 | 51 | 1093 | | 286 | 1571 | |
| V/C Ratio(X) | 0.86 | 0.00 | 0.34 | 0.27 | 0.00 | 0.78 | 0.60 | 0.81 | | 0.83 | 0.62 | |
| Avail Cap(c_a), veh/h | 873 | 0 | 705 | 552 | 0 | 700 | 127 | 1157 | | 315 | 1571 | |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Upstream Filter(I) | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 |
| Uniform Delay (d), s/veh | 21.8 | 0.0 | 17.6 | 17.3 | 0.0 | 20.3 | 28.5 | 18.3 | 0.0 | 23.8 | 11.8 | 0.0 |
| Incr Delay (d2), s/veh | 3.4 | 0.0 | 0.4 | 0.4 | 0.0 | 2.6 | 8.2 | 4.5 | 0.0 | 14.8 | 0.9 | 0.0 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 6.1 | 0.0 | 1.4 | 0.9 | 0.0 | 3.9 | 0.5 | 5.6 | 0.0 | 4.2 | 4.2 | 0.0 |
| Unsig. Movement Delay, s/veh | | | | | | | | | | | | |
| LnGrp Delay(d),s/veh | 25.2 | 0.0 | 18.0 | 17.7 | 0.0 | 22.9 | 36.8 | 22.7 | 0.0 | 38.6 | 12.7 | 0.0 |
| LnGrp LOS | C | A | B | B | A | C | D | C | | D | B | |
| Approach Vol, veh/h | | 577 | | | 387 | | | 912 | | | 1206 | |
| Approach Delay, s/veh | | 23.6 | | | 21.8 | | | 23.2 | | | 17.8 | |
| Approach LOS | | C | | | C | | | C | | | B | |

| Timer - Assigned Phs | 1 | 2 | | 4 | 5 | 6 | | 8 |
|---|---|---|---|---|---|---|---|---|
| Phs Duration (G+Y+Rc), s | 15.0 | 24.3 | | 20.6 | 6.5 | 32.8 | | 20.6 |
| Change Period (Y+Rc), s | 4.5 | 4.5 | | 4.5 | 4.5 | 4.5 | | 4.5 |
| Max Green Setting (Gmax), s | 10.5 | 21.0 | | 29.0 | 5.0 | 27.5 | | 29.0 |
| Max Q Clear Time (g_c+I1), s | 10.3 | 16.6 | | 13.7 | 3.2 | 15.0 | | 6.4 |
| Green Ext Time (p_c), s | 0.1 | 3.3 | | 1.7 | 0.0 | 8.6 | | 0.1 |

| Intersection Summary | |
|---|---|
| HCM 6th Ctrl Delay | 21.0 |
| HCM 6th LOS | C |

**Notes**

Unsignalized Delay for [NBR, SBR] is excluded from calculations of the approach delay and intersection delay.

# ATTACHMENT E: TECHNICAL MEMORANDUM #4

## ALTERNATIVES DEVELOPMENT AND EVALUATION

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# TECHNICAL MEMORANDUM 4

DATE: April 28, 2023

TO: Project Team

FROM: Eileen Chai, EIT; Kayla Fleskes, PE; John Bosket, PE | DKS Associates

SUBJECT: US 97 at Reed Market Road Operations and Safety Study
Alternatives Development and Evaluation - DRAFT

Project #22129-001

This memorandum describes the development and evaluation of concepts for improving transportation conditions within the US 97 at Reed Market Road study area. Initial concepts were discussed during a concept evaluation workshop with the Technical Advisory Committee (TAC). Based on feedback received during the workshop, the top concepts were further refined and evaluated against the goals and evaluation criteria from *Technical Memorandum #1: Study Background and Goals and Objectives*. This memorandum includes a description of the top concepts and their performance relative to the evaluation criteria.

This memorandum is divided into the following sections:

- **Process for developing and evaluating concepts –** This section describes in more detail how the top concepts were selected at each intersection for further evaluation.
- **Reed Market Road cross section improvements** – This section provides examples for how the cross section of Reed Market Road could be adjusted in the future and discusses how there is a desire for intersection improvements intended for short-term construction to be compatible with the existing cross sections while also maintaining forward compatibility with any potential long-range cross section.
- **Short-term intersection improvements** – Describes the short-term recommendations at two intersections with relatively limited funding available: Reed Market Road/Chamberlain Street and 3rd Street/Brosterhous Road.
- **Alternative evaluation (by intersection) –** This section describes the alternatives and the evaluation findings for each of the five major study intersections. Each alternative was evaluated relative to the six project goals and each intersection discussion includes a documentation of the analysis as well as a summary discussing the key differentiators in qualitative scoring between alternatives.

Following this evaluation, a preferred concept will be selected at each intersection and the entire corridor will be evaluated using microsimulation to verify that the alternatives will function well as a system.

## PROCESS FOR DEVELOPING AND EVALUATING CONCEPTS

Based on the needs identified in Technical Memoranda #1-3 and prior planning project recommendations, the project team developed an initial set of concepts at each of the study intersections. These initial concepts were presented to TAC members during a four-hour evaluation workshop held on December 7, 2022. During the workshop, the concepts were discussed and some were qualitatively scored relative to No-Build conditions and against each of the project goals.

After further discussion and consideration of the feedback received during the workshop, the Project Management Team determined that the criteria requiring reasonable alignment with available funding should be considered as "pass/fail" criteria for this project. Therefore, after reevaluating the alternatives using the pass/fail criteria related to cost, the Project Management Team separated the preliminary alternatives into the categories of "Considered and Dismissed" and "Forwarded for Further Refinement and Evaluation." Alternatives in the former category were deemed to either have few merits based on the full range of evaluation criteria or to have costs that would likely exceed current funding expectations. These alternatives were removed from further consideration in this project, while the remaining alternatives were forwarded for further analysis. The results of that analysis are documented in this memorandum.

## REED MARKET ROAD CROSS SECTION IMPROVEMENTS

Opportunities to cross US 97 for people walking and biking are limited in the vicinity of the Reed Market Road overcrossing. The current facility does not provide low-stress walking and biking routes with varying buffers along the narrower sidewalk and non-separated bike lanes. Nearest adjacent crossings are at the Wilson Avenue overcrossing located 2,400 feet to the north and at the Central Oregon Historic Canal Trail undercrossing located 1,700 feet to the south. Both of these crossings are designated as part of the low-stress network in the Bend Transportation System Plan (TSP). It should be recognized that the canal trail has limited access points connecting to goods and services. Given the distance between Wilson Avenue and the canal crossing, enhancing the ability to walk and bike across US 97 at Reed Market Road would be beneficial.

While Reed Market Road is not a designated low-stress route, improvements to provide low-stress walking and biking facilities are required by the standard cross sections when the street is reconstructed. Providing low-stress walking and biking facilities would require reconstruction to widen the overpass and the overall cross section. At this time, however, a reconstruction project is neither planned nor funded. Furthermore, formally changing the long-range design of Reed Market Road is not currently identified in the City's TSP project list or in the Draft 2024-2027 Statewide Transportation Improvement Program (STIP). That said, through this planning process, there is a desire for intersection improvements intended for near-term construction to be compatible with the existing cross sections while also maintaining forward compatibility with any potential future cross section changes.

Therefore, Figures 1-4 show examples of long-range cross section designs that may be considered along Reed Market Road in the future. All intersection improvements discussed later in this memorandum should be designed to be compatible with the existing cross section while not precluding a future long-term cross section along Reed Market Road. The example cross sections

below show the option of people biking on a multi-use path at sidewalk level. While shown as one-direction bike travel, the facilities could be designed to accommodate two-direction bike travel. Note that any changes in the cross section (such as reducing the travel lane width) at the US 97 interchange require coordination with the Mobility Advisory Committee (MAC).

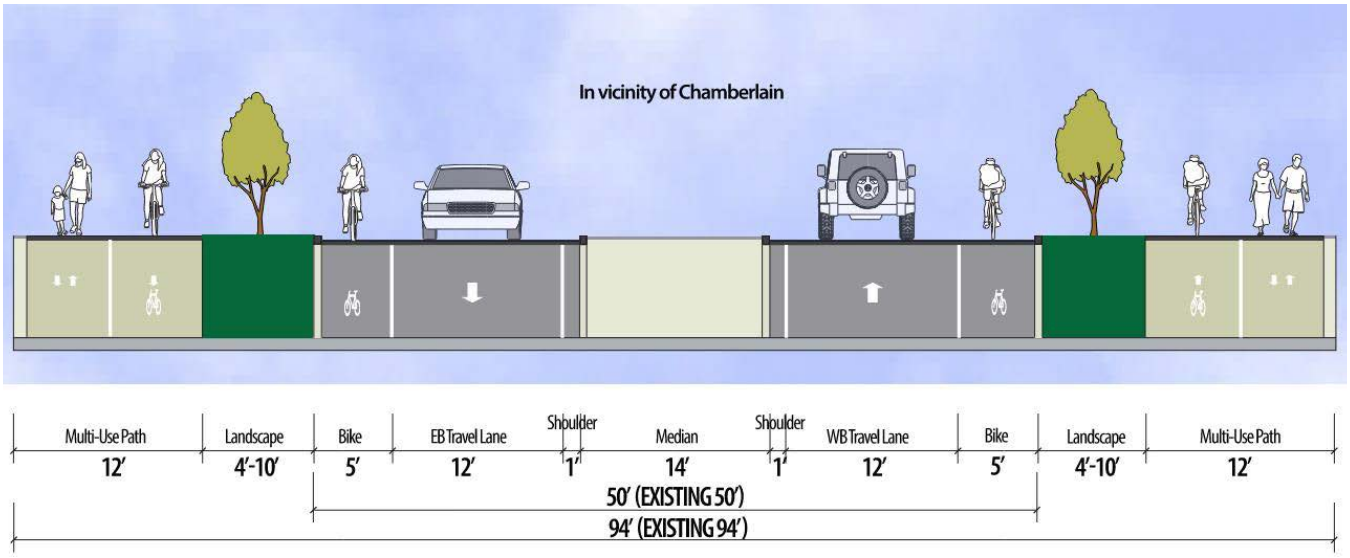


**FIGURE 1. POTENTIAL LONG-TERM REED MARKET ROAD CROSS SECTION (IN VICINITY OF CHAMBERLAIN STREET)**

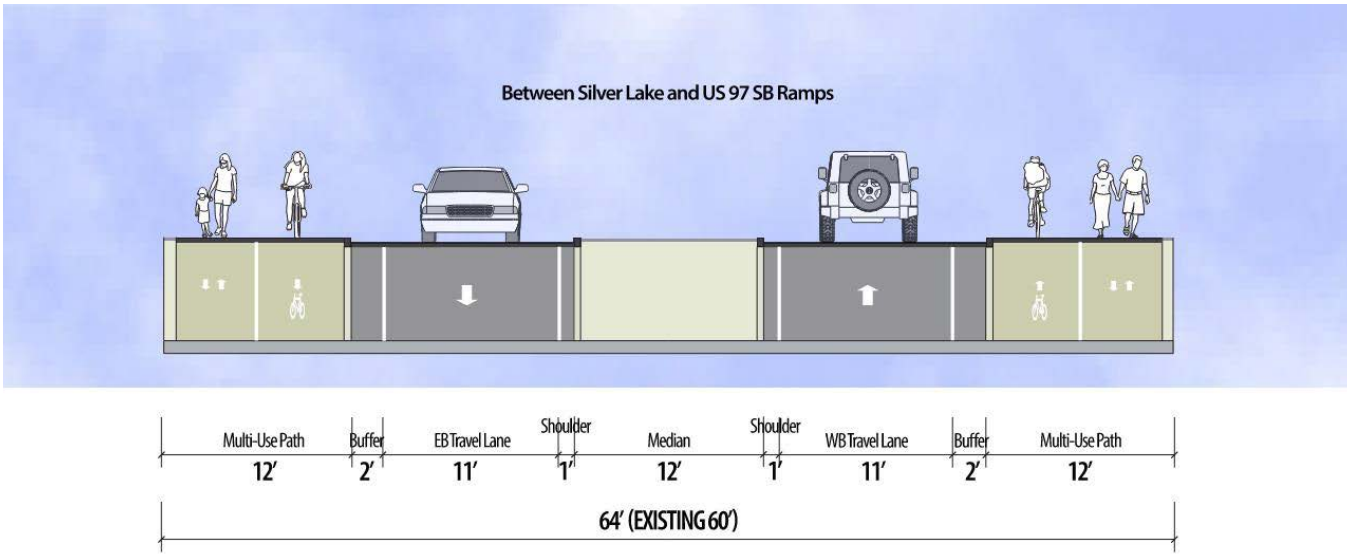


**FIGURE 2. POTENTIAL LONG-TERM REED MARKET ROAD CROSS SECTION (BETWEEN SILVER LAKE BOULEVARD AND US 97 SOUTHBOUND RAMPS)**

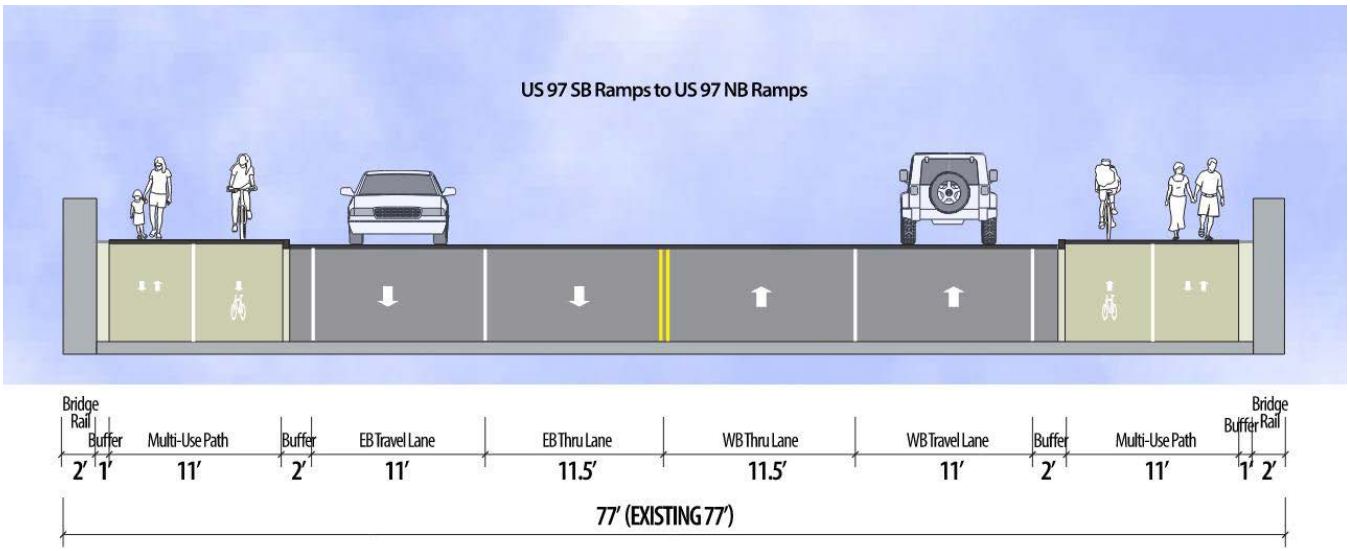


**FIGURE 3. POTENTIAL LONG-TERM REED MARKET ROAD CROSS SECTION (US 97 SOUTHBOUND RAMPS TO US 97 NORTHBOUND RAMPS)**

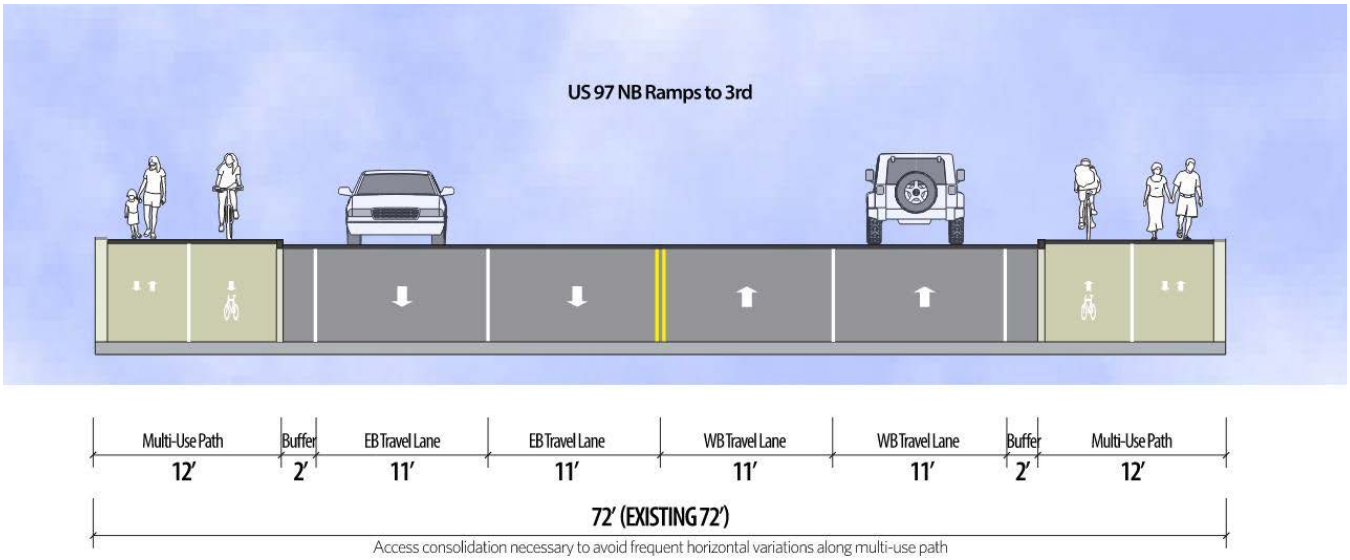


**FIGURE 4. POTENTIAL LONG-TERM REED MARKET ROAD CROSS SECTION (US 97 NORTHBOUND RAMPS TO 3RD STREET)**

## SHORT-TERM INTERSECTION IMPROVEMENTS

Within the study area, two intersections have relatively limited (less than $250,000) funding for improvements: Reed Market Road/Chamberlain Street and 3rd Street/Brosterhous Road. Several short-term enhancements are recommended at these two locations and discussed in more detail below.

### REED MARKET ROAD/CHAMBERLAIN STREET IMPROVEMENTS

Chamberlain Street has been identified as a key walking and biking route in the Bend TSP. The City has approximately $250,000 in the Neighborhood Street Safety Program to pave a portion of Chamberlain Street and install crossing enhancements at Reed Market Road. It is recommended that these crossing enhancements include:

- New pedestrian crossing on the east leg.
- Wayfinding signage for people walking and biking.
- Median cutouts for a bicycle crossing and green pavement markings, such as in the example shown in Figure 5.
- Additional pedestrian and bicycle crossing warning signage, such as in the example in Figure 5.
- Possible vegetation removal in the median to improve pedestrian visibility.
- Preserving space for future bus stops along Reed Market Road.
- Adding enhanced lighting at the intersection.

**FIGURE 5. EXAMPLE BICYCLE CROSSING THROUGH A MEDIAN IN PORTLAND, OR**

*Source: Google Streetview, Google Earth*

## 3RD STREET/BROSTERHOUS ROAD

The City is currently conducting a study[1] to evaluate potential short-term and long-term improvement options to enhance safety at this intersection. As a result of that study, several signing, striping, lighting, and signal timing treatments were recommended as short-term improvements that would use existing funding identified in the Bend Capital Improvement Program ($130,000), including:

- Re-striping the eastbound and westbound approaches to move the bike lanes to the left of the right turn lanes (consistent with the signalization at the intersection) and add bicycle conflict striping. The re-striping helps address the lane offset through the intersection.
- Re-striping the eastbound approach to make the right turn lane channelization clearer to drivers.
- Adding signage on the eastbound approach to make the lane channelization clearer to drivers.
- Modifying the striping for the channelized right turns on the northbound and southbound approaches, adding signage, and adding reflectors to the islands.
- Installing lighting at the intersection to enhance nighttime visibility to prevent potential crashes.
- Working with the Central Oregon Irrigation District to install a gate across the canal trail to encourage people walking and biking along the Canal Trail to use the traffic signal to cross Brosterhous Road. People walking and biking along the trail (east leg of the intersection) are more likely to cross Brosterhous Road at the trail instead of using the intersection crossing, which contributes to safety concerns from crossing at an uncontrolled location in close proximity to the signalized intersection.
- Adding a Leading Pedestrian Interval (LPI) to enhance safety for people walking and biking. It should be noted that the signal timing change alone does not address motor vehicle conflicts.
- Implementing eastbound and westbound split phasing to reduce the conflicts between left-turning vehicles and other road users. It should be noted this improvement creates additional intersection delay and requires an upgrade to the signal heads and a structural analysis to determine the feasibility of the existing signal poles and span wire to accommodate the four section signal heads.

While no additional funding has been identified for this intersection, several long-term treatments are discussed in more detail later in the memorandum.

[1] Bend 3rd Street Evaluation and Signal Upgrade; February 2023; DKS Associates.

## ALTERNATIVE EVALUATION

The alternatives were compared using the evaluation criteria documented in *Technical Memorandum #1: Study Background and Goals and Objectives* for each of the six project goal areas:

- Goal 1: Increase System Functionality, Quality and Connectivity for All Users
- Goal 2: Ensure Safety for All Users
- Goal 3: Support Economic Development
- Goal 4: Protect Livability and Ensure Equity and Access
- Goal 5: Steward the Environment
- Goal 6: Develop Solutions That Are Cost-Effective and Implementable

Concept figures are included for each alternative in the body of the memorandum as well as in Appendix A. Each of the alternatives was scored relative to evaluation criteria to highlight the assumed level of benefit. These qualitative scores will help guide the discussion of the key opportunities and tradeoffs associated with each alternative and lead to ultimately selecting a preferred alternative. Each evaluation criterion is rated on the qualitative scale listed in Table 1. The following sections describe the evaluation of each of the five major study intersections.

**TABLE 1: ALTERNATIVE SCORING SCALE**

| QUALITATIVE SCORE | PERFORMANCE |
|---|---|
| | Excellent |
| | Good |
| | Fair |
| | Poor |
| | Very Poor |

## REED MARKET ROAD/BROOKSWOOD BOULEVARD

The Reed Market Road/Brookswood Boulevard intersection was analyzed independently based on an analysis completed in 2019-2020 for the City of Bend. The previous study, documented in a February 2020 report, analyzed both the addition of lanes, using the methodologies outlined in the Highway Capacity Manual (HCM), and the existing geometry with a metering signal system for improved system reliability. The metering evaluation was completed using Vissim 11 and was followed up with a field validation study using temporary signals and manual control.

The current evaluation considered two alternatives:

- Alternative 1 - Multilane Roundabout:
  - Under this alternative, left turn lanes were added on the northbound and southbound approaches and right turn lanes were added on the eastbound and westbound approaches. These lane additions were selected based on the findings of the 2019-2020 study and to specifically address peak period patterns during both the AM and PM peak periods. Figure 6 shows the multilane configuration. This alternative maintains the same sidewalk and bike lane with option to exit to the sidewalk or continue in the travel lane. In addition to adding capacity through additional lanes, the geometry shown in Figure 6 also adjusts curb lines to make drivers intended movements more apparent, which may increase gap acceptance for downstream drivers.
- Alternative 2 - Multilane Roundabout with Metering:
  - The second alternative assumed the same geometry and added metering signals to each approach. The metering signals were placed upstream of the lane additions and are intended to operate independently from the roundabout; drivers still must yield at the roundabout during metering operation. The metering signal logic was informed by the previous Vissim study and field evaluation. The metering signals have been made completely dynamic, turning on and off when the metering signals will provide benefit.

### EVALUATION METHODOLOGY

For this evaluation, the alternatives have both been evaluated using Vissim. The alternatives evaluation utilized the existing calibrated roundabout model from the 2019 study, with updated geometry for the proposed multilane configuration. The Vissim model was calibrated in 2019 utilizing volume and queueing metrics. The model analyzed the evening peak period, 3 PM to 6 PM. The roundabout was modeled using priority rules for yielding. Full details on the simulation model development and calibration are included in Appendix D.

For this study, 2040 turning movement counts were provided for the PM peak hour and two-hour peak period. Findings from the 2019 study showed that changing volume profiles and routes throughout the peak period are a critical factor to the queueing experienced. Due to this, this study included the same volume profiles and routing profiles from the 2019 study but were scaled to match the provided 2040 peak hour volume data. The scaled volume data was validated to be representative of peak hour conditions.

**FIGURE 6. PARTIAL MULTILANE ROUNDABOUT AT REED MARKET ROAD/BROOKSWOOD BOULEVARD**

The metering logic is complex and was uniquely developed for this analysis based on past simulation and field test scenarios at this intersection. For this analysis, metering signals were tested in the multilane roundabout alternative; however, the metering signals were placed on the approaches at the single-lane cross section, upstream of where the multilane section develops. Due to this, programming and infrastructure needs for the metering alternative are based on a single lane. The metering signals can operate in one of three modes: off, single-approach, or dual-approach:

- When in the off mode, all signals are dark. The off mode cannot be shorter than two minutes..
- In the single-approach mode, a single approach is metered with periods of green, yellow, and red. Metering signals on all other approaches are dark. The signal will go red if gaps on the metered approach rise beyond a threshold or if it has been green for a set duration. The signal will be green if the adjacent, downstream approach is no longer queued or reaches a set duration.
- During the dual-approach mode, two adjacent approaches are metered. The metering signals on the other two approaches are dark. Both approaches first are held in red, the adjacent,

downstream approach then gets a green indication, then the upstream approach gets a green indication. Green and red activating targets are established similar to the single-approach mode.

Although the evaluation made use of one (single-approach mode) or two (dual-approach mode) metering signals at a time, metering signals are assumed to be placed on each approach to allow operational flexibility through different time periods of the day. There are activating targets in all modes to transition to another mode based on conditions.

The metering logic makes use of several detectors along each approach and in the roundabout. On each approach are a series of four detectors. Detector 0 is at the yield line at the roundabout, Detector 1 is at the stop bar of the metering signal, Detector 3 is just downstream of the ideal max queue (for example south of Columbia Street or west of the ramp terminal), Detector 2 is halfway between Detector 1 and 3.

## GOAL 1: INCREASE SYSTEM FUNCTIONALITY, QUALITY AND CONNECTIVITY FOR ALL USERS

### OBJECTIVES A AND B (TRAFFIC OPERATIONS)

Objectives A and B of Goal 1 relate to traffic operations, both for US 97 (A) and the local roadway system in the interchange area (B).

Given the location of the Reed Market Road/Brookswood Boulevard intersection, the isolated intersection operations have minimal effect on US 97 mainline. However, metering signals do provide the ability to prioritize certain approaches, which can reduce the occurrence of queues extending from the intersection to the US 97 ramps. This has the potential to reduce the probability of queues causing traffic to back down the ramps to the US 97 mainline. However, the pilot project identified that if the volumes vary significantly over various time periods, it may be difficult to program an approach that consistently reduces queues and improves operation.

For the local roadway network within the study area, the metering signals alternative is shown to improve operations beyond the multilane roundabout alternative. However, metering signals do not completely mitigate congestion. Table 2 shows the average delay through the network for vehicles simulated. Without meters, the average delay is nearly 500 seconds/vehicle. With meters, the delay is improved by about 25 percent to 384 seconds. Table 3 shows the average queue length across the 3-hour period for each approach. With metering, the queues are spread more evenly across each approach. Based on prior analysis, this spreading of the queues has the most potential to benefit US 97 during the AM peak period when queueing can reach the interchange ramps. Similar to queue spreading, delay is also spread. Without metering, the southbound and westbound approaches experience relatively low delay and the northbound approach experiences extremely high delay. With metering, northbound approach delay reduces, while the southbound and westbound movements have an increase in delay.

**TABLE 2: MICROSIMULATION DELAY**

| ALTERNATIVE | TOTAL VEHICLES (ACTIVE + ARRIVED + LATENT) | VEHICLE HOURS OF DELAY (TOTAL DELAY + LATENT DELAY) (HOURS) | AVERAGE DELAY (SECONDS/VEHICLE) |
|---|---|---|---|
| **MULTILANE** | 10,582 | 1,460 | 497 |
| **MULTILANE METERED** | 10,571 | 1,129 | 384 |

**TABLE 3: MICROSIMULATION AVERAGE QUEUE**

| ALTERNATIVE | NORTHBOUND | SOUTHBOUND | EASTBOUND | WESTBOUND |
|---|---|---|---|---|
| **DISTANCE AVAILABLE** | 1,100 feet to SW Hillwood Ct | 860 feet to SW Columbia St | 1,200 feet to N Alderwood Cir | 1,700 feet to US 97 Ramp Terminal |
| **MULTILANE** | 3,440+ feet (south of Rock Bluff Ln) | 25 feet | 1,120 feet | 200 feet |
| **MULTILANE METERED** | 2,880 feet (between McClellan Rd and Rock Bluff Ln) | 1,660 feet (north of Powerhouse Dr) | 565 feet | 640 feet |

+ QUEUE EXCEEDED MODEL GEOMETRY FOR A LARGE PORTION OF THE PEAK PERIOD

In addition to the Vissim microsimulation analysis, a HCM analysis was conducted for the No Build and multilane build condition. The metered alternative cannot be modeled with HCM methodologies. There are some other key differences between an HCM analysis and a microsimulation analysis. The HCM analysis analyzes a single 15-minute period based on the peak hour volume and a peak hour factor (PHF). The microsimulation analysis was a three-hour analysis with varying demand and routing conditions for each 15-minute period in the three-hour period. Through the field evaluation of the metering, the directionality of traffic flow peaking was observed to have an impact on roundabout operations. An HCM analysis of the roundabout will not fully replicate these traffic flow patterns, particularly for approaches significantly over capacity, and will differ from the Vissim results. The intent of the HCM analysis is to provide a relative assessment of the improvement that could be expected over the No Build scenario by converting the roundabout to a multilane roundabout. Table 4 and Table 5 list the HCM delay, level of service, volume-to-capacity (v/c) ratio and 95th percentile queue lengths and the software reports are included in Appendix B.

Widening for the partial multilane roundabout has significant benefits compared to the No-Build condition.

**TABLE 4: HCM DELAY AND LEVEL OF SERVICE**

| | AVERAGE DELAY BY APPROACH (SEC) [LOS] V/C | | | | |
|---|---|---|---|---|---|
| **ALTERNATIVE** | Northbound | Southbound | Eastbound | Westbound | Intersection |
| **NO-BUILD** | 339 [F] **1.69** | 265 [F] **1.53** | 353 [F] **1.72** | 296 [F] **1.60** | 309 [F] NA |
| **MULTILANE** | 68 [F] **1.08** | 21 [C] 0.80 | 104 [F] **1.21** | 24 [C] 0.80 | 51 [F] NA |

**Bold and red** indicates approach v/c ratio greater than 1.0.

**TABLE 5: HCM 95TH PERCENTILE QUEUE LENGTH**

| | 95TH PERCENTILE QUEUE LENGTH (FEET) | | | |
|---|---|---|---|---|
| **ALTERNATIVE** | Northbound | Southbound | Eastbound | Westbound |
| **NO-BUILD** | 1,175 | 1,290 | 1,175 | 1,260 |
| **MULTILANE** | 440 | 205 | 545 | 200 |

Note: 25 feet per vehicle is used to estimate the queue length.

Note: HCM queue results report those vehicles which are in queue for the roundabout itself. Queues extending beyond side streets may be longer due to vehicles which are turning before the roundabout. Queues may also extend onto the side street.

## OBJECTIVE C (ACTIVE TRANSPORTATION)

Both proposed alternatives increase the roundabout entries from one lane to two lanes. This increases the number of conflict points and potentially increases speeds on the approaches. However, the roundabout exits remain single lane, which is beneficial for accommodation of pedestrians who are blind or have limited vision (see NCHRP Report 674)[2]. Rectangular rapid flashing beacons (RRFBs) would likely be installed to facilitate pedestrian crossings on the dual entry lanes. Placement of the metering signals relative to the downstream RRFBs would require additional design consideration. During the field evaluation of the metering condition in 2019 there was no noticeable impact on yielding for pedestrians by drivers on the metered or unmetered approaches.

The proposed multilane geometric design continues to allow people bicycling to either use the roundabout traffic lanes or to exit using bicycle ramps and use crosswalks to navigate the intersection.

## OBJECTIVE D (TRANSIT)

The alternatives for this intersection have no specific transit improvements other than a reduction in delay for existing or future transit lines on the corridor. While no prioritization was modeled within the metered roundabout alternative, the meters could presumably be used to reduce delay for transit vehicles by providing transit vehicle priority. Further study would be needed to

[2] NCHRP Report 674: Crossing Solutions at Roundabouts and Channelized Turn Lanes for Pedestrians with Vision Disabilities, National Cooperative Highway Research Program, 2010.

determine the appropriate balance between reducing transit delay and increasing delay and queuing on remaining approaches.

### GOAL 1 SCORING SUMMARY

Table 6 shows the overall scoring results under Goal 1 for the improvement alternatives at Reed Market Road/Brookswood Boulevard.

**TABLE 6: GOAL 1 SCORING AT REED MARKET ROAD/BROOKSWOOD BOULEVARD**

| OBJECTIVE | PERFORMANCE | |
|---|---|---|
| | ALT 1 | ALT 2 |
| A. TRAFFIC OPERATIONS (ODOT) | - | - |
| B. TRAFFIC OPERATIONS (CITY) | ^ | ^ |
| C. ACTIVE TRANSPORTATION | v | v |
| D. TRANSIT | ^ | ^ |

## GOAL 2: ENSURE SAFETY FOR ALL USERS

Expansion of the roundabout to include multilane approaches will increase the number of conflict points for all users. However, multilane roundabouts still have a better safety performance by reducing the number and severity of crashes compared to other alternatives that would increase capacity, including signalized intersections.

Reduction in queueing leads to increased safety by limiting queues from extending onto the Parkway.

While emergency vehicle preemption was not modeled within the metered roundabout alternative, the meters could presumably be used to reduce delay for emergency vehicles with emergency lights active by providing preemption. Further study would be needed to determine the appropriate balance between emergency vehicle access and queue impacts on the other approaches.

Table 7 shows the scoring results under Goal 2 for the alternatives.

**TABLE 7: GOAL 2 SCORING AT REED MARKET ROAD/BROOKSWOOD BOULEVARD**

| OBJECTIVE | PERFORMANCE | |
|---|---|---|
| | ALT 1 | ALT 2 |
| A. CRASH REDUCTION | | |
| B. SAFETY FOR PEOPLE WALKING AND BIKING | | |
| C. ODOT'S ACCESS SPACING | - | - |

## GOAL 3: SUPPORT ECONOMIC DEVELOPMENT

Both alternatives serve to increase capacity of the intersection, reducing queueing impacts on property access points and improving peak hour access to commercial areas. All alternatives are expected to accommodate freight access, with no significant changes from existing conditions.

Table 8 shows the scoring results under Goal 3 for the alternatives.

**TABLE 8: GOAL 3 SCORING AT REED MARKET ROAD/BROOKSWOOD BOULEVARD**

| OBJECTIVE | PERFORMANCE | |
|---|---|---|
| | ALT 1 | ALT 2 |
| A. ACCESS EFFECTIVENESS | | |
| B. TRUCK FREIGHT ACCOMMODATION | | |

## GOAL 4: PROTECT LIVABILITY AND ENSURE EQUITY AND ACCESS

By reducing delay at the intersection, the viability of transit along the Reed Market Road, Brookswood Boulevard, and Bond Street corridors is improved over the existing condition. Furthermore, reduced delay at this intersection supports access from residential areas to commercial uses.

Table 9 shows the scoring results under Goal 4 for the alternatives.

**TABLE 9: GOAL 4 SCORING AT REED MARKET ROAD/BROOKSWOOD BOULEVARD**

| OBJECTIVE | PERFORMANCE | |
|---|---|---|
| | ALT 1 | ALT 2 |
| A. COMPLETE STREET | I | I |
| B. EQUITY | I | I |

## GOAL 5: STEWARD THE ENVIRONMENT

By reducing delay at the intersection, both alternatives and especially the metering alternative reduce emissions from idling vehicles. Table 10 shows the scoring results under Goal 5 for the alternatives.

**TABLE 10: GOAL 5 SCORING AT REED MARKET ROAD/BROOKSWOOD BOULEVARD**

| OBJECTIVE | PERFORMANCE | |
|---|---|---|
| | ALT 1 | ALT 2 |
| A. REDUCE EMISSIONS | ^ | ^ |

## GOAL 6: DEVELOP SOLUTIONS THAT ARE COST-EFFECTIVE AND IMPLEMENTABLE

The February 2020 report documented estimated costs for the multilane alternative as well as the option to add metering signals. The 2020 estimated costs as well as adjusted 2023 costs are:

- Multilane Roundabout:
  - 2020 cost estimate = $3,475,000
  - 2023 cost estimate = $3,996,250 (Assumes 15 percent increase due to inflation)
- Addition of Metering Signals
  - 2020 cost estimate = $453,440
  - 2023 cost estimate = $680,160 (Assumes 50 percent increase due to inflation and increased costs for signal equipment)

As shown in Table 11, the expected funding at this intersection is $4.25 million. Therefore, Alternative 1 is expected to fit within the expected funding while Alternative 2 may not. The multilane alternative concept was developed with the intent to generally maintain the inscribed circle diameter footprint to reduce construction impacts and allow for staged construction. Additionally, the alternatives summarized in this analysis allow for phasing with the option to construct the multilane alternative and then add metering when the incremental operational benefits justify the additional cost.

**TABLE 11: COST ESTIMATES FOR ALTERNATIVES AT REED MARKET ROAD/BROOKSWOOD BOULEVARD**

| | ALT 1 | ALT 2 | EXPECTED FUNDING |
|---|---|---|---|
| TOTAL COST | $4.0 million | $4.7 million | $4.25 million |

Table 12 shows the scoring results under Goal 6 for the alternatives.

**TABLE 12: GOAL 6 SCORING AT REED MARKET ROAD/BROOKSWOOD BOULEVARD**

| OBJECTIVE | PERFORMANCE | |
|---|---|---|
| | ALT 1 | ALT 2 |
| A. LOW-COST, HIGH BENEFIT | ^ | I |
| B. LEVERAGE PARTNERSHIPS | ^ | I |
| C. CONSTRUCTABLE IN PHASES, MAINTENANCE, DESIGN EXCEPTIONS, TRAFFIC MAINTENANCE DURING CONSTRUCTION | I | ^ |

## SUMMARY OF EVALUATION

Table 13 summarizes the scoring for each of the two alternatives across the project goals. Key differentiators in scoring between alternatives include:

- Goal 1: Increase System Functionality, Quality and Connectivity for All Users
  - The Multilane alternative improves operations over the No Build scenario but does not resolve all operational issues.
  - The Multilane with Metering alternative provides additional benefit over the Multilane alternative and allows specific control of where queueing happens and the ability to control queues where other elements of the system could be impacted (e.g., the US 97 ramps).
- Goal 2: Ensure Safety for All Users
  - While both alternatives result in an increased number of conflict points over the existing single-lane roundabout, multilane roundabouts still have a better safety performance than other alternatives that would increase capacity, including signalized intersections.
  - The addition of meters could incorporate emergency vehicle preemption to facilitate emergency response during queued conditions. Further study is required to determine actual impacts.
- Goal 3: Support Economic Development
  - The Multilane alternative increases capacity of the intersection, reducing impacts on property access points and improving peak hour access to commercial areas.

- The metering condition further improves property access by limiting excessive queue growth on any one approach.

- Goal 4: Protect Livability and Ensure Equity and Access
  - Both alternatives provide increased access to areas served by this intersection.
- Goal 5: Steward the Environment
  - Both alternatives result in emissions reduction by reducing vehicular delay. The metering alternative results in additional delay reduction.
- Goal 6: Develop Solutions that are Cost-Effective and Implementable
  - The Multilane alternative has been developed to minimize impacts during construction. In addition, the lane additions identified in this concept are not dependent on each other and could be phased over time.
  - The addition of meters can be considered once the additional benefit justifies the additional cost.

**TABLE 13: REED MARKET ROAD/BROOKSWOOD BOULEVARD ALTERNATIVE PERFORMANCE**

| | GOAL | ALTERNATIVE 1 | ALTERNATIVE 2 |
|---|---|---|---|
| GOAL 1 | Increase System Functionality, Quality and Connectivity for All Users | ^ | ^ |
| GOAL 2 | Ensure Safety for All Users | I | I |
| GOAL 3 | Support Economic Development | I | I |
| GOAL 4 | Protect Livability and Ensure Equity and Access | I | I |
| GOAL 5 | Steward the Environment | ^ | ^ |
| GOAL 6 | Develop Solutions That Are Cost-Effective and Implementable | ^ | I |

## REED MARKET ROAD/US 97 SOUTHBOUND RAMP TERMINAL

The Reed Market Road and US 97 southbound ramp terminal is currently signalized and has a southbound left-turn lane and shared left-through-right turn lane. Congestion at the intersection is projected to be slightly worse than the adopted mobility target, with the intersection operating near capacity. In addition, even today, westbound queues from the Reed Market Road/Brookswood Boulevard intersection spill back through the southbound ramp terminal, making the actual level of congestion experienced worse than calculated. If these conditions are not mitigated, the southbound exit ramp queue could spill back into the portion of the ramp needed for safe deceleration and stopping. Other issues to be addressed include conflicts with the westbound right-turn lane drop and the westbound bike lane crossover, and some reported challenges for heavy vehicles attempting to make the westbound right turn to the southbound loop ramp.

Two alternatives to address these concerns at the intersection were evaluated, including:

- Alternative 1: Providing an additional southbound dedicated right-turn lane
- Alternative 2: Extending the US 97 southbound exit ramp

Potential options to improve westbound bicycle comfort level in both alternatives include shifting the bike lane adjacent to the curb, adding a bike ramp to provide an option to cross using the sidewalk or crosswalk, and adding a bike signal at the intersection (adding a bike signal may also require modifications to the signal such as a right-turn overlap with blank-out sign and potentially a bike level-push button). For both alternatives, the analysis assumed that the signal cycle length would be increased and that the signal would be coordinated with a signal at the US 97 Northbound ramp terminal and other signalized intersections within the study area to enhance corridor operations. Figures 7 and 8 show concepts of both alternatives, with zoomable images included in Appendix A.

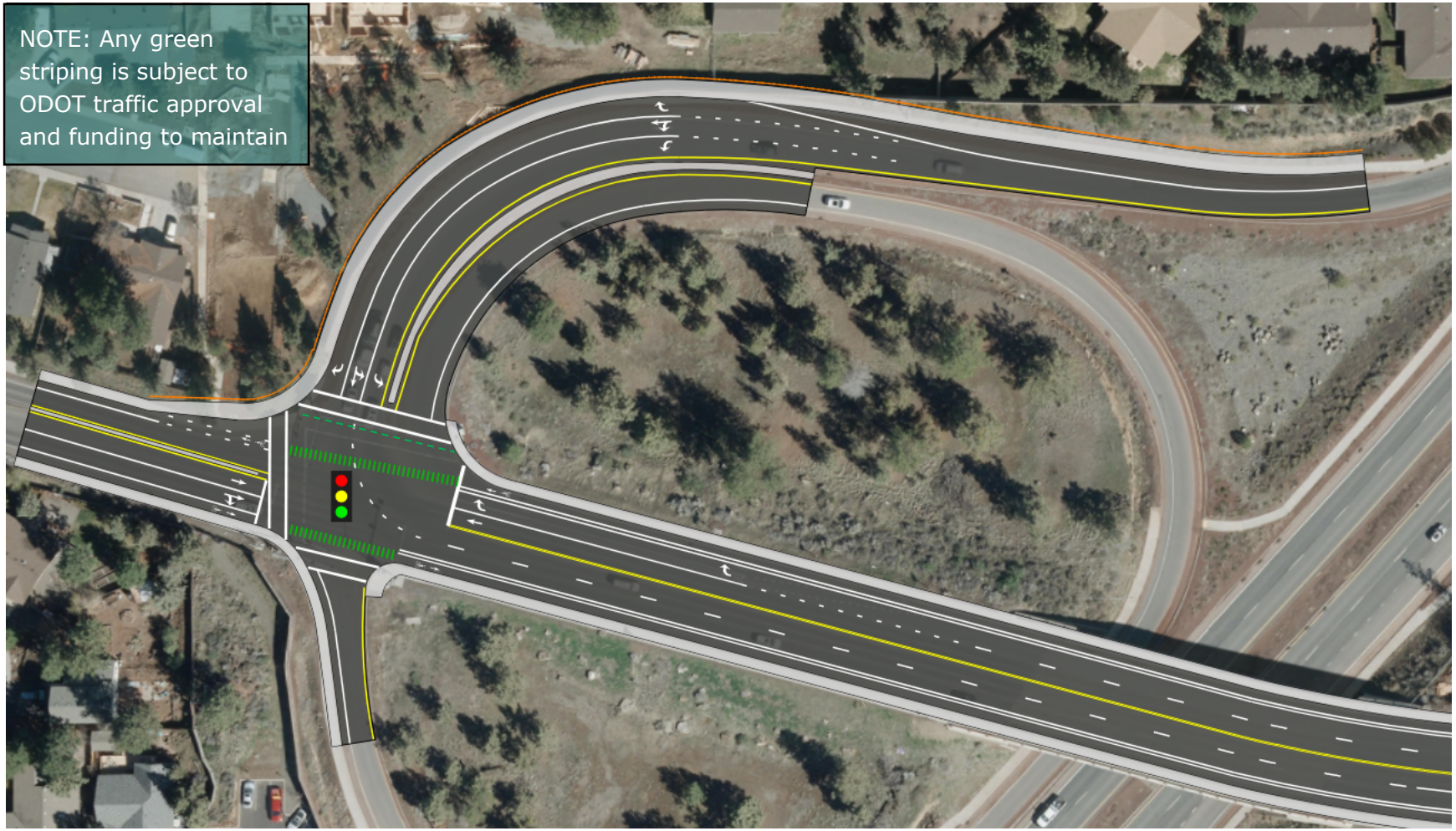


**FIGURE 7. ALTERNATIVE 1 AT REED MARKET ROAD/US 97 SOUTHBOUND RAMP**

**FIGURE 8. ALTERNATIVE 2 AT REED MARKET ROAD/US 97 SOUTHBOUND RAMP**

Figure 9 shows how the cross section on Reed Market Road can be modified to add buffered bike lanes within the existing structure while keeping people biking to the right of motor vehicle traffic approaching the southbound ramp terminal intersection. This would reduce the travel lane width to add buffers to the bike lane while maintaining the existing curb-to-curb width. Note that any changes in cross section at the US 97 interchange would need to be coordinated with the MAC.

This would also include a bike signal at the US 97 southbound ramp terminal and restricting westbound right-turn-on-red (RTOR) movements to reduce the risk of right-hook crashes as people biking cross the right turn lane through the intersection. Note: if a bike signal were to be implemented, it would require State Traffic Engineer approval and a blank-out sign with right-turn overlap may be recommended.

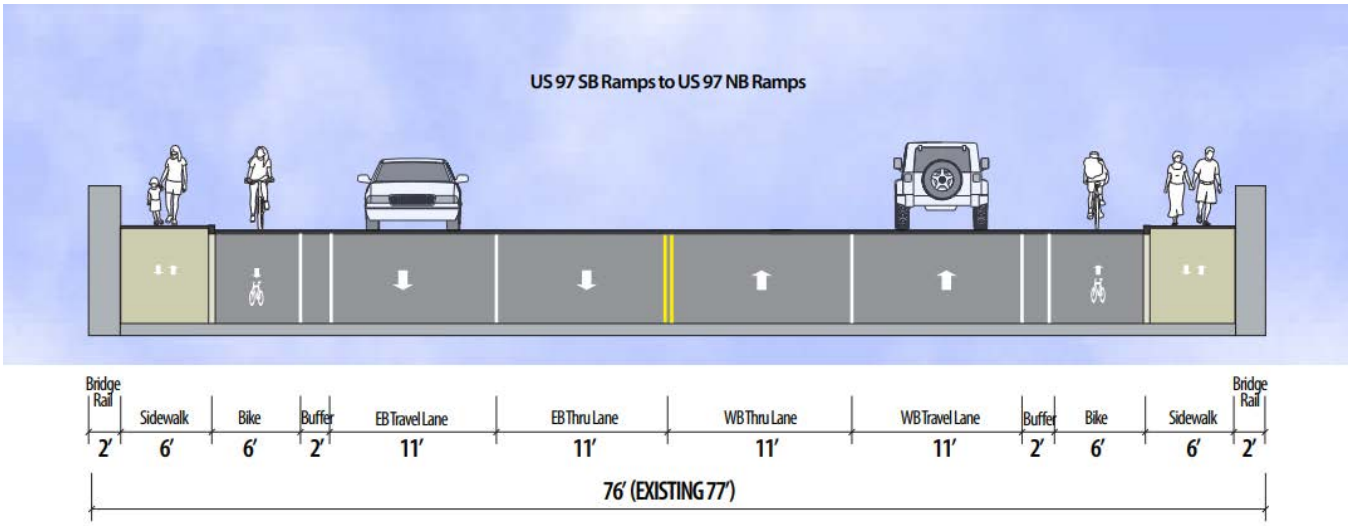


**FIGURE 9. REED MARKET ROAD CROSS SECTION TO PROVIDE BUFFERED BIKE LANES (US 97 SOUTHBOUND RAMPS TO US 97 NORTHBOUND RAMPS)**

## GOAL 1: INCREASE SYSTEM FUNCTIONALITY, QUALITY, AND CONNECTIVITY FOR ALL USERS

### OBJECTIVES A AND B (TRAFFIC OPERATIONS)

Table 14 summarizes the results for the two alternatives under future (year 2040) conditions, with the intersection's performance compared to the mobility standard.[3] As shown in the table, none of the alternatives are expected to meet the Highway Design Manual mobility standard, although Alternative 1 is expected to nearly meet the standard and would have a much lower v/c ratio than the No-Build condition. The additional southbound right-turn lane helps to accommodate the heavy southbound right-turn traffic (255 vehicles), reducing delay, queueing on the southbound approach, and providing storage for queue spillback from the Reed Market Road and Brookswood

[3] Intersection operations are reported using Highway Capacity Manual (HCM) 6th Edition methodology and the software reports are included in Appendix B.

Boulevard roundabout. In Alternative 2, extending the deceleration lane can help provide enough safe stopping distance on the ramp to prevent queue spillback onto the US 97 mainline. Due to signal timing changes associated with coordinating signal timing with the northbound ramp terminal (if implemented), the intersection v/c ratio is expected to improve slightly in Alternative 2 compared to the No-Build conditions but would still fail to meet the mobility standard. Both alternatives are expected to mitigate the risk of queue spillback onto mainline US 97. However, it is likely that risk of queue spillback will be significantly mitigated by removing bottlenecks elsewhere on Reed Market Road, indicating that adding the southbound right-turn lane or lengthening the on-ramp may not be needed until later in the 20-year planning horizon.

**TABLE 14: FUTURE 2040 DESIGN HOUR TRAFFIC OPERATIONS AT REED MARKET ROAD/US 97 SOUTHBOUND RAMP TERMINAL**

| INTER-SECTION | JURIS-DICTION | ALTER-NATIVE[A] | CONTROL | MOBILITY STANDARD[E] | V/C[B] | LOS[C] | DELAY[D] (SEC) |
|---|---|---|---|---|---|---|---|
| REED MARKET RD & US 97 SB | ODOT (30HV) | No-Build | Signalized | ≤ 0.90 | **0.94** | C | 26 |
| | | Alt 1 | Signalized [F] | ≤ 0.75 | **0.78** | C | 25 |
| | | Alt 2 | Signalized [F] | ≤ 0.75 | **0.91** | C | 30 |

**Bold and red** indicate a failure to meet the mobility standard.

30HV=30th highest hour; LOS=level of service; ODOT=Oregon Department of Transportation v/c=volume-to-capacity

[A] Future condition results represent 30HV operations for ODOT intersections and average weekday operations for City intersections, consistent with mobility standards.

[B] v/c ratio reported as the overall intersection v/c ratio at signalized intersections.

[C] LOS reported as the overall intersection LOS for signalized intersections.

[D] Control delay reported for overall intersection delay for signalized intersections.

[E] Oregon Highway Plan mobility targets apply to the no-build condition only. ODOT Highway Design Manual mobility standards apply to new construction. Note that ODOT adopted an alternative mobility target for this intersection as part of the US 97 Parkway Plan, which assumed a 0.90 v/c ratio during 30 HV conditions and ensuring 95$^{th}$ percentile queues do not extend into the portion of the exit ramp needed for deceleration (this applies to the no-build condition only).

[F] Includes westbound right-turn-on-red restriction but does not assume a protected bicycle phase due to HCM 6$^{th}$ edition limitations. The protected bicycle phase was tested with Highway Capacity Manual (HCM) 2000 methodology and did not have a significant impact on overall intersection delay.

### OBJECTIVE C (ACTIVE TRANSPORTATION)

The current westbound right-turn lane drop at the southbound ramp terminal crosses the bike lane after a grade change with limited warning to motorists, causing conflicts and safety concerns. Both alternatives could include improvements to bicycle crossing safety to resolve the westbound bicycle conflict issue by shifting the bike lane adjacent to the curb and adding a bike signal at the intersection. However, the alternatives do increase the risk of conflict due to right-hook crashes during the green phase. These accidents could be reduced with the installation of a raised island that moves people biking to a more visible position. Both alternatives are expected to equally enhance the quality of biking facilities travelling through the intersection to cross US 97 and provide an option to use the sidewalk or crosswalk. However, Alternative 1 requires southbound

road widening to provide the additional right-turn lane, resulting in a longer crossing distance that increases exposure for people walking and biking. Since this is a signalized intersection, this exposure is minimized, so Alternative 2 scores only slightly better on enhancing facilities for people walking and biking across US 97. It should be noted that both US 97 and Reed Market Road are not designated low-stress bicycle network or key walking and biking routes, therefore the related evaluation criteria were not evaluated.

### OBJECTIVE D (TRANSIT)

Route 6 will be modified to serve downtown and the Oregon State University Cascades Campus by travelling along Reed Market Road between 3rd Street and Brookswood Boulevard. Among the two alternatives, Alternative 1 is expected to improve traffic operations at the intersection, reducing delays for future eastbound and westbound traffic by more than 20 percent and improving future transit travel times along Reed Market Road.

### GOAL 1 SCORING SUMMARY

Table 15 shows the overall scoring results under Goal 1 for the improvement alternatives at the Reed Market Road/US 97 southbound ramp terminal.

**TABLE 15: GOAL 1 SCORING AT THE REED MARKET ROAD/US 97 SOUTHBOUND RAMP TERMINAL**

| OBJECTIVE | PERFORMANCE | |
|---|---|---|
| | ALT 1 | ALT 2 |
| A. TRAFFIC OPERATIONS (ODOT) | ⏫ | I |
| B. TRAFFIC OPERATIONS (CITY) | N/A | N/A |
| C. ACTIVE TRANSPORTATION | I | ^ |
| D. TRANSIT | ^ | I |

## GOAL 2: ENSURE SAFETY FOR ALL USERS

Both Alternative 1 and Alternative 2 are expected to help manage the risk of queues spilling back to the US 97 mainline. Alternative 1 has the potential to reduce all types of crashes by four percent[4] by adding a right-turn lane. Both alternatives also place the bike lane adjacent to the curb and include a protected crossing of the intersection with a bike signal and restricting RTOR movements, which could be implemented through the use of a blank-out sign to avoid a full-time RTOR restriction. This improvement reduces conflict points between people biking and vehicles, which significantly minimizes risk factors that could lead to bicycle-related crashes. In addition,

[4] ODOT Crash Reduction Factor List, 2023, ID: H4.

such an improvement is also expected to help increase physical separation between users by providing a buffer to the current curb tight sidewalk. However, Alternative 1 requires roadway widening on the southbound approach, resulting in longer crossing times and increased exposure for people walking and biking.

ODOT has adopted interchange and access management spacing standards in the Oregon Highway Plan (OHP)[5] that specify the minimum separation required between adjacent interchange ramp tapers and access points along crossroads. The ODOT-adopted access spacing standards require a spacing distance of greater than 5,280 feet (1 mile) along US 97 between adjacent ramp tapers. The current spacing between the Reed Market Road and Colorado Avenue southbound ramp tapers is approximately 3,100 feet, failing to meet the standard. Alternative 1 has no effect on access spacing along US 97, while Alternative 2 is expected to shorten the access spacing slightly by extending the deceleration lane by 200 to 500 feet.

Table 16 shows the scoring results under Goal 2 for the alternatives.

**TABLE 16: GOAL 2 SCORING AT REED MARKET ROAD/US 97 SOUTHBOUND RAMP TERMINAL**

| OBJECTIVE | PERFORMANCE | |
|---|---|---|
| | ALT 1 | ALT 2 |
| A. CRASH REDUCTION | ^ | ^ |
| B. SAFETY FOR PEOPLE WALKING AND BIKING | ^ | ^^ |
| C. ODOT'S ACCESS SPACING | I | v |

## GOAL 3: SUPPORT ECONOMIC DEVELOPMENT

Neither of these alternatives is expected to impact effective access to properties along Reed Market Road, although some additional right-of-way will be needed with Alternative 1. Both alternatives have minimal impacts on facilities accommodating heavy vehicle movements along US 97 and to and from destinations along Reed Market Road. Moving the right-turn lane farther from the curb may provide some minor benefits to freight vehicles making a westbound right turn, although more information is needed about vertical design elements. Note that any changes in cross section at the US 97 interchange would need to be coordinated with the MAC. Scoring results for both alternatives under this goal are presented in Table 17.

[5] 1999 Oregon Highway Plan, as amended May 2015, Oregon Department of Transportation, Appendix C.

**TABLE 17: GOAL 3 SCORING AT REED MARKET ROAD/US 97 SOUTHBOUND RAMP TERMINAL**

| OBJECTIVE | PERFORMANCE | |
|---|---|---|
| | ALT 1 | ALT 2 |
| A. ACCESS EFFECTIVENESS | I | I |
| B. TRUCK FREIGHT ACCOMMODATION | I | I |

## GOAL 4: PROTECT LIVABILITY AND ENSURE EQUITY AND ACCESS

Table 18 presents the scoring results for alternatives under the goal to protect livability and ensure equity and access.

As discussed under Goal 1 and Goal 2, both alternatives have similar improvements planned to enhance safety for people walking and biking. However, Alternative 1 results in a longer crossing distance that increases exposure of people walking and biking through the intersection, although that exposure is minimized with the traffic signal. Therefore, Alternatives 1 and 2 score similarly on addressing existing barriers for people walking and biking along Reed Market Road. As noted under Goal 1 Objective D, Alternative 1 is expected to improve traffic operations at the intersection, reducing delay for future eastbound and westbound transit along Reed Market Road and potentially better accommodating planned transit service improvements.

Both alternatives are not expected to disproportionately impact properties owned, used, or accessed by historically underrepresented community members relative to other populations.

**TABLE 18: GOAL 4 SCORING AT REED MARKET ROAD/US 97 SOUTHBOUND RAMP TERMINAL**

| OBJECTIVE | PERFORMANCE | |
|---|---|---|
| | ALT 1 | ALT 2 |
| A. COMPLETE STREET | ^ | ^ |
| B. EQUITY | I | I |

## GOAL 5: STEWARD THE ENVIRONMENT

As shown in Table 19, both alternatives score fair on reducing vehicle emissions. Alternative 1 reduces overall vehicle delay better than Alternative 2, including transit delay. However, Alternative 2 better supports access for people walking and biking than Alternative 1. Therefore, both alternatives are expected to have similar impacts on vehicle emissions.

**TABLE 19: GOAL 5 SCORING AT REED MARKET ROAD/US 97 SOUTHBOUND RAMP TERMINAL**

| OBJECTIVE | PERFORMANCE | |
|---|---|---|
| | ALT 1 | ALT 2 |
| A. REDUCE EMISSIONS | I | I |

## GOAL 6: DEVELOP SOLUTIONS THAT ARE COST-EFFECTIVE AND IMPLEMENTABLE

Table 20 lists the planning-level cost estimate of each alternative, with detailed cost estimates included in Appendix C. Alternative 2 is generally more cost-effective than Alternative 1, at approximately half the price, although both alternatives are likely to fit within the expected funding available for the interchange.

**TABLE 20: COST ESTIMATE FOR ALTERNATIVES AT REED MARKET ROAD/US 97 SOUTHBOUND RAMP TERMINAL**

| | ALT 1 | ALT 2 | EXPECTED FUNDING[A] |
|---|---|---|---|
| PLANNING LEVEL COST ESTIMATE | $5.7 million | $2.3 million | $10.25 million (total for interchange) |

[A] Future funding estimate provided by ODOT, consistent with the project cost listed in the Bend Transportation System Plan.

Both alternatives are expected to be compatible with other project recommendations from the US 97 Parkway Plan, Bend TSP, and GO Bond. Both alternative designs would need to be constructed in a single phase and are expected to require limited design exceptions. Both are also expected to be able to be reasonably maintained after construction. During construction, Alternative 2 would likely have a larger impact on US 97 mainline traffic but less of an impact on traffic travelling along Reed Market Road. Table 21 lists the scoring of each of the alternatives.

**TABLE 21: GOAL 6 SCORING AT REED MARKET ROAD/US 97 SOUTHBOUND RAMP TERMINAL**

| OBJECTIVE | PERFORMANCE | |
|---|---|---|
| | ALT 1 | ALT 2 |
| A. LOW-COST, HIGH BENEFIT | ^ | ^^ |
| B. LEVERAGE PARTNERSHIPS | ^ | ^ |
| C. CONSTRUCTABLE IN PHASES, MAINTENANCE, DESIGN EXCEPTIONS, TRAFFIC MAINTENANCE DURING CONSTRUCTION | ^ | ^ |

## SUMMARY OF EVALUATION

Table 22 summarizes the scoring for the two alternatives across the project goals. Key differentiators in scoring between alternatives include:

- Goal 1: Increase System Functionality, Quality, and Connectivity for All Users
  - Alternative 1 significantly reduces the overall intersection v/c ratio by adding a southbound right-turn lane. This results in less queueing on the southbound approach and reduces delay for the eastbound and westbound movements, which may better support a planned transit route travelling along Reed Market Road.
  - Both alternatives equally enhance biking facilities across US 97 by addressing the conflict between people biking and westbound right-turning vehicles. A drawback of Alternative 1 is the longer southbound crossing distance, increasing exposure for people walking and biking.
- Goal 2: Ensure Safety for All Users
  - Both alternatives are expected to have similar reductions in crash frequency and severity, based on crash reduction factors. Both alternatives address the conflict between people biking and westbound right-turning vehicles.
  - In Alternative 1, adding a southbound right-turn lane lengthens the crossing distance, increasing exposure for people walking and biking.
  - Alternative 2 lengthens the deceleration lane length, resulting in less distance between the Reed Market Road and Colorado Avenue southbound interchange ramp tapers, worsening the already deficient access spacing.
- Goal 3: Support Economic Development
  - Neither alternative is expected to impact effective access to properties along Reed Market Road.
  - Both alternatives have minimal impacts on facilities accommodating heavy vehicle movements along US 97 and to and from destinations along Reed Market Road.
- Goal 4: Protect Livability and Ensure Equity and Access
  - Alternative 2 scores better on addressing existing barriers for people walking and biking along Reed Market Road as Alternative 1 results in a longer crossing distance that increases exposure of people walking and biking through the intersection.
  - Alternative 1 is expected to reduce delays for future eastbound and westbound transit along Reed Market Road and potentially better accommodate planned transit service improvements.
  - Both alternatives are not expected to disproportionately impact properties owned, used, or accessed by historically underrepresented community members relative to other populations.
- Goal 5: Steward the Environment
  - Alternative 1 is expected to slightly reduce vehicle delays and emissions but does not perform as well with respect to people walking and biking.
  - Alternative 2 improves conditions for people walking and biking but slightly increases vehicle delay and emissions.
- Goal 6: Develop Solutions that are Cost-Effective and Implementable
  - Alternative 2 is more cost-effective than Alternative 1 but could have slightly larger impacts on traffic during construction.

**TABLE 22: REED MARKET ROAD/US 97 SB RAMP TERMINAL ALTERNATIVE PERFORMANCE**

| | GOAL | ALTERNATIVE 1 | ALTERNATIVE 2 |
|---|---|---|---|
| GOAL 1 | Increase System Functionality, Quality, and Connectivity for All Users | ^ | I |
| GOAL 2 | Ensure Safety for All Users | ^ | ^ |
| GOAL 3 | Support Economic Development | I | I |
| GOAL 4 | Protect Livability and Ensure Equity and Access | ^ | ^ |
| GOAL 5 | Steward the Environment | I | I |
| GOAL 6 | Develop Solutions That Are Cost-Effective and Implementable | ^ | ^^ |

## REED MARKET ROAD/US 97 NORTHBOUND RAMP TERMINAL/DIVISION STREET

The Reed Market Road/US 97 northbound ramp terminal intersection is currently controlled by a two-way stop. The northbound left-turn movement has limited sight distance and high volumes along Reed Market Road, particularly in the future, resulting in significant delays for northbound left-turning vehicles. Reed Market Road and Division Street, located 150 feet east of the US 97 northbound ramp terminal, are also controlled by a two-way stop and serve as the US 97 northbound entrance ramp but allow for two-way traffic to serve local properties, inconsistent with ODOT's access management and spacing standards and resulting in a shorter than standard acceleration lane[6] onto US 97. Two alternatives to address these concerns at the intersection were evaluated, including:

- Alternative 1:
  - Constructing a traffic signal at the US 97 northbound ramp terminal.
  - Converting the north leg of Division Street to right-in, right-out only (the northbound Division Street entrance ramp would still not meet ODOT's standard for acceleration lane length).
- Alternative 2:
  - Constructing a traffic signal at the US 97 northbound ramp terminal.

[6] Division Street to northbound US 97 ramp has existing acceleration lane length of 425 feet, not meeting the ODOT Highway Design Manual minimum acceleration lane length of 540 feet.

- Separating the northbound entrance ramp from Division Street and aligning the new entrance ramp with the Reed Market Road/US 97 northbound ramp signalized intersection (the new entrance ramp would meet ODOT's standard for acceleration lane length).
- Leaving Division Street north of Reed Market Road in place to provide business access, but converting the approach to Reed Market Road to right-in and right-out movements only.
- Converting the south leg of Division Street to right-in and right-out only.

The signal at the northbound ramp terminal is assumed to be coordinated with other signalized intersections within the study area (i.e., the US 97 southbound ramp and 3rd Street intersections). Note that with the realignment of the new US 97 entrance ramp in Alternative 2, there may be an opportunity to further lengthen the loop ramp (Reed Market Road eastbound right turn onto US 97 northbound) acceleration lane, but that option is not included in the current cost estimate. An alternative that included construction of a roundabout at this intersection was also considered during the preliminary screening phase. However, it was dismissed due to several issues such as the alignment of the existing US 97 overcrossing, topography, and impacts to adjacent development, which would have likely made the cost of construction far greater than available funding for improvements at the interchange. Figures 10 and 11 show concepts of both alternatives, with zoomable images included in Appendix A.

One potential solution in the future to improve safety for people walking and biking is to implement a raised or protected island on both the southeast and southwest corners at the intersection of Division Street and possibly at the US 97 off ramp to the eastbound sidewalk on the east leg. However, the option at the US 97 off ramp may be less feasible due to the grades. In addition, since Brosterhous Road is a designated low-stress network, an option to improve safety is widening the short segment of Division Street from Reed Market Road to Brosterhous Road with a shared use path for people walking and biking to access the signal crossing Reed Market Road at Division Street. This avoids the need to use the Reed Market Road and 3rd Street intersection if the protected intersection design is not selected there.

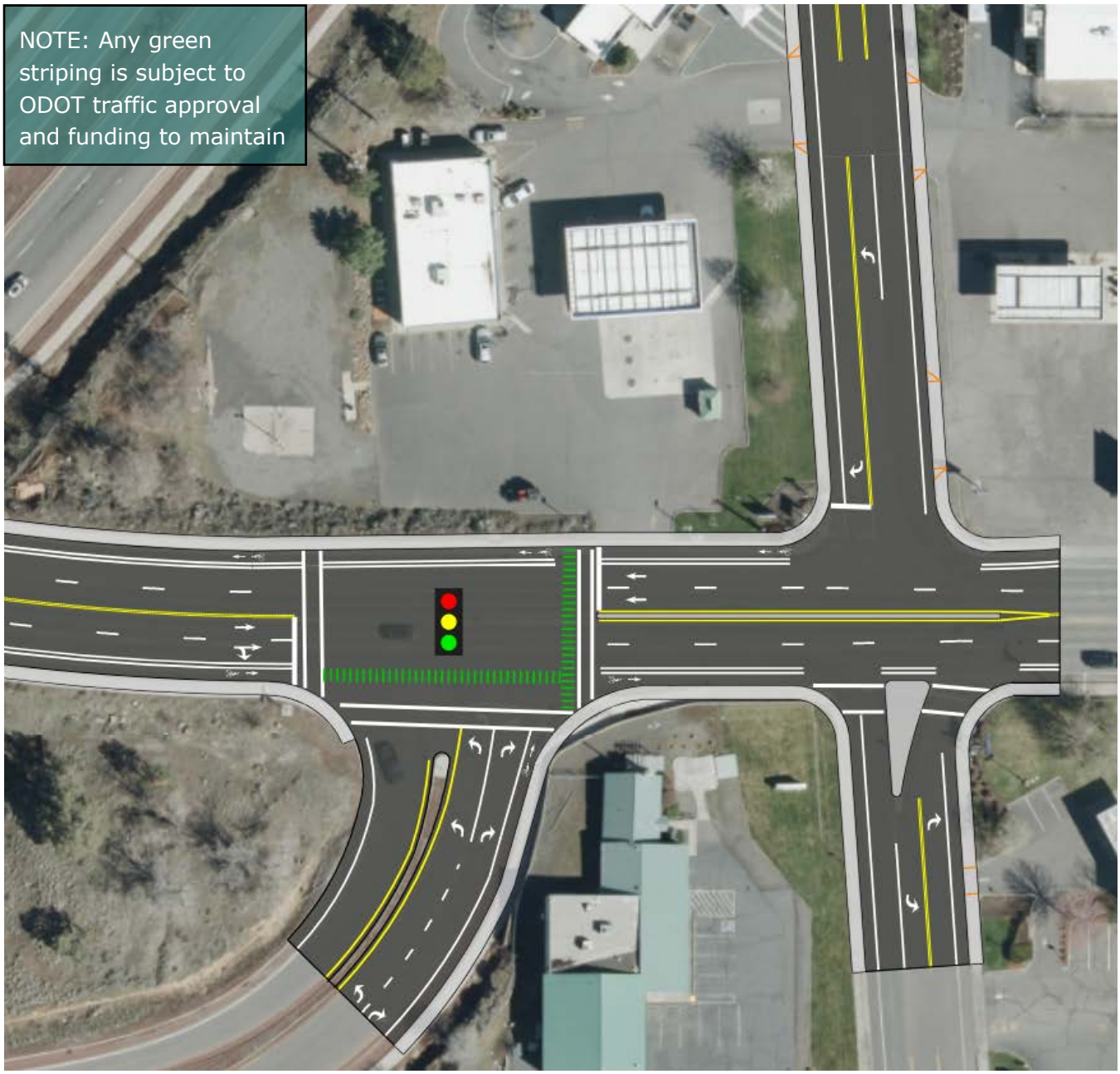


**FIGURE 10. ALTERNATIVE 1 AT REED MARKET ROAD/US 97 NORTHBOUND RAMP**

**FIGURE 11. ALTERNATIVE 2 AT REED MARKET ROAD/US 97 NORTHBOUND RAMP**

## GOAL 1: INCREASE SYSTEM FUNCTIONALITY, QUALITY, AND CONNECTIVITY FOR ALL USERS

### OBJECTIVES A AND B (TRAFFIC OPERATIONS)

Table 23 summarizes the results for the two alternatives under future conditions, with the intersection's performance compared to the applicable mobility standard.[7]

With the addition of a traffic signal, both alternatives are expected to operate significantly better at the US 97 northbound ramp terminal. Both operate with similar levels of delay and the same intersection v/c ratio, meeting the mobility standard. It should be noted that the increased vehicular delay for Alternative 2 at the US 97 northbound ramp terminal is due to delay associated with the westbound right-turn traffic volumes onto US 97 northbound, which occurs at Division Street in Alternative 1. In addition, both alternatives also restricted left turns at Division Street, which was converted to right-in, right-out only. Given the high east-west traffic volumes, restricting left turns helps reduce conflict points and prevents left-turn vehicles from blocking the approaches when waiting for potential gaps.

**TABLE 23: FUTURE 2040 DESIGN HOUR TRAFFIC OPERATIONS AT REED MARKET ROAD/US 97 NORTHBOUND RAMP TERMINAL/DIVISION STREET**

| INTERSECTION | JURIS-DICTION | ALTER-NATIVE[A] | CONTROL | MOBILITY STANDARD[E] | V/C[B] | LOS[C] | DELAY (SEC)[D] |
|---|---|---|---|---|---|---|---|
| **REED MARKET RD & US 97 NB** | ODOT (30HV) | No-Build | TWSC | ≤ 0.85 (ramp)<br>≤ 0.85 (Reed Market Rd) | NA/**2.56** | NA/F | NA/>150 |
| | | Alt 1 | Signalized | ≤ 0.75 | 0.63 | A | 6 |
| | | Alt 2 | Signalized | ≤ 0.75 | 0.63 | A | 9 |
| **REED MARKET RD & DIVISION ST** | ODOT (30HV) | No-Build | TWSC | ≤ 1.00 | 0.46/0.14 | B/C | 14/17 |
| | | Alt 1 | TWSC | ≤ 1.00 | 0.43/0.14 | A/C | 0/17 |
| | | Alt 2 | TWSC | ≤ 1.00 | 0.43/0.14 | A/C | 0/17 |

**Bold and red** indicate a failure to meet the mobility target.

30HV=30th highest hour; LOS=level of service; ODOT=Oregon Department of Transportation; TWSC=two-way stop-controlled; v/c=volume-to-capacity

[A] Future condition results represent 30HV operations for ODOT intersections and average weekday operations for City intersections, consistent with mobility targets.

[7] Intersection operations are reported using Highway Capacity Manual 6th Edition methodology and the software reports are included in Appendix B.

[B] v/c ratio reported as the overall intersection v/c ratio at signalized intersections and v/c ratio for major street/minor street at TWSC intersections.

[C] LOS reported as the worst major street LOS/minor street LOS for TWSC intersections and overall intersection LOS for signalized intersections.

[D] Control delay reported for worst case major street/minor street for TWSC intersections and overall intersection delay for signalized intersections.

[E] ODOT Highway Design Manual v/c standards apply to new construction.

### OBJECTIVE C (ACTIVE TRANSPORTATION)

In both alternatives, installing a traffic signal provides a new enhanced crossing for people walking and biking across Reed Market Road. In addition, both alternatives implement right-in, right-out only movements at Division Street, which helps to reduce conflict points between intersection users. Both alternatives are expected to improve Reed Market Road and US 97 active transportation crossings.

### OBJECTIVE D (TRANSIT)

Both alternatives add a new traffic signal at the US 97 northbound ramp terminal. This slightly increases delay for eastbound and westbound vehicles, including future transit along Reed Market Road, but overall intersection delay is still less than ten seconds, indicating limited impact to transit vehicles. Therefore, both alternatives score fair on the criterion of enhancing transit facilities across US 97.

### GOAL 1 SCORING SUMMARY

Table 24 presents the scoring results for the alternatives for each objective under Goal 1.

**TABLE 24: GOAL 1 SCORING AT REED MARKET ROAD/US 97 NORTHBOUND RAMP TERMINAL/DIVISION STREET**

| OBJECTIVE | PERFORMANCE | |
|---|---|---|
| | ALT 1 | ALT 2 |
| A. TRAFFIC OPERATIONS (ODOT) | ⏫ | ⏫ |
| B. TRAFFIC OPERATIONS (CITY) | ⏶ | ⏶ |
| C. ACTIVE TRANSPORTATION | ⏶ | ⏶ |
| D. TRANSIT | ⏸ | ⏸ |

## GOAL 2: ENSURE SAFETY FOR ALL USERS

Both alternatives include the installation of a traffic signal, which reduce angle crashes by 67 percent[8] but can also increase rear-end crashes by 143 percent,[9] according to ODOT's crash reduction factors. Despite these conflicting effects, the overall impact is expected to be positive since angle crashes tend to result in higher severity injuries, and about half of the crashes at this location have involved turning movements.

Converting Division Street to right-in, right-out operations restricts left-turn movements and reduces conflict points, with the potential to reduce overall crashes by 45 percent.[10] Both alternatives include the Division Street right-in, right-out turn restrictions, indicating similar effects on reducing the crash frequency and severity based on the crash reduction factor.

With a traffic signal in both alternatives, the northbound left-turn movement will no longer need to wait and find a gap with heavy east-west traffic volumes and limited sight distance. In Alternative 2, the added north leg to access US 97 will enhance safety by consolidating conflicts between people biking westbound and vehicles making a westbound right turn onto US 97 at a traffic signal, where a leading pedestrian interval or leading bicycle interval (LPI/LBI) could be considered. Alternative 2 also mitigates access management conflicts on the entrance-ramp by separating US 97 access from Division Street. This also allows for a lengthening of the acceleration lane to meet ODOT standards.

Table 25 shows the scoring results for both alternatives under the safety evaluation.

**TABLE 25: GOAL 2 SCORING AT REED MARKET ROAD/US 97 NORTHBOUND RAMP TERMINAL/DIVISION STREET**

| OBJECTIVE | PERFORMANCE | |
|---|---|---|
| | ALT 1 | ALT 2 |
| A. CRASH REDUCTION | ^ | ^ |
| B. SAFETY FOR PEOPLE WALKING AND BIKING | ^ | ^^ |
| C. ODOT'S ACCESS SPACING | I | ^^ |

[8] ODOT Crash Reduction Factor List, 2023, ID: H22.

[9] ODOT Crash Reduction Factor List, 2023, ID: H23.

[10] Crash Modification Factors (CMF) Clearinghouse, US DOT Federal Highway Administration, CMF ID 9821. Note: This CMF is based on a study of three-leg intersections.

## GOAL 3: SUPPORT ECONOMIC DEVELOPMENT

Table 26 shows the scoring results under the goal of supporting economic development for both alternatives. Both alternatives include the restriction of the Division Street approaches to only right-in and right-out turning movements. While this will improve safety by eliminating closely spaced turning conflicts, it will also reduce the accessibility to some properties from certain directions. Furthermore, Alternative 2 would result in the acquisition of up to two properties. While the removal of businesses is not directly addressed by the evaluation criteria, it is assumed to score negatively in meeting the goal of supporting economic development.

In addition, both alternatives would have no negative impacts on facilities accommodating heavy vehicle movements along US 97 and to and from destinations along Reed Market Road. However, the separation of the US 97 entrance ramp from Division Street that is part of Alternative 2 could make it easier for heavy vehicles to get up to merging speed before entering the Parkway.

**TABLE 26: GOAL 3 SCORING AT REED MARKET ROAD/US 97 NORTHBOUND RAMP TERMINAL/DIVISION STREET**

| OBJECTIVE | PERFORMANCE | |
|---|---|---|
| | ALT 1 | ALT 2 |
| A. ACCESS EFFECTIVENESS | | |
| B. TRUCK FREIGHT ACCOMMODATION | | |

## GOAL 4: PROTECT LIVABILITY AND ENSURE EQUITY AND ACCESS

Alternative 2 scores higher on the evaluation of providing a complete streets approach along the Reed Market Road corridor. As discussed under Goal 1, both alternatives address existing barriers for people walking and biking by enhancing walking and biking facilities, providing an enhanced crossing at US 97 northbound ramp terminal, and reducing left-turn conflicts at Division Street. Alternative 2 further mitigates access management conflicts and supports people walking and biking crossing US 97 by adding a north leg at the US 97 ramp terminal and removing access to US 97 on the north leg of Division Street. Again, both alternatives have minimal impacts on accommodating planned transit service improvements and expansions. Although a traffic signal improves the traffic operation, it also increases intersection delay and affects transit continuous flow.

Neither alternative is expected to disproportionately impact properties owned, used, or accessed by historically underrepresented community members relative to other populations.

Table 27 shows the scoring results under Goal 4.

**TABLE 27: GOAL 4 SCORING AT REED MARKET ROAD/US 97 NORTHBOUND RAMP TERMINAL/DIVISION STREET**

| OBJECTIVE | PERFORMANCE | |
|---|---|---|
| | ALT 1 | ALT 2 |
| A. COMPLETE STREET | | |
| B. EQUITY | | |

## GOAL 5: STEWARD THE ENVIRONMENT

As shown in Table 28, both alternatives are expected to perform similarly with respect to stewarding the environment. Both significantly reduced delay at the US 97 northbound ramp terminal (with a similar impact on vehicle emissions) and both have similar benefits to people walking, biking, and taking transit.

**TABLE 28: GOAL 5 SCORING AT REED MARKET ROAD/US 97 NORTHBOUND RAMP TERMINAL/DIVISION STREET**

| OBJECTIVE | PERFORMANCE | |
|---|---|---|
| | ALT 1 | ALT 2 |
| A. REDUCE EMISSIONS | | |

## GOAL 6: DEVELOP SOLUTIONS THAT ARE COST-EFFECTIVE AND IMPLEMENTABLE

Table 29 lists the planning-level cost estimate for each alternative, with detailed cost estimates included in Appendix C. While the alternatives offer comparable benefits, Alternative 2 provides better safety for all users. However, Alternative 1 is more cost-effective given it costs less than half of Alternative 2 costs. In addition, at approximately $4 million, Alternative 1 better fits within funding expectations.

**TABLE 29: COST ESTIMATES FOR ALTERNATIVES AT REED MARKET ROAD/US 97 NORTHBOUND RAMP TERMINAL/DIVISION STREET**

| | ALT 1 | ALT 2 | EXPECTED FUNDING |
|---|---|---|---|
| PLANNING LEVEL COST ESTIMATE | $4.0 million | $9.4 million | $10.25 million (total for interchange) |

Both alternatives are expected to be compatible with other project recommendations from the US 97 Parkway Plan, Bend TSP, and GO Bond, although Alternative 2 better enhances access onto US 97 by increasing the acceleration lane length. Note that Alternative 1 could function as a first phase of Alternative 2. Both alternatives are expected to require limited design exceptions and are not expected to create maintenance challenges. Table 30 lists the scoring of each of the alternatives.

**TABLE 30: GOAL 6 SCORING AT REED MARKET ROAD/US 97 NORTHBOUND RAMP TERMINAL/DIVISION STREET**

| OBJECTIVE | PERFORMANCE | |
|---|---|---|
| | ALT 1 | ALT 2 |
| A. LOW-COST, HIGH BENEFIT | ⏫ | ⏬ |
| B. LEVERAGE PARTNERSHIPS | ⏫ | 🔼 |
| C. CONSTRUCTABLE IN PHASES, MAINTENANCE, DESIGN EXCEPTIONS, TRAFFIC MAINTENANCE DURING CONSTRUCTION | 🔼 | 🔼 |

## SUMMARY OF EVALUATION

Table 31 summarizes the scoring for each of the two alternatives across the project goals. Key differentiators in scoring between alternatives include:

- Goal 1: Increase System Functionality, Quality, and Connectivity for All Users
  - In both alternatives, traffic operations at the Reed Market Road and US 97 northbound ramp terminal are significantly improved by installing a traffic signal. Reed Market Road and Division Street no longer experience westbound and eastbound delay by restricting left-turn movements at the intersection.
  - In both alternatives, installing a traffic signal provides enhanced crossings of Reed Market Road for people walking and biking. Implementing the right-in, right-out treatment at Division Street also helps to reduce conflict points between intersection users.
  - Alternative 2 further supports US 97 crossings by adding a north leg to the intersection of Reed Market Road and US 97 northbound ramp terminal accessing US 97 and removing conflicts from the combined north Division Street and US 97 off ramp.
- Goal 2: Ensure Safety for All Users
  - Both alternatives include a new traffic signal at the US 97 northbound ramp terminal and restrict turning movements to right-in and right-out only at Division Street, similarly reducing crash frequency and severity.
  - Alternative 2 further enhances safety by mitigating access management conflicts on the US 97 northbound entrance ramp by removing US 97 access on north Division Street.

- Goal 3: Support Economic Development
  - Both alternatives include the restriction of the Division Street approaches to only right-in and right-out turning movements. While this would improve safety by eliminating closely spaced turning conflicts, it would also reduce the accessibility to some properties to and from certain directions. Furthermore, Alternative 2 would result in the acquisition of up to two properties.
  - Both alternatives would have no negative impacts on facilities accommodating heavy vehicle movements along US 97 and to and from destinations along Reed Market Road. However, the separation of the US 97 entrance ramp from Division Street that is part of Alternative 2 could make it easier for heavy vehicles to get up to merging speed before entering the Parkway.
- Goal 4: Protect Livability and Ensure Equity and Access
  - Both alternatives address existing barriers for people walking and biking by enhancing walking and biking facilities, providing an enhanced crossing at US 97 northbound ramp terminal, and reducing left-turn conflicts at Division Street.
  - Alternative 2 further mitigates access management conflicts and supports people walking and biking on US 97 by removing US 97 access on north Division Street.
  - Both alternatives have minimal impacts on accommodating planned transit service improvements and expansions.
  - Neither alternative is expected to disproportionately impact properties owned, used, or accessed by historically underrepresented community members relative to other populations.
- Goal 5: Steward the Environment
  - Both alternatives significantly improve traffic operations with less vehicular delays and have similar impacts on enhancing walking and biking facilities.
- Goal 6: Develop Solutions that are Cost-Effective and Implementable
  - Alternative 1 is more cost-effective than Alternative 2 and fits within funding expectations.
  - Alternative 1 could be designed as a first phase of Alternative 2 to improve the acceleration lane length of the US 97 northbound entrance ramp.

**TABLE 31: REED MARKET ROAD/US 97 NORTHBOUND RAMP TERMINAL/DIVISION STREET ALTERNATIVE PERFORMANCE**

| | GOAL | ALTERNATIVE 1 | ALTERNATIVE 2 |
|---|---|---|---|
| GOAL 1 | Increase System Functionality, Quality, and Connectivity for All Users | ^ | ^ |
| GOAL 2 | Ensure Safety for All Users | ^ | ^^ |
| GOAL 3 | Support Economic Development | v | v |
| GOAL 4 | Protect Livability and Ensure Equity and Access | I | ^ |
| GOAL 5 | Steward the Environment | ^ | ^ |
| GOAL 6 | Develop Solutions That Are Cost-Effective and Implementable | ^^ | I |

## REED MARKET ROAD/3RD STREET

The Reed Market Road and 3rd Street intersection is the confluence of two major arterial roadways in Bend and serves high traffic volumes on all approaches. This intersection is very congested today (v/c ratio of 1.05) and is forecast to be even more so in the future (v/c ratio of 1.26 by 2040). A major contributor to this congestion is the lack of separate eastbound and westbound left-turn lanes, which limits signal operations to split phasing. The existing bicycle and walking facilities are high-stress. Three alternatives to address these concerns at the intersection were evaluated, including:

- Alternative 1:
  - (a) Adding eastbound and westbound left-turn lanes
  - (b) Adding eastbound and westbound left-turn lanes and a dedicated southbound right turn lane.
- Alternative 2:
  - (a) Adding the same lanes as Alternative 1(a) and implementing a protected intersection design
  - (b) Adding the same lanes as Alternative 1(b) and implementing a protected intersection design
- Alternative 3:
  - Constructing a dual lane roundabout with northbound and southbound right-turn slip lanes.

Figures 12 to 14 show concepts of all three alternatives,[11] with zoomable images included in Appendix A. Note that all alternatives show the intersection shifted to the northwest to minimize right-of-way costs and impacts. A potential option for accommodating people biking in both Alternatives 1 and 2 is widening sidewalks to allow them to exit and use the crosswalks. In Alternative 3, people biking have the option to exit and use the sidewalk or stay in the lane travelling through the roundabout.

[11] Note: For Alternative 1 and 2, only alternatives with a southbound right-turn lane are shown in the concept drawings.

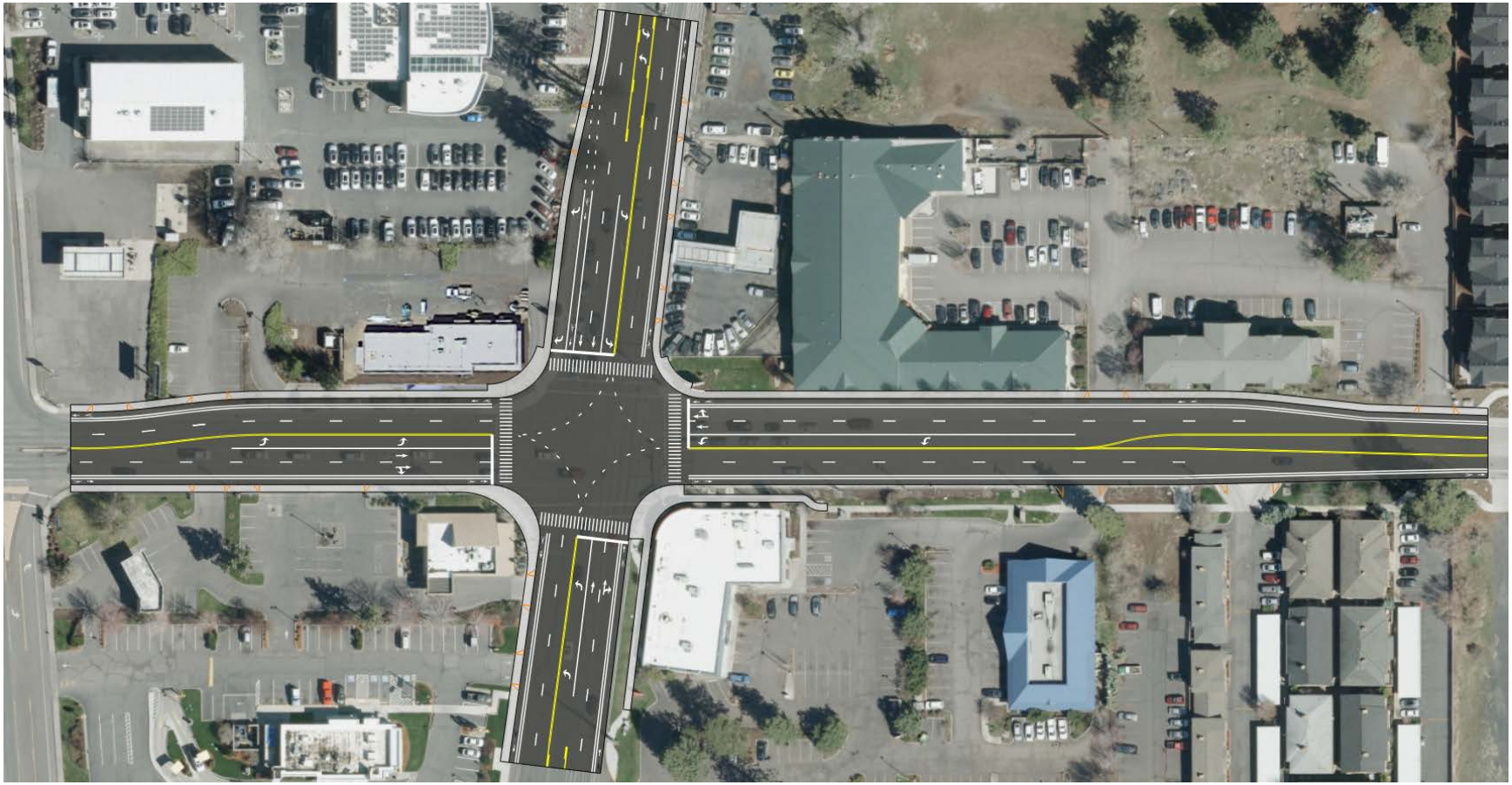

**FIGURE 12. ALTERNATIVE 1(B) AT REED MARKET ROAD/3RD STREET**

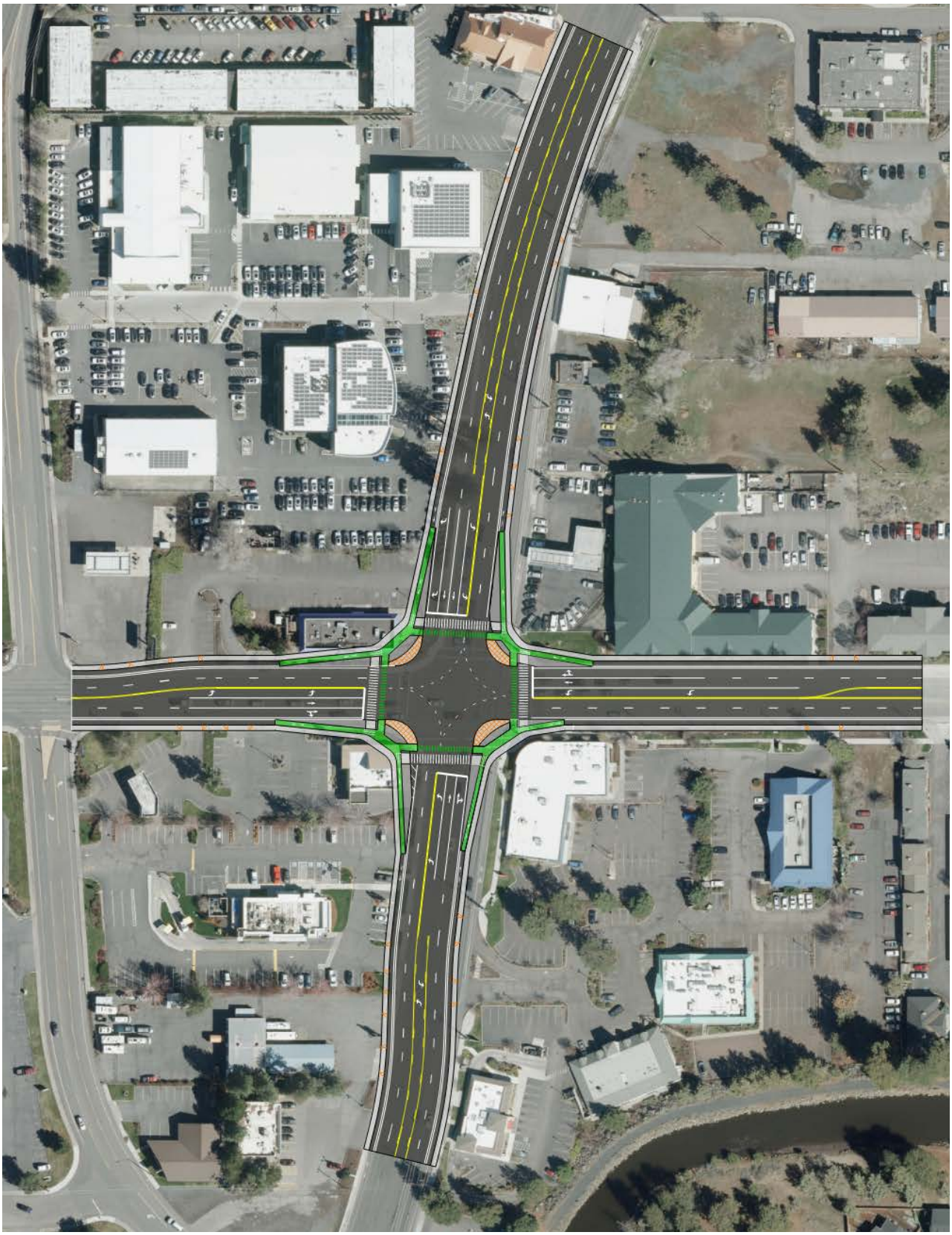

**FIGURE 13. ALTERNATIVE 2(B) AT REED MARKET ROAD/3RD STREET**

**FIGURE 14. ALTERNATIVE 3 AT REED MARKET ROAD/3RD STREET**

## GOAL 1: INCREASE SYSTEM FUNCTIONALITY, QUALITY, AND CONNECTIVITY FOR ALL USERS

### OBJECTIVES A AND B (TRAFFIC OPERATIONS)

Table 32 summarizes the results for the three alternatives under future conditions, with the intersection's performance compared to the mobility standard.[12]

In Alternative 1(a), the overall intersection performance is significantly improved by adding eastbound and westbound left-turn lanes. Adding a southbound right-turn lane (b) results in even better improvements with lower v/c ratio and delay. The mobility standard would easily be met under both conditions.

In Alternative 2, signal timing strategies of leading pedestrian intervals (LPIs)/leading bicycle intervals (LBIs) and RTOR restrictions are assumed in the protected intersection design. LPIs or LBIs give people walking and biking the opportunity to enter the crosswalk approximately five seconds before vehicles are given a green signal indication, while restricting RTOR removes conflicts between motorists and people walking and biking. As a variation of Alternative 1, Alternative 2 also significantly improves the traffic operation in a similar pattern to Alternative 1 with and without a dedicated southbound right-turn lane. However, Alternative 2 results in more intersection delays due to the additional protected phases for people walking and biking. The mobility standard would be met, but with less reserve capacity than under Alternative 1.

In Alternative 3, adding a dual lane roundabout with northbound and southbound right-turn slip lanes increases motor vehicle capacity and improves traffic flow through the intersection but fails to meet the mobility standard. All approaches except the eastbound approach (which operates with a v/c ratio of 0.83) are expected to operate with a v/c ratio greater than 1.00 during the peak hour.

Alternative 1 and 2 significantly improve operations compared to the No-Build condition, can meet the mobility standard, and experience similar delays. Therefore, both alternatives score well on this objective. Although Alternative 3 improves operations, it scores only fair because it fails to meet the mobility standard and would still have insufficient capacity to serve demand. Also, a roundabout is less compatible with interactions with adjacent signalized intersections compared to Alternative 1 and 2.

[12] Intersection operations are reported using Highway Capacity Manual 6th and 2000 Edition methodology and the software reports are included in Appendix B.

**TABLE 32: FUTURE 2040 DESIGN HOUR TRAFFIC OPERATIONS AT REED MARKET ROAD/3RD STREET**

| INTERSECTION | JURIS-DICTION | ALTERNATIVE[A] | CONTROL | MOBILITY STANDARD | V/C[B] | LOS[C] | DELAY (SEC)[D] |
|---|---|---|---|---|---|---|---|
| REED MARKET RD & 3RD ST | City (AWD) | No-Build | Signalized | ≤ 1.00 | **1.26** | F | >150 |
| | | Alt 1(a) | Signalized | ≤ 1.00 | 0.90 | E | 61 |
| | | Alt 1(b) | Signalized | ≤ 1.00 | 0.88 | E | 56 |
| | | Alt 2(a)[E] | Signalized | ≤ 1.00 | 0.96 | F | 81 |
| | | Alt 2(b)[E] | Signalized | ≤ 1.00 | 0.95 | E | 68 |
| | | Alt 3 | Roundabout | ≤ 1.00 | **1.03 (NB)** | F | 103 |

**Bold and red** indicate a failure to meet the mobility target.

AWD=average weekday; LOS=level of service; v/c=volume-to-capacity

[A] Future condition results represent 30HV operations for ODOT intersections and average weekday operations for City intersections, consistent with mobility targets.

[B] v/c ratio reported as the overall intersection v/c ratio at signalized intersections and worse case approach v/c at roundabouts.

[C] LOS is reported as the worst-case approach LOS for roundabouts and overall intersection LOS for signalized intersections.

[D] Control delay reported for the worst case approach delay for roundabouts and overall intersection delay for signalized intersections.

[E] Analyzed using Highway Capacity Manual (HCM) 2000 methodology, as leading-pedestrian-interval phasing is not supported in Synchro HCM 6th Edition

### OBJECTIVE C (ACTIVE TRANSPORTATION)

3rd Street is identified as a key walking and biking route and is designated as part of the City's low-stress bicycle network, which is intended to serve all ages and abilities of people biking. However, 3rd Street at Reed Market Road is currently a high-stress crossing. Alternative 1 is not compatible with the key walking and biking route framework as adding turn lanes requires road widening, resulting in longer crossing times and increased exposure for people walking and biking. Especially in Alternative 1(b), with an additional southbound right-turn lane, people biking on the southbound bike lane would need to cross the added right-turn lane upstream of the intersection.

Alternative 2 is compatible with the key walking and biking route designation, as protected intersections physically separate people walking and biking away from vehicles, reduce vehicle turning speeds, increase visibility, and improve the level of traffic stress for people walking and biking.

In Alternative 3, adding a dual-lane roundabout is expected to reduce vehicle speeds and provide two-stage crossings for people walking and biking due to the raised splitter island. Dual-lane roundabouts require vehicles in both lanes to yield to people crossing, and even with the

installation of a rectangular rapid-flashing beacon, may not be comfortable for all users to cross. Therefore, Alternative 2 scores the highest under the evaluation of active transportation.

### OBJECTIVE D (TRANSIT)

Transit Route 6 (Reed Market Road) and Route 1-4 (3rd Street) will be travelling through the intersection of Reed Market Road and 3rd Street. Route 1-4 currently has transit stops close to the intersection (within 250 feet) along 3rd Street. Alternatives 1 and 2 are expected to significantly improve the intersection traffic operations, with less delay for transit vehicles than the No-Build condition. However, Alternative 2 provides a better opportunity for people walking and biking to access nearby transit stops. Alternative 3 is anticipated to improve the operations with less delay for transit but not as significantly as the other two alternatives.

### GOAL 1 SCORING SUMMARY

Table 33 shows the scores of all alternatives for Goal 1.

**TABLE 33: GOAL 1 SCORING AT REED MARKET ROAD/3RD STREET**

| OBJECTIVE | PERFORMANCE | | |
|---|---|---|---|
| | ALT 1 | ALT 2 | ALT 3 |
| A. TRAFFIC OPERATIONS (ODOT) | N/A | N/A | N/A |
| B. TRAFFIC OPERATIONS (CITY) | ^ | ^ | I |
| C. ACTIVE TRANSPORTATION | v | ^^ | I |
| D. TRANSIT | ^ | ^^ | I |

## GOAL 2: ENSURE SAFETY FOR ALL USERS

In Alternatives 1 and 2, adding left-turn lanes at the intersection will likely have minimal safety impacts on reducing left-turn crashes since the intersection currently operates with split phasing, which already separates left-turn conflicts between through vehicles and pedestrians. As mentioned previously under the Goal 2 discussion for the Reed Market Road at US 97 Southbound Ramp Terminal area, adding a right-turn lane (Alternatives 1b and 2b) may reduce all crash types by up to four percent. However, adding turn lanes results in longer crossing times and increased exposure for people walking and biking.

In Alternative 2, the protected intersection design keeps people walking and biking physically separated from motor vehicles, provides better visibility of people crossing, and reduces vehicle turning speeds by utilizing raised islands at the intersection corners. It reduces the distance and time that people walking and biking are exposed to conflicts, which results in motorists yielding to people walking and biking over 98 percent of the time and can be more effective than a turn lane

with a dedicated bike signal at reducing vehicle-bicycle conflicts at the intersection.[13] In addition, LPIs/LBIs and RTOR restrictions mitigate conflicts with right-turning vehicles, where LPIs/LBIs have the potential to reduce walking and biking related crashes by up to 37 percent,[14] and RTOR could reduce walking and biking related crashes by up to 41 percent.[15]

In Alternative 3, converting a signalized intersection to a roundabout is expected to reduce conflict points at the intersection by up to 75 percent and enhances safety by reducing vehicle speeds entering and through the intersection.[16] Converting a signalized intersection into a double-lane roundabout has the potential to reduce all crashes by up to 19 percent.[17]

As noted above, Alternative 2 generally enhances the safety of people walking and biking better than Alternative 1 or 3 do. None of the alternatives address access spacing along Reed Market Road. Table 34 documents the scoring results under the goal of ensuring safety.

**TABLE 34: GOAL 2 SCORING AT REED MARKET ROAD/3RD STREET**

| OBJECTIVE | PERFORMANCE | | |
|---|---|---|---|
| | ALT 1 | ALT 2 | ALT 3 |
| A. CRASH REDUCTION | | | |
| B. SAFETY FOR PEOPLE WALKING AND BIKING | | | |
| C. ODOT'S ACCESS SPACING | N/A | N/A | N/A |

## GOAL 3: SUPPORT ECONOMIC DEVELOPMENT

Table 35 shows the scoring under this goal. While the removal of businesses is not directly addressed by the evaluation criteria, it is assumed to score negatively against the goal of supporting economic development. Alternative 1 is expected to have more limited impact on the right-of-way, likely avoiding impacts to existing structures. Alternative 2 would result in impacts to two buildings on the northwest and southwest corners. Alternatives 1 and 2 have minimal impacts on maintaining effective access to properties along Reed Market Road in a manner that supports the economic development objectives of existing and future businesses. However, in Alternative 3, the dual lane roundabout does require a larger right-of-way, potentially impacting more properties and modifying more access points along 3rd Street and Reed Market Road. For example,

[13] National Association of City Transportation Officials, https://nacto.org/publication/dont-give-up-at-the-intersection/protected-intersections/.

[14] ODOT Crash Reduction Factor List, 2023, ID: BP3.

[15] ODOT Crash Reduction Factor List, 2023, ID: BP25.

[16] ODOT Crash Reduction Factor List, 2023, ID: H19.

[17] Crash Modification Factors Clearinghouse, US DOT Federal Highway Administration, CMF ID 4194.

Alternative 3 could require modifying circulation to the McDonald's property on the southwest corner of the intersection.

All alternatives are designed to accommodate heavy vehicle (WB-67) movements along US 97 and to and from destinations along Reed Market Road.

**TABLE 35: GOAL 3 SCORING AT REED MARKET ROAD/3RD STREET**

| OBJECTIVE | PERFORMANCE | | |
|---|---|---|---|
| | ALT 1 | ALT 2 | ALT 3 |
| A. ACCESS EFFECTIVENESS | I | ⌄ | ⌄ |
| B. TRUCK FREIGHT ACCOMMODATION | I | I | I |

## GOAL 4: PROTECT LIVABILITY AND ENSURE EQUITY AND ACCESS

Table 36 shows the scoring for all alternatives under this goal. Alternative 2 scores the highest on the evaluation of incorporating a complete streets approach at Reed Market Road and 3rd Street, for reasons noted in Goal 1 Objective C. No alternatives are expected to disproportionately impact properties owned, used, or accessed by historically underrepresented community members relative to other populations.

**TABLE 36: GOAL 4 SCORING AT REED MARKET ROAD/3RD STREET**

| OBJECTIVE | PERFORMANCE | | |
|---|---|---|---|
| | ALT 1 | ALT 2 | ALT 3 |
| A. COMPLETE STREET | I | ⌃⌃ | I |
| B. EQUITY | I | I | I |

## GOAL 5: STEWARD THE EENVIRONMENT

As shown in Table 37, Alternative 2 performs better than Alternatives 1 and 3 on environmental stewardship in terms of reducing vehicle emissions. All the alternatives significantly reduce delay compared to the No-Build condition, but Alternative 2 best implements the key walking and biking route improvements along 3rd Street to better support walking, biking, and access to transit. The roundabout in Alternative 3 is expected to serve active transportation users slightly better and

roundabouts generally reduce emissions throughout the day due to reduced stopping and idling compared to traffic signals.[18]

**TABLE 37: GOAL 5 SCORING AT REED MARKET ROAD/3RD STREET**

| OBJECTIVE | PERFORMANCE | | |
|---|---|---|---|
| | ALT 1 | ALT 2 | ALT 3 |
| A. REDUCE EMISSIONS | ^ | ^^ | ^ |

## GOAL 6: DEVELOP SOLUTIONS THAT ARE COST-EFFECTIVE AND IMPLEMENTABLE

Table 38 lists the planning level cost estimate for each alternative, with detailed cost estimates included in Appendix C. All alternatives include right-of-way impacts, ranging in assumed costs from $1 million to $4 million dollars, which significantly increases the overall project cost. Note that for Alternatives 1 and 2, the cost estimates shown are for Alternatives 1(b) and 2(b), which include the southbound right turn lane and would therefore be greater than the costs for Alternatives 1(a) and 2(a). During design, if project costs for Alternative 1(b) cannot be reduced to align with the available funding of $5 million, Alternative 1(a) could be chosen instead, which eliminates the southbound right turn lane and would reduce costs while still meeting the mobility standard. Although the southbound right-turn lane could also not be added in Alternative 2(b) (i.e., opting for Alternative 2(a)), the right-of-way costs are still expected to be significant due to the protected intersection design. In addition, all alternatives assume full depth pavement reconstruction, which adds significant cost. There is the potential that Alternative 1 in particular would not require as much pavement reconstruction, as the intersection is not shifted as significantly to the northwest as other alternatives.

**TABLE 38: PLANNING LEVEL COST ESTIMATES FOR ALTERNATIVES AT REED MARKET ROAD/3RD STREET**

| | ALT 1(B) | ALT 2(B) | ALT 3 | EXPECTED FUNDING |
|---|---|---|---|---|
| PLANNING LEVEL COST ESTIMATE | $7.0 million | $10.3 million | $10.8 million | $5 million |

Alternative 1 and Alternative 2 are expected to be more compatible with other projects along the corridor, as the surrounding intersections are expected to be controlled by traffic signals. Alternative 1 scores the highest on the criteria of developing a design that is constructable in phases and could be reasonably maintained. All alternatives would likely need to be constructed in

[18] Roundabouts: An Informational Guide, Federal Highway Administration.

a single phase. All alternatives have similar impacts on minimizing the number of potential design exceptions.

Alternatives 1 and 3 create less maintenance challenges after construction, while the protected intersection design in Alternative 2 involves several elements such as pavement markings and raised islands that require regular maintenance and provide more challenges for snow removal. Road widening in Alternatives 1 and 2 can be more easily constructed with regard to the ability to maintain movements of all modes during construction, while Alternative 3 would be more challenging to maintain traffic during construction. Table 39 shows the scoring for all alternatives under Goal 6.

**TABLE 39. GOAL 6 SCORING AT REED MARKET ROAD/3RD STREET**

| OBJECTIVE | PERFORMANCE | | |
|---|---|---|---|
| | ALT 1 | ALT 2 | ALT 3 |
| A. LOW-COST, HIGH BENEFIT | ⌄ | ⌄⌄ | ⌄⌄ |
| B. LEVERAGE PARTNERSHIPS | ⌄ | ⌄⌄ | ⌄⌄ |
| C. CONSTRUCTABLE IN PHASES, MAINTENANCE, DESIGN EXCEPTIONS, TRAFFIC MAINTENANCE DURING CONSTRUCTION | I | I | ⌄ |

## SUMMARY OF EVALUATION

Table 40 summarizes the scoring for each of the three alternatives across the project goals. Key differentiators in scoring between alternatives include:

- Goal 1: Increase System Functionality, Quality, and Connectivity for All Users
  - All alternatives were able to meet the mobility target to a similar degree, with a significant decrease in delays based on the operational results.
  - Alternative 1 requires roadway widening, which results in longer crossing and increased exposure for people walking and biking. Especially in Alternative 1(b), with the additional southbound right-turn lane, people biking southbound must also cross the right-turn lane upstream of the intersection.
  - Alternative 2 provides physical separation, reduces vehicle speeds, improves visibility, and provides LPIs or LBIs and RTOR restrictions to support the implementation of a key walking and biking route on 3rd Street.
  - Alternative 3 provides a two-stage crossing for people walking and biking and reduces vehicles speeds but requires drivers in both lanes of the roundabout to yield to people crossing at the intersection.
- Goal 2: Ensure Safety for All Users

- As noted above, Alternative 2 is expected to best address safety for people walking and biking, followed by Alternative 3. Alternative 1 increases exposure for people walking and biking, with longer crossings.

- Goal 3: Support Economic Development
  - Alternatives 1 and 2 have minimal impacts on maintaining effective access to properties along Reed Market Road in a manner that supports the economic development objectives of existing and future businesses.
  - In Alternative 3, the dual lane roundabout does require a larger right-of-way, potentially impacting more businesses.
  - All alternatives have minimal impacts on facilities accommodating heavy vehicle movements along US 97 and to and from destinations along Reed Market Road
- Goal 4: Protect Livability and Ensure Equity and Access
  - As noted above, Alternative 2 is expected to best address conditions for people walking and biking, followed by Alternative 3.
  - All three alternatives have similar property impacts and are not expected to disproportionally impact properties owned, used, or accessed by historically underrepresented community members relative to other populations.
- Goal 5: Steward the Environment
  - Alternative 1 significantly reduces vehicular delays, but road widening creates a deficiency on supporting walking, biking, and use of transit.
  - Alternative 2 notably reduces vehicular delays, but the delays would be longer than those of Alternative 1 due to the added LPIs or LBIs phasing. However, Alternative 2 supports walking, biking, and the use of transit by reducing speed, providing physical separation and protected phases, and enhancing visibility.
  - Alternative 3 produces less vehicular delays than Alternative 2 while creating a lower speed environment by providing refugee islands to help support walking, biking, and use of transit at the intersection, but not as much as Alternative 2.
- Goal 6: Develop Solutions that are Cost-Effective and Implementable
  - All alternatives are expected to exceed available funding, although there is potential to reduce right-of-way costs in Alternative 1 by not adding the southbound right-turn lane to better align with available funding (i.e., selecting Alternative 1(a)).
  - Alternatives 1 and 2 are more compatible with other projects along the corridor, as the surrounding intersections are expected to remain traffic signals.
  - Alternative 2 is expected to require more maintenance and provide more challenges for snow removal.
  - Alternative 1 and 2 can be more easily constructed with regard to the ability to maintain movements of all modes during construction, while Alternative 3 would be more challenging in maintaining traffic during construction.

**TABLE 40: REED MARKET ROAD/3RD STREET ALTERNATIVE PERFORMANCE**

| | GOAL | ALTERNATIVE 1 | ALTERNATIVE 2 | ALTERNATIVE 3 |
|---|---|---|---|---|
| GOAL 1 | Increase System Functionality, Quality, and Connectivity for All Users | | | |
| GOAL 2 | Ensure Safety for All Users | | | |
| GOAL 3 | Support Economic Development | | | |
| GOAL 4 | Protect Livability and Ensure Equity and Access | | | |
| GOAL 5 | Steward the Environment | | | |
| GOAL 6 | Develop Solutions That Are Cost-Effective and Implementable | | | |

## 3RD STREET/BROSTERHOUS ROAD

The 3rd Street and Brosterhous Road intersection currently operates with shared left-through lanes (an atypical configuration) and permissive left turns on the eastbound and westbound approaches, causing delay for through movements and increasing conflicts between motorists and people walking and biking at the intersection. The City is currently conducting a study and has identified short-term improvements (see page 6) that will expend the existing funds budgeted in the City's CIP (approximately $130,000).

Two long-term (i.e., unfunded) alternatives to address these concerns at the intersection were evaluated, including:

- Alternative 1:
  - Converting lane configuration and signal phasing to protected eastbound and westbound left turns.
  - Adding an eastbound dedicated right-turn lane.
  - Adding bike boxes on all approaches.
- Alternative 2:
  - Converting lane configuration and signal phasing to protected eastbound and westbound left turns.
  - Adding an eastbound dedicated right-turn lane.
  - Implementing a protected intersection design.

The intersection is assumed to be coordinated with other signalized intersections within the study area to provide continuous traffic flow at the target speed. A protected intersection design would look similar to that shown in the concept drawing for Alternative 2 at the Reed Market Road/3rd Street intersection.

### OBJECTIVES A AND B (TRAFFIC OPERATIONS)

Table 41 summarizes the results for the improvement alternatives under future conditions, with the intersection's performance compared to the mobility standard.[19]

In Alternative 1, converting to protected eastbound and westbound left turns reduces the intersection v/c ratio but slightly increases delays, as the heavy westbound right-turn movement shares a lane with westbound through vehicles and the intersection operates with a longer cycle length due to the protected left-turn phases. The additional eastbound right-turn lane also helps mitigate queueing so that queues do not extend back to Reed Market Road.

In Alternative 2, LPIs/LBIs and RTOR restrictions were assumed. As a result, Alternative 2 experiences more delays than Alternative 1 but is still able to meet the mobility standard. The additional eastbound right-turn lane also helps mitigate queueing so that queues do not extend back to Reed Market Road.

**TABLE 41: FUTURE 2040 DESIGN HOUR TRAFFIC OPERATIONS AT 3RD STREET/BROSTERHOUS ROAD**

| INTERSECTION | JURIS-DICTION | ALTERNATIVE[A] | CONTROL | MOBILITY STANDARD | V/C[B] | LOS[C] | DELAY (SEC)[D] |
|---|---|---|---|---|---|---|---|
| 3RD ST & BROSTERHOUS RD | City (AWD) | No-Build | Signalized | ≤ 1.00 | 0.89 | C | 21 |
| | | Alt 1 | Signalized | ≤ 1.00 | 0.75 | C | 31 |
| | | Alt 2 | Signalized | ≤ 1.00 | 0.87 | D | 47 |

**Bold and red** indicate a failure to meet the mobility target.

AWD = average weekday, LOS=level of service, v/c=volume-to-capacity.

[A] Future condition results represent 30HV operations for ODOT intersections and average weekday operations for City intersections, consistent with mobility targets.

[B] v/c ratio reported as the overall intersection v/c ratio at signalized intersections.

[C] LOS reported as the overall intersection LOS for signalized intersections.

[D] Control delay reported for the overall intersection delay for signalized intersections.

[19] Intersection operations are reported using Highway Capacity Manual 6th and2000 methodology and the software reports are included in Appendix B.

### OBJECTIVE C (ACTIVE TRANSPORTATION)

3rd Street and a segment of Brosterhous Road (from 3rd Street to Parrell Road) are identified as a key walking and biking route according to the City's TSP. Both 3rd Street and Brosterhous Road are designated as part of the City's low-stress bicycle network and intended to serve all ages and abilities of people biking. Today, walking and biking facilities (primarily sidewalks and on-street bike lanes) are discontinuous and high-stress in the area. Both alternatives improve conditions for people walking and biking, but Alternative 2 better meets the need of a key walking and biking route.

In Alternative 1, the eastbound road widening lengthens the crossing distance and increases exposure for people walking and biking. However, the protected eastbound and westbound left-turn phase reduces eastbound and westbound left-turning conflicts and ensures protected phasing for people walking and biking. In addition, bike boxes provide dedicated space to allow people biking to perform a two-stage left turn, eliminating the need to cross over two lanes of heavy traffic to reach the turn lane.

Alternative 2 is a variation of Alternative 1 that excludes bike boxes but includes a protected intersection design. Alternative 2 significantly enhances the quality of walking and biking facilities by utilizing raised islands at the intersection corners to provide physical separation, providing extra crossing time associated with LPIs or LBIs, reducing vehicle turning speeds, and improving visibility.

### OBJECTIVE D (TRANSIT)

Transit Route 1-4 (3rd Street) will be travelling through the intersection of 3rd Street and Brosterhous Road and has transit stops close to the intersection (within 350 feet). Based on the operational results, both alternatives would improve operations but result in higher delays due to the increased cycle length and lane configuration changes. In Alternative 2, the protected intersection design provides better access to transit.

### GOAL 1 SCORING SUMMARY

Table 42 shows the scoring results on the objectives under this goal.

**TABLE 42: GOAL 1 SCORING AT 3RD STREET/BROSTERHOUS ROAD**

| OBJECTIVE | PERFORMANCE | |
|---|---|---|
| | ALT 1 | ALT 2 |
| A. TRAFFIC OPERATIONS (ODOT) | N/A | N/A |
| B. TRAFFIC OPERATIONS (CITY) | | |
| C. ACTIVE TRANSPORTATION | | |
| D. TRANSIT | | |

## GOAL 2: ENSURE SAFETY FOR ALL USERS

Table 43 presents the scoring results for Goal 2. In both alternatives, the protected left-turn phasing has a potential to reduce left-turning crashes by up to 99 percent[20] while adding a right-turn lane, as previously mentioned under the Reed Market Road/US 97 Southbound Ramp Terminal discussion, has the potential to reduce all crashes by up to four percent. Adding a left-turn bike box improves visibility by placing people biking in motorists' direct line of sight when stopping at the intersection and allows people biking to make a two-stage left turn more easily. Adding a left-turn bike box has the potential of reducing bicycle crashes by up to 35 percent.[21]

Alternative 2 includes the features of LPIs/LBIs and RTOR restrictions that mitigate right-turning conflicts with people walking and biking. As mentioned previously under Reed Market Road and 3rd Street, LPIs/LBIs have the potential to reduce pedestrian-related crashes by up to 19 percent, and RTOR could reduce pedestrian and bicycle crashes by up to 41 percent.

Alternative 1 has minimal impact on designing and building facilities and routes that maximizes safety for people walking and biking, mainly due to the longer crossing distance. The protected left-turn phasing was able to help improve the exposure concerns by providing protected crossing but does not perform as well as the protected intersection design in Alternative 2. In Alternative 2, the protected intersection design significantly minimizes conflicts and risk factors that could lead to crashes by providing physical separation and LPIs/LBIs, restricting RTOR, reducing vehicle turning speeds, and improving visibility.

**TABLE 43: GOAL 2 SCORING AT 3RD STREET/BROSTERHOUS ROAD**

| OBJECTIVE | PERFORMANCE | |
|---|---|---|
| | ALT 1 | ALT 2 |
| A. CRASH REDUCTION | ⏫ | ⏫ |
| B. SAFETY FOR PEOPLE WALKING AND BIKING | ⏸ | ⏫ |
| C. ODOT'S ACCESS SPACING | N/A | N/A |

## GOAL 3: SUPPORT ECONOMIC DEVELOPMENT

Table 44 shows the scoring results for Goal 3. Alternative 1 and 2 are expected to have minimal impacts on property access along Reed Market Road and Division Street/Brosterhous Road. Neither alternative is expected to have a significant impact on accommodating heavy vehicle movements along 3rd Street.

[20] ODOT Crash Reduction Factor List, 2023, ID: I9.

[21] ODOT Crash Reduction Factor List, 2023, ID: BP7.

**TABLE 44: GOAL 3 SCORING AT 3RD STREET/BROSTERHOUS ROAD**

| OBJECTIVE | PERFORMANCE | |
|---|---|---|
| | ALT 1 | ALT 2 |
| A. ACCESS EFFECTIVENESS | I | I |
| B. TRUCK FREIGHT ACCOMMODATION | N/A | N/A |

## GOAL 4: PROTECT LIVABILITY AND ENSURE EQUITY AND ACCESS

The evaluation criterion of addressing existing barriers for people walking and biking across or along Reed Market Road is not applicable at this intersection and will not be evaluated. Alternative 2 scores better on accommodating planned transit service improvements and expansions by providing better access because of the protected intersection design, as discussed under Goal 1. Both alternatives have minimal impacts on properties owned, used, or accessed by historically underrepresented community members proportionate to those of other populations. Table 45 presents the scoring results for the alternatives.

**TABLE 45: GOAL 4 SCORING AT 3RD STREET/BROSTERHOUS ROAD**

| OBJECTIVE | PERFORMANCE | |
|---|---|---|
| | ALT 1 | ALT 2 |
| A. COMPLETE STREET | I | ^ |
| B. EQUITY | I | I |

## GOAL 5: STEWARD THE ENVIRONMENT

As shown in Table 46, both alternatives score fair under the criterion of reducing vehicle emissions. The main driver of the ability to reduce vehicle emissions is related to the level of delay in the improvement alternatives, which is discussed in detail under Goal 1. Alternative 1 results in higher vehicle delays (31 seconds compared to 21 seconds) but provides safer crossing opportunities for people walking and biking with the protected eastbound and westbound left-turn movements and better access to transit. Alternative 2 results in even higher delays but the protected intersection design significantly improves safety for people walking and biking, supporting the connections in the local system and the use of alternative travel modes.

**TABLE 46: GOAL 5 SCORING AT 3RD STREET/BROSTERHOUS ROAD**

| OBJECTIVE | PERFORMANCE | |
|---|---|---|
| | ALT 1 | ALT 2 |
| A. REDUCE EMISSIONS | I | I |

## GOAL 6: DEVELOP SOLUTIONS THAT ARE COST-EFFECTIVE AND IMPLEMENTABLE

Table 47 shows the scoring results for the alternatives. Both alternatives would require a full rebuild of the intersection, including a new traffic signal. There is no funding allocated for a long-term enhancement at this intersection so neither alternative would be easily implemented. Therefore, both alternatives score poorly on the criteria on prioritizing low-cost and high-benefit solutions, and creating solutions that are compatible with recommendations from prior planning studies.

Both alternatives at 3rd Street and Brosterhous Road would need to be implemented in a single phase and would minimize the number of potential design exceptions. The protected intersection design in Alternative 2 would be more challenging to maintain, particularly with respect to snow removal.

**TABLE 47: GOAL 6 SCORING AT 3RD STREET/BROSTERHOUS ROAD**

| OBJECTIVE | PERFORMANCE | |
|---|---|---|
| | ALT 1 | ALT 2 |
| A. LOW-COST, HIGH BENEFIT | ⏬ | ⏬ |
| B. LEVERAGE PARTNERSHIPS | ⏬ | ⏬ |
| C. CONSTRUCTABLE IN PHASES, MAINTENANCE, DESIGN EXCEPTIONS, TRAFFIC MAINTENANCE DURING CONSTRUCTION | I | ⌄ |

## SUMMARY OF EVALUATION

Table 48 summarizes the scoring for each of the two alternatives across the project goals. Key differentiators in scoring between alternatives:

- Goal 1: Increase System Functionality, Quality and Connectivity for All Users
  - Both alternatives are able to meet the mobility target but result in higher delays than the No-Build condition. There is more delay in Alternative 2 due to implementing LPIs/LBIs for people walking and biking.
  - Both alternatives reduce eastbound and westbound left-turning conflicts and ensure protected phasing for people walking and biking by providing protected eastbound and westbound left-turn phases.
  - Alternative 1 requires roadway widening, which lengthens the crossing distance and increases exposure for people walking and biking. However, bike boxes allow people biking to locate themselves in front of vehicles for better visibility.
  - Alternative 2 also requires roadway widening but significantly enhances the quality of walking and biking facilities by utilizing raised islands at the intersection corners to provide physical separation, providing extra crossing time associated with LPIs/LBIs, reducing vehicle turning speeds, and improving visibility.
  - Both alternatives are able to improve operations but result in longer delay due to the increased cycle length.
  - In Alternative 2, the protected intersection design provides better access to transit.
- Goal 2: Ensure Safety for All Users
  - Both alternatives are expected to significantly improve safety by adding protected eastbound and westbound left-turn phases to address a known crash history at this intersection.
  - Alternative 1 has less of an impact on designing and building facilities and routes that maximizes safety for people walking and biking, as it does not provide physical separation between vehicles and people walking and biking.
  - In Alternative 2, the protected intersection design significantly minimizes conflicts and risk factors that could lead to crashes by providing physical separation and LPIs/LBIs, restricting RTOR, reducing vehicle turning speeds, and improving visibility.
- Goal 3: Support Economic Development
  - Both alternatives have minimal impacts on supporting economic development within the study area.
- Goal 4: Protect Livability and Ensure Equity and Access
  - Alternative 2 scores better on accommodating planned transit service improvements and expansions by providing better access to transit.
  - Both alternatives have minimal impacts on properties owned, used, or accessed by historically underrepresented community members proportionate to those of other populations.
- Goal 5: Steward the Environment
  - Alternative 1 results in slightly higher vehicle delay (vehicle emissions) but does enhance facilities for people walking and biking by providing protected eastbound and westbound left-turn phases.

- Alternative 2 generates higher vehicle delays but the protected intersection design significantly improves safety for people walking and biking, supporting the connections in the local system and the use of alternative travel modes.

- Goal 6: Develop Solutions that are Cost-Effective and Implementable
  - Both alternatives would require a full rebuild of the intersection, and given there is no funding allocated for a long-term enhancement at the intersection, would greatly exceed expected funding.
  - The protected intersection design in Alternative 2 would be more challenging to maintain, particularly with respect to snow removal.

**TABLE 48: 3RD STREET/BROSTERHOUS ROAD ALTERNATIVE PERFORMANCE**

| | GOAL | ALTERNATIVE 1 | ALTERNATIVE 2 |
|---|---|---|---|
| GOAL 1 | Increase System Functionality, Quality, and Connectivity for All Users | | |
| GOAL 2 | Ensure Safety for All Users | | |
| GOAL 3 | Support Economic Development | | |
| GOAL 4 | Protect Livability and Ensure Equity and Access | | |
| GOAL 5 | Steward the Environment | | |
| GOAL 6 | Develop Solutions That Are Cost-Effective and Implementable | | |

# APPENDIX

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# APPENDIX A: ALTERNATIVE CONCEPT DRAWINGS

## REED MARKET ROAD/US 97 SOUTHBOUND RAMP TERMINAL – ALTERNATIVE 1

NOTE: Any green striping is subject to ODOT traffic approval and funding to maintain

## REED MARKET ROAD/US 97 SOUTHBOUND RAMP TERMINAL – ALTERNATIVE 2

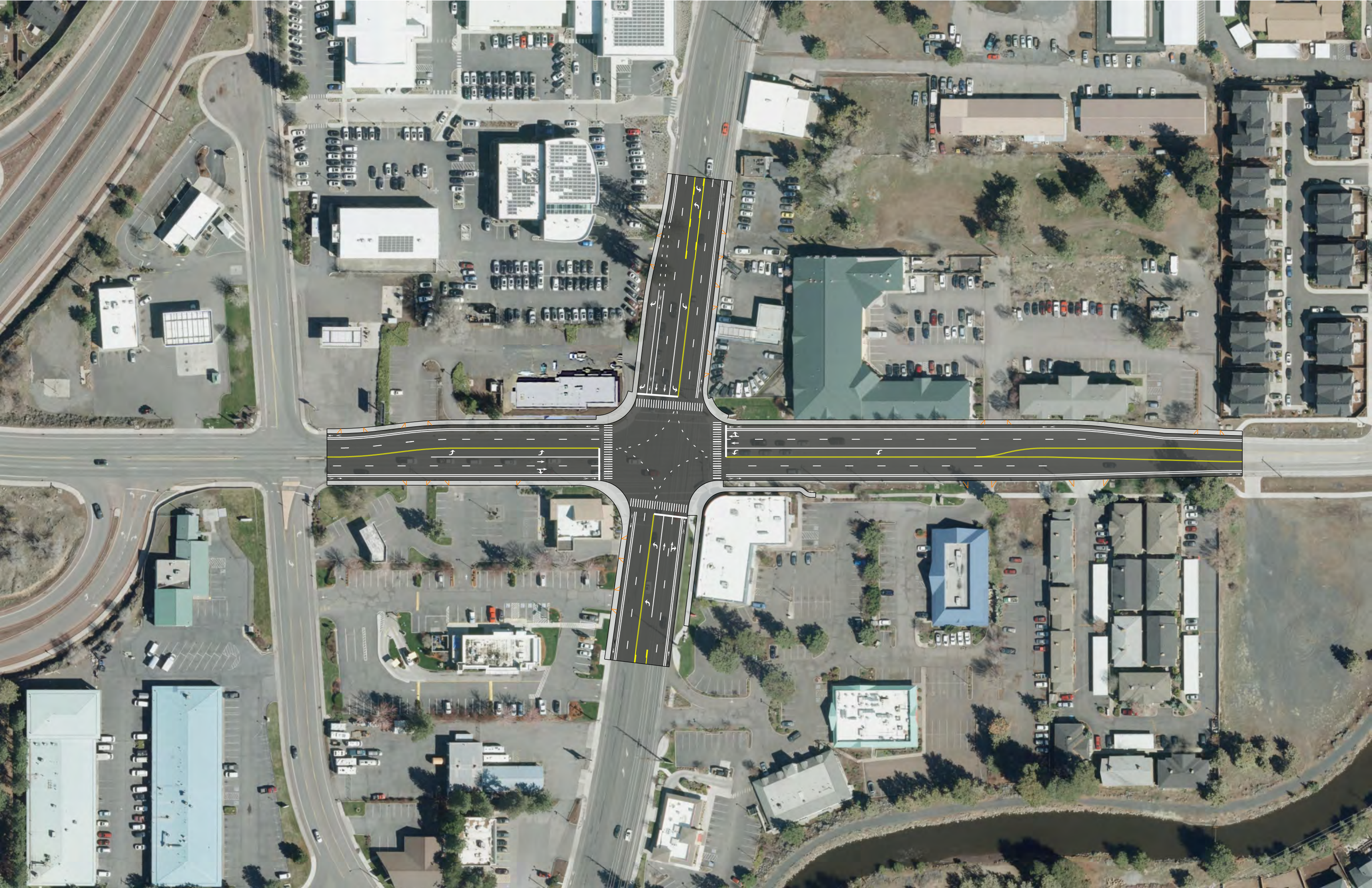
## REED MARKET ROAD/US 97 NORTHBOUND RAMP TERMINAL/DIVISION STREET – ALTERNATIVE 1

NOTE: Any green striping is subject to ODOT traffic approval and funding to maintain

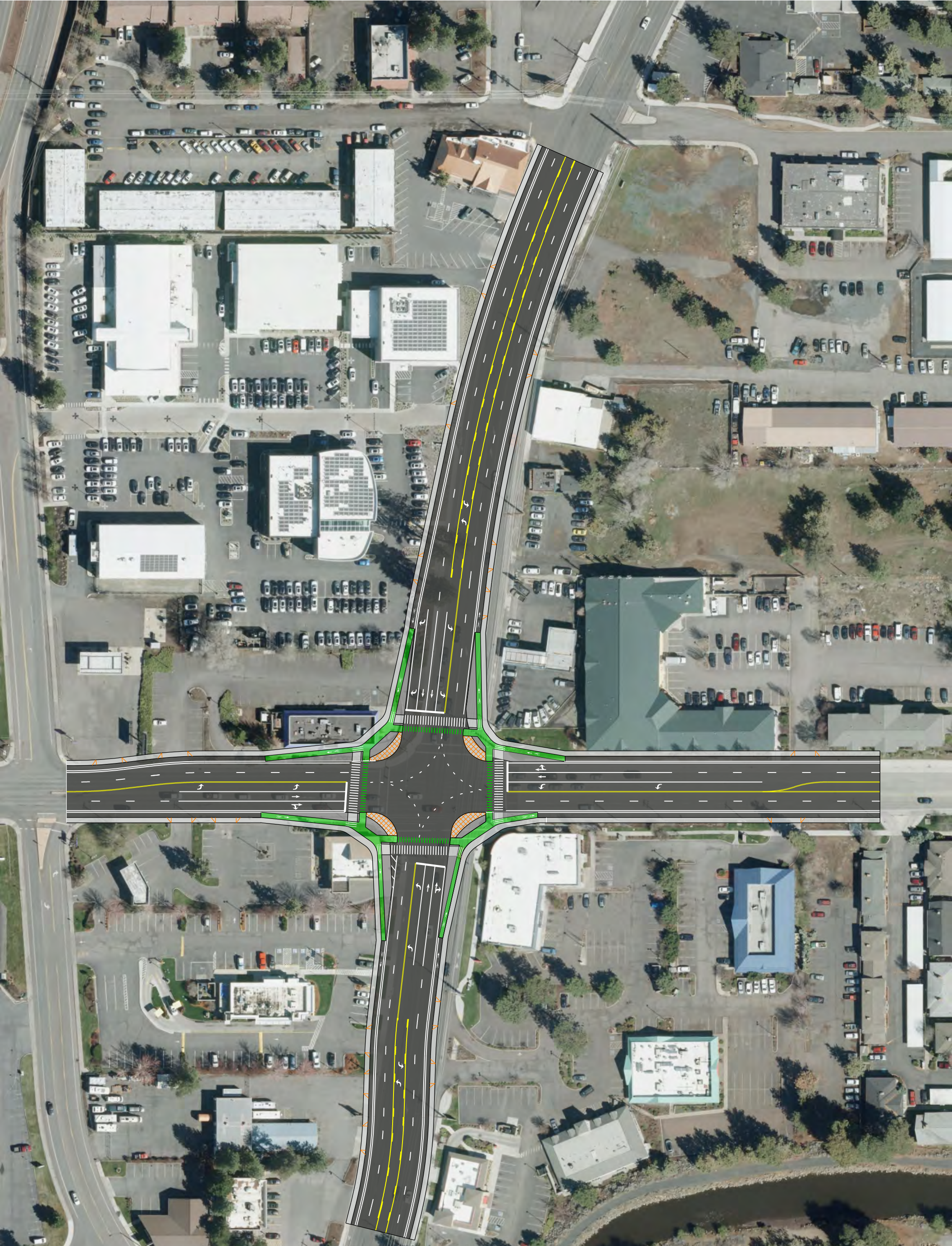
## REED MARKET ROAD/US 97 NORTHBOUND RAMP TERMINAL/DIVISION STREET – ALTERNATIVE 2

NOTE: Any green striping is subject to ODOT traffic approval and funding to maintain

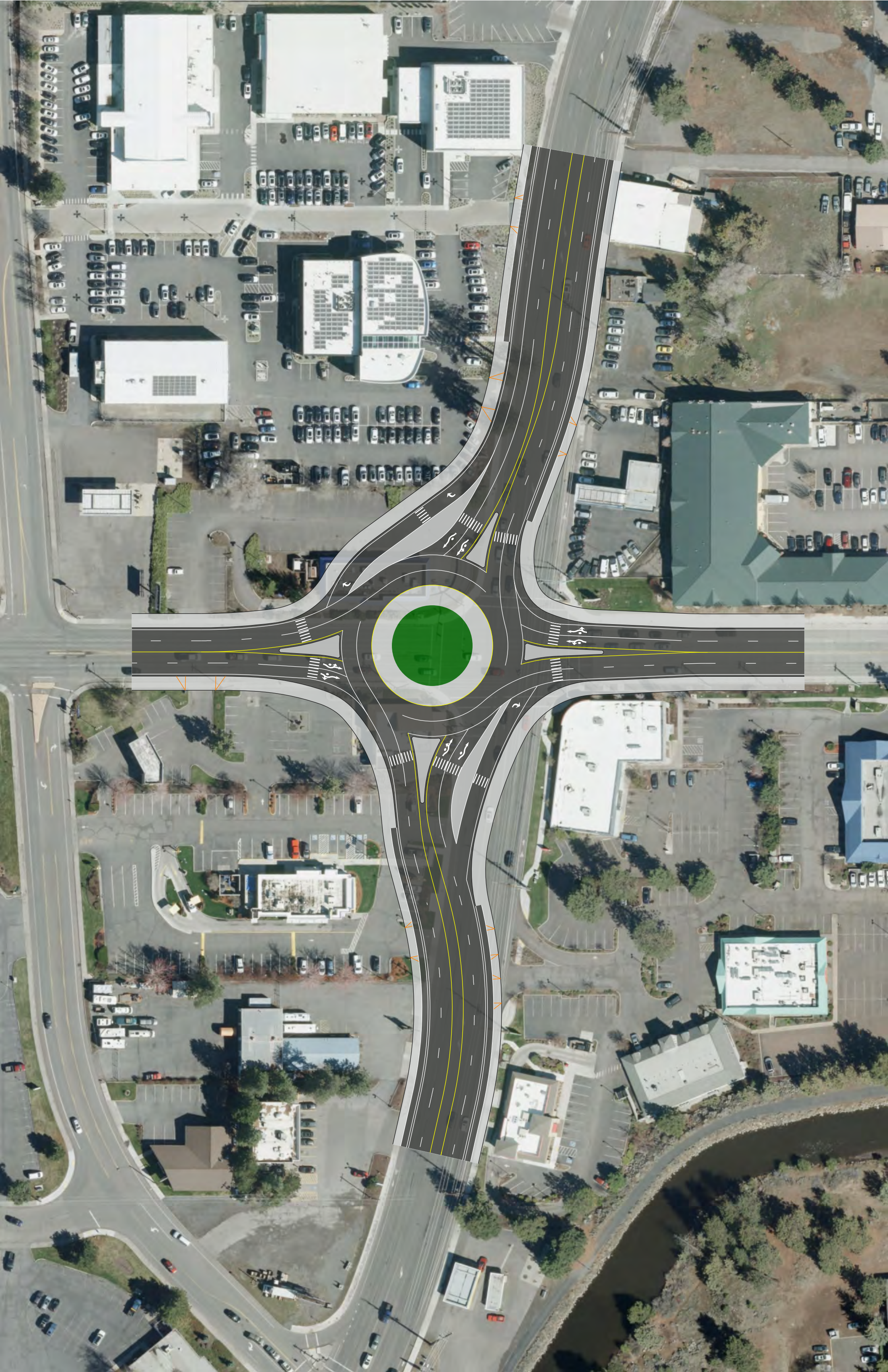
## REED MARKET ROAD/3RD STREET -ALTERNATIVE 1



## REED MARKET ROAD/3RD STREET -ALTERNATIVE 2



## REED MARKET ROAD/3RD STREET -ALTERNATIVE 3



# APPENDIX B: SOFTWARE REPORTS

| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 1285 | 270 | 0 | 860 | 125 | 125 |
| Future Volume (veh/h) | 1285 | 270 | 0 | 860 | 125 | 125 |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | | 0.98 | 1.00 | | 1.00 | 1.00 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Work Zone On Approach | No | | | No | No | |
| Adj Sat Flow, veh/h/ln | 1736 | 1736 | 0 | 1750 | 1750 | 1723 |
| Adj Flow Rate, veh/h | 1367 | 275 | 0 | 915 | 133 | 83 |
| Peak Hour Factor | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Percent Heavy Veh, % | 1 | 1 | 0 | 0 | 0 | 2 |
| Cap, veh/h | 2283 | 451 | 0 | 2776 | 164 | 144 |
| Arrive On Green | 1.00 | 1.00 | 0.00 | 1.00 | 0.10 | 0.10 |
| Sat Flow, veh/h | 2821 | 540 | 0 | 3500 | 1667 | 1460 |
| Grp Volume(v), veh/h | 815 | 827 | 0 | 915 | 133 | 83 |
| Grp Sat Flow(s),veh/h/ln | 1650 | 1625 | 0 | 1663 | 1667 | 1460 |
| Q Serve(g_s), s | 0.0 | 0.0 | 0.0 | 0.0 | 9.4 | 6.5 |
| Cycle Q Clear(g_c), s | 0.0 | 0.0 | 0.0 | 0.0 | 9.4 | 6.5 |
| Prop In Lane | | 0.33 | 0.00 | | 1.00 | 1.00 |
| Lane Grp Cap(c), veh/h | 1377 | 1357 | 0 | 2776 | 164 | 144 |
| V/C Ratio(X) | 0.59 | 0.61 | 0.00 | 0.33 | 0.81 | 0.58 |
| Avail Cap(c_a), veh/h | 1377 | 1357 | 0 | 2776 | 389 | 341 |
| HCM Platoon Ratio | 2.00 | 2.00 | 1.00 | 2.00 | 1.00 | 1.00 |
| Upstream Filter(I) | 0.80 | 0.80 | 0.00 | 1.00 | 1.00 | 1.00 |
| Uniform Delay (d), s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 53.0 | 51.7 |
| Incr Delay (d2), s/veh | 1.5 | 1.6 | 0.0 | 0.3 | 7.0 | 2.7 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 0.6 | 0.6 | 0.0 | 0.1 | 4.2 | 2.5 |
| Unsig. Movement Delay, s/veh | | | | | | |
| LnGrp Delay(d),s/veh | 1.5 | 1.6 | 0.0 | 0.3 | 60.0 | 54.4 |
| LnGrp LOS | A | A | A | A | E | D |
| Approach Vol, veh/h | 1642 | | | 915 | 216 | |
| Approach Delay, s/veh | 1.6 | | | 0.3 | 57.9 | |
| Approach LOS | A | | | A | E | |

| Timer - Assigned Phs | 2 | 4 | 8 |
|---|---|---|---|
| Phs Duration (G+Y+Rc), s | 15.8 | 104.2 | 104.2 |
| Change Period (Y+Rc), s | 4.0 | 4.0 | 4.0 |
| Max Green Setting (Gmax), s | 28.0 | 84.0 | 84.0 |
| Max Q Clear Time (g_c+I1), s | 11.4 | 2.0 | 2.0 |
| Green Ext Time (p_c), s | 0.4 | 18.5 | 7.1 |

| Intersection Summary | |
|---|---|
| HCM 6th Ctrl Delay | 5.5 |
| HCM 6th LOS | A |

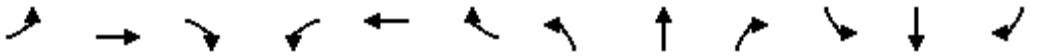
| Intersection | |
|---|---|
| Int Delay, s/veh | 0.5 |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 0 | 760 | 650 | 0 | 820 | 430 | 0 | 0 | 50 | 0 | 0 | 40 |
| Future Vol, veh/h | 0 | 760 | 650 | 0 | 820 | 430 | 0 | 0 | 50 | 0 | 0 | 40 |
| Conflicting Peds, #/hr | 2 | 0 | 2 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Free | Free | Stop | Stop | Stop | Stop | Stop | Stop |
| RT Channelized | - | - | None | - | - | None | - | - | Stop | - | - | None |
| Storage Length | - | - | - | - | - | - | - | - | 0 | - | - | 0 |
| Veh in Median Storage, # | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Grade, % | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Peak Hour Factor | 97 | 97 | 97 | 97 | 97 | 97 | 97 | 97 | 97 | 97 | 97 | 97 |
| Heavy Vehicles, % | 3 | 1 | 1 | 0 | 1 | 2 | 0 | 0 | 4 | 33 | 0 | 0 |
| Mvmt Flow | 0 | 784 | 670 | 0 | 845 | 443 | 0 | 0 | 52 | 0 | 0 | 41 |

| Major/Minor | Major1 | | | Major2 | | | Minor1 | | | Minor2 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Conflicting Flow All | - | 0 | 0 | - | - | 0 | - | - | 729 | - | - | 646 |
| Stage 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| Stage 2 | - | - | - | - | - | - | - | - | - | - | - | - |
| Critical Hdwy | - | - | - | - | - | - | - | - | 6.98 | - | - | 6.9 |
| Critical Hdwy Stg 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| Critical Hdwy Stg 2 | - | - | - | - | - | - | - | - | - | - | - | - |
| Follow-up Hdwy | - | - | - | - | - | - | - | - | 3.34 | - | - | 3.3 |
| Pot Cap-1 Maneuver | 0 | - | - | 0 | - | - | 0 | 0 | 361 | 0 | 0 | 419 |
| Stage 1 | 0 | - | - | 0 | - | - | 0 | 0 | - | 0 | 0 | - |
| Stage 2 | 0 | - | - | 0 | - | - | 0 | 0 | - | 0 | 0 | - |
| Platoon blocked, % | | - | - | | - | - | | | | | | |
| Mov Cap-1 Maneuver | - | - | - | - | - | - | - | - | 360 | - | - | 418 |
| Mov Cap-2 Maneuver | - | - | - | - | - | - | - | - | - | - | - | - |
| Stage 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| Stage 2 | - | - | - | - | - | - | - | - | - | - | - | - |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| HCM Control Delay, s | 0 | 0 | 16.7 | 14.6 |
| HCM LOS | | | C | B |

| Minor Lane/Major Mvmt | NBLn1 | EBT | EBR | WBT | WBR | SBLn1 |
|---|---|---|---|---|---|---|
| Capacity (veh/h) | 360 | - | - | - | - | 418 |
| HCM Lane V/C Ratio | 0.143 | - | - | - | - | 0.099 |
| HCM Control Delay (s) | 16.7 | - | - | - | - | 14.6 |
| HCM Lane LOS | C | - | - | - | - | B |
| HCM 95th %tile Q(veh) | 0.5 | - | - | - | - | 0.3 |



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 160 | 555 | 85 | 260 | 600 | 110 | 365 | 780 | 275 | 205 | 850 | 195 |
| Future Volume (veh/h) | 160 | 555 | 85 | 260 | 600 | 110 | 365 | 780 | 275 | 205 | 850 | 195 |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | 1.00 | | 0.97 | 1.00 | | 0.97 | 1.00 | | 0.98 | 1.00 | | 0.98 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Work Zone On Approach | | No | | | No | | | No | | | No | |
| Adj Sat Flow, veh/h/ln | 1885 | 1885 | 1826 | 1885 | 1885 | 1870 | 1885 | 1870 | 1870 | 1885 | 1885 | 1885 |
| Adj Flow Rate, veh/h | 160 | 555 | 74 | 260 | 600 | 97 | 365 | 780 | 247 | 205 | 850 | 77 |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Percent Heavy Veh, % | 1 | 1 | 5 | 1 | 1 | 2 | 1 | 2 | 2 | 1 | 1 | 1 |
| Cap, veh/h | 192 | 692 | 92 | 254 | 779 | 126 | 403 | 954 | 302 | 245 | 980 | 415 |
| Arrive On Green | 0.07 | 0.15 | 0.14 | 0.14 | 0.25 | 0.25 | 0.22 | 0.36 | 0.35 | 0.14 | 0.27 | 0.27 |
| Sat Flow, veh/h | 1795 | 3165 | 421 | 1795 | 3074 | 496 | 1795 | 2637 | 835 | 1795 | 3582 | 1565 |
| Grp Volume(v), veh/h | 160 | 313 | 316 | 260 | 349 | 348 | 365 | 525 | 502 | 205 | 850 | 77 |
| Grp Sat Flow(s),veh/h/ln | 1795 | 1791 | 1795 | 1795 | 1791 | 1779 | 1795 | 1777 | 1695 | 1795 | 1791 | 1565 |
| Q Serve(g_s), s | 10.6 | 20.3 | 20.4 | 17.0 | 21.7 | 21.8 | 23.7 | 32.2 | 32.2 | 13.4 | 27.1 | 4.6 |
| Cycle Q Clear(g_c), s | 10.6 | 20.3 | 20.4 | 17.0 | 21.7 | 21.8 | 23.7 | 32.2 | 32.2 | 13.4 | 27.1 | 4.6 |
| Prop In Lane | 1.00 | | 0.23 | 1.00 | | 0.28 | 1.00 | | 0.49 | 1.00 | | 1.00 |
| Lane Grp Cap(c), veh/h | 192 | 391 | 392 | 254 | 454 | 451 | 403 | 643 | 613 | 245 | 980 | 415 |
| V/C Ratio(X) | 0.83 | 0.80 | 0.81 | 1.02 | 0.77 | 0.77 | 0.90 | 0.82 | 0.82 | 0.84 | 0.87 | 0.19 |
| Avail Cap(c_a), veh/h | 269 | 463 | 464 | 254 | 454 | 451 | 419 | 643 | 613 | 254 | 980 | 415 |
| HCM Platoon Ratio | 0.67 | 0.67 | 0.67 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Upstream Filter(I) | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.65 | 0.65 | 0.65 | 1.00 | 1.00 | 1.00 |
| Uniform Delay (d), s/veh | 54.7 | 48.7 | 48.8 | 51.5 | 41.5 | 41.7 | 45.3 | 34.7 | 35.0 | 50.5 | 41.5 | 34.1 |
| Incr Delay (d2), s/veh | 12.9 | 7.8 | 8.1 | 62.3 | 7.5 | 7.8 | 15.8 | 7.5 | 7.8 | 20.0 | 10.3 | 1.0 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 5.6 | 10.3 | 10.4 | 12.0 | 10.5 | 10.5 | 12.2 | 14.9 | 14.3 | 7.3 | 13.2 | 1.9 |
| Unsig. Movement Delay, s/veh | | | | | | | | | | | | |
| LnGrp Delay(d),s/veh | 67.5 | 56.4 | 56.9 | 113.8 | 49.0 | 49.5 | 61.1 | 42.2 | 42.8 | 70.5 | 51.8 | 35.1 |
| LnGrp LOS | E | E | E | F | D | D | E | D | D | E | D | D |
| Approach Vol, veh/h | | 789 | | | 957 | | | 1392 | | | 1132 | |
| Approach Delay, s/veh | | 58.9 | | | 66.8 | | | 47.4 | | | 54.1 | |
| Approach LOS | | E | | | E | | | D | | | D | |

| Timer - Assigned Phs | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Phs Duration (G+Y+Rc), s | 31.0 | 36.8 | 17.8 | 34.4 | 20.4 | 47.4 | 22.0 | 30.2 |
| Change Period (Y+Rc), s | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 |
| Max Green Setting (Gmax), s | 27.0 | 26.0 | 18.0 | 29.0 | 16.0 | 37.0 | 17.0 | 30.0 |
| Max Q Clear Time (g_c+I1), s | 25.7 | 29.1 | 12.6 | 23.8 | 15.4 | 34.2 | 19.0 | 22.4 |
| Green Ext Time (p_c), s | 0.2 | 0.0 | 0.3 | 1.1 | 0.0 | 1.7 | 0.0 | 1.3 |

| Intersection Summary | |
|---|---|
| HCM 6th Ctrl Delay | 55.6 |
| HCM 6th LOS | E |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 85 | 345 | 270 | 55 | 25 | 480 | 30 | 855 | 50 | 230 | 940 | 25 |
| Future Volume (veh/h) | 85 | 345 | 270 | 55 | 25 | 480 | 30 | 855 | 50 | 230 | 940 | 25 |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | 1.00 | | 0.98 | 1.00 | | 0.98 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Work Zone On Approach | | No | | | No | | | No | | | No | |
| Adj Sat Flow, veh/h/ln | 1736 | 1723 | 1750 | 1723 | 1682 | 1736 | 1600 | 1736 | 1750 | 1723 | 1750 | 1450 |
| Adj Flow Rate, veh/h | 85 | 345 | 116 | 55 | 25 | 240 | 30 | 855 | 0 | 230 | 940 | 0 |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Percent Heavy Veh, % | 1 | 2 | 0 | 2 | 5 | 1 | 11 | 1 | 0 | 2 | 0 | 22 |
| Cap, veh/h | 105 | 399 | 336 | 69 | 28 | 270 | 40 | 1397 | | 258 | 1844 | |
| Arrive On Green | 0.06 | 0.23 | 0.23 | 0.04 | 0.21 | 0.21 | 0.03 | 0.42 | 0.00 | 0.31 | 1.00 | 0.00 |
| Sat Flow, veh/h | 1654 | 1723 | 1454 | 1641 | 134 | 1286 | 1524 | 3386 | 0 | 1641 | 3413 | 0 |
| Grp Volume(v), veh/h | 85 | 345 | 116 | 55 | 0 | 265 | 30 | 855 | 0 | 230 | 940 | 0 |
| Grp Sat Flow(s),veh/h/ln | 1654 | 1723 | 1454 | 1641 | 0 | 1420 | 1524 | 1650 | 0 | 1641 | 1663 | 0 |
| Q Serve(g_s), s | 6.1 | 23.1 | 8.0 | 4.0 | 0.0 | 21.8 | 2.3 | 24.2 | 0.0 | 16.0 | 0.0 | 0.0 |
| Cycle Q Clear(g_c), s | 6.1 | 23.1 | 8.0 | 4.0 | 0.0 | 21.8 | 2.3 | 24.2 | 0.0 | 16.0 | 0.0 | 0.0 |
| Prop In Lane | 1.00 | | 1.00 | 1.00 | | 0.91 | 1.00 | | 0.00 | 1.00 | | 0.00 |
| Lane Grp Cap(c), veh/h | 105 | 399 | 336 | 69 | 0 | 298 | 40 | 1397 | | 258 | 1844 | |
| V/C Ratio(X) | 0.81 | 0.87 | 0.34 | 0.80 | 0.00 | 0.89 | 0.75 | 0.61 | | 0.89 | 0.51 | |
| Avail Cap(c_a), veh/h | 124 | 541 | 457 | 96 | 0 | 423 | 93 | 1397 | | 349 | 1844 | |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 2.00 | 2.00 | 2.00 |
| Upstream Filter(I) | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 1.00 | 0.00 | 0.22 | 0.22 | 0.00 |
| Uniform Delay (d), s/veh | 55.5 | 44.3 | 38.5 | 57.0 | 0.0 | 46.1 | 58.0 | 26.9 | 0.0 | 40.1 | 0.0 | 0.0 |
| Incr Delay (d2), s/veh | 27.6 | 9.8 | 0.5 | 26.6 | 0.0 | 14.2 | 18.3 | 2.0 | 0.0 | 4.9 | 0.2 | 0.0 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 3.3 | 10.9 | 2.9 | 2.2 | 0.0 | 8.8 | 1.1 | 9.8 | 0.0 | 5.8 | 0.1 | 0.0 |
| Unsig. Movement Delay, s/veh | | | | | | | | | | | | |
| LnGrp Delay(d),s/veh | 83.1 | 54.1 | 39.0 | 83.6 | 0.0 | 60.2 | 76.4 | 28.9 | 0.0 | 45.0 | 0.2 | 0.0 |
| LnGrp LOS | F | D | D | F | A | E | E | C | | D | A | |
| Approach Vol, veh/h | | 546 | | | 320 | | | 885 | | | 1170 | |
| Approach Delay, s/veh | | 55.4 | | | 64.3 | | | 30.5 | | | 9.0 | |
| Approach LOS | | E | | | E | | | C | | | A | |

| Timer - Assigned Phs | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Phs Duration (G+Y+Rc), s | 23.4 | 55.3 | 11.6 | 29.7 | 7.7 | 71.0 | 9.0 | 32.3 |
| Change Period (Y+Rc), s | 4.5 | 4.5 | 4.0 | 4.5 | 4.5 | 4.5 | 4.0 | 4.5 |
| Max Green Setting (Gmax), s | 25.5 | 32.3 | 9.0 | 35.7 | 7.3 | 50.5 | 7.0 | 37.7 |
| Max Q Clear Time (g_c+I1), s | 18.8 | 26.2 | 8.1 | 23.8 | 4.3 | 2.0 | 6.0 | 25.1 |
| Green Ext Time (p_c), s | 0.9 | 4.7 | 0.0 | 1.0 | 0.0 | 25.2 | 0.0 | 1.5 |

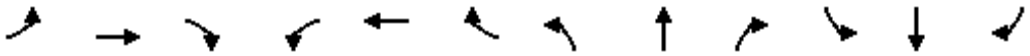
| Intersection Summary | |
|---|---|
| HCM 6th Ctrl Delay | 30.3 |
| HCM 6th LOS | C |

**Notes**

Unsignalized Delay for [NBR, SBR] is excluded from calculations of the approach delay and intersection delay.

# HCM 6th Signalized Intersection Summary
## 5: SE 3rd St & SW Reed Market Rd

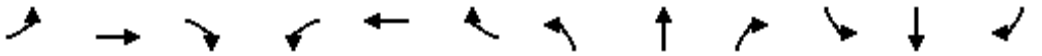
04/20/2023



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 160 | 555 | 85 | 260 | 600 | 110 | 365 | 780 | 275 | 205 | 850 | 195 |
| Future Volume (veh/h) | 160 | 555 | 85 | 260 | 600 | 110 | 365 | 780 | 275 | 205 | 850 | 195 |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | 1.00 | | 0.97 | 1.00 | | 0.97 | 1.00 | | 0.98 | 1.00 | | 0.98 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Work Zone On Approach | | No | | | No | | | No | | | No | |
| Adj Sat Flow, veh/h/ln | 1885 | 1885 | 1826 | 1885 | 1885 | 1870 | 1885 | 1870 | 1870 | 1885 | 1885 | 1885 |
| Adj Flow Rate, veh/h | 160 | 555 | 74 | 260 | 600 | 97 | 365 | 780 | 247 | 205 | 850 | 77 |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Percent Heavy Veh, % | 1 | 1 | 5 | 1 | 1 | 2 | 1 | 2 | 2 | 1 | 1 | 1 |
| Cap, veh/h | 205 | 698 | 93 | 254 | 763 | 123 | 344 | 1023 | 324 | 209 | 1037 | 94 |
| Arrive On Green | 0.04 | 0.07 | 0.07 | 0.14 | 0.25 | 0.24 | 0.19 | 0.39 | 0.38 | 0.12 | 0.31 | 0.30 |
| Sat Flow, veh/h | 1795 | 3165 | 421 | 1795 | 3074 | 496 | 1795 | 2638 | 835 | 1795 | 3315 | 300 |
| Grp Volume(v), veh/h | 160 | 313 | 316 | 260 | 349 | 348 | 365 | 525 | 502 | 205 | 459 | 468 |
| Grp Sat Flow(s),veh/h/ln | 1795 | 1791 | 1795 | 1795 | 1791 | 1779 | 1795 | 1777 | 1696 | 1795 | 1791 | 1824 |
| Q Serve(g_s), s | 10.6 | 20.6 | 20.8 | 17.0 | 21.8 | 22.0 | 23.0 | 30.8 | 30.9 | 13.7 | 28.4 | 28.5 |
| Cycle Q Clear(g_c), s | 10.6 | 20.6 | 20.8 | 17.0 | 21.8 | 22.0 | 23.0 | 30.8 | 30.9 | 13.7 | 28.4 | 28.5 |
| Prop In Lane | 1.00 | | 0.23 | 1.00 | | 0.28 | 1.00 | | 0.49 | 1.00 | | 0.16 |
| Lane Grp Cap(c), veh/h | 205 | 395 | 396 | 254 | 445 | 442 | 344 | 689 | 658 | 209 | 560 | 571 |
| V/C Ratio(X) | 0.78 | 0.79 | 0.80 | 1.02 | 0.78 | 0.79 | 1.06 | 0.76 | 0.76 | 0.98 | 0.82 | 0.82 |
| Avail Cap(c_a), veh/h | 224 | 463 | 464 | 254 | 493 | 489 | 344 | 689 | 658 | 209 | 560 | 571 |
| HCM Platoon Ratio | 0.33 | 0.33 | 0.33 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Upstream Filter(I) | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.65 | 0.65 | 0.65 | 1.00 | 1.00 | 1.00 |
| Uniform Delay (d), s/veh | 56.3 | 52.9 | 53.0 | 51.5 | 42.1 | 42.3 | 48.5 | 31.9 | 32.2 | 52.9 | 38.1 | 38.2 |
| Incr Delay (d2), s/veh | 14.2 | 7.4 | 7.7 | 62.3 | 7.0 | 7.3 | 56.2 | 5.2 | 5.4 | 55.8 | 12.6 | 12.4 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 6.0 | 10.8 | 10.9 | 12.0 | 10.5 | 10.5 | 15.5 | 13.9 | 13.4 | 9.3 | 14.2 | 14.4 |
| Unsig. Movement Delay, s/veh | | | | | | | | | | | | |
| LnGrp Delay(d),s/veh | 70.5 | 60.3 | 60.7 | 113.8 | 49.1 | 49.6 | 104.7 | 37.1 | 37.6 | 108.7 | 50.7 | 50.6 |
| LnGrp LOS | E | E | E | F | D | D | F | D | D | F | D | D |
| Approach Vol, veh/h | | 789 | | | 957 | | | 1392 | | | 1132 | |
| Approach Delay, s/veh | | 62.5 | | | 66.9 | | | 55.0 | | | 61.2 | |
| Approach LOS | | E | | | E | | | E | | | E | |

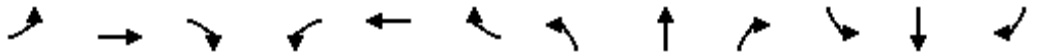
| Timer - Assigned Phs | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Phs Duration (G+Y+Rc), s | 27.0 | 41.5 | 17.7 | 33.8 | 18.0 | 50.5 | 21.0 | 30.5 |
| Change Period (Y+Rc), s | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 |
| Max Green Setting (Gmax), s | 22.0 | 32.0 | 14.0 | 32.0 | 13.0 | 41.0 | 16.0 | 30.0 |
| Max Q Clear Time (g_c+I1), s | 25.0 | 30.5 | 12.6 | 24.0 | 15.7 | 32.9 | 19.0 | 22.8 |
| Green Ext Time (p_c), s | 0.0 | 0.9 | 0.1 | 1.5 | 0.0 | 4.3 | 0.0 | 1.3 |

| Intersection Summary | |
|---|---|
| HCM 6th Ctrl Delay | 60.7 |
| HCM 6th LOS | E |



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 885 | 95 | 0 | 855 | 130 | 0 | 0 | 0 | 670 | 0 | 255 |
| Future Volume (vph) | 0 | 885 | 95 | 0 | 855 | 130 | 0 | 0 | 0 | 670 | 0 | 255 |
| Ideal Flow (vphpl) | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 |
| Total Lost time (s) | | 4.0 | | | 4.0 | 4.0 | | | | 4.0 | 4.0 | 4.0 |
| Lane Util. Factor | | 0.95 | | | 1.00 | 1.00 | | | | 0.95 | 0.95 | 1.00 |
| Frpb, ped/bikes | | 1.00 | | | 1.00 | 0.97 | | | | 1.00 | 1.00 | 0.97 |
| Flpb, ped/bikes | | 1.00 | | | 1.00 | 1.00 | | | | 1.00 | 1.00 | 1.00 |
| Frt | | 0.99 | | | 1.00 | 0.85 | | | | 1.00 | 1.00 | 0.85 |
| Flt Protected | | 1.00 | | | 1.00 | 1.00 | | | | 0.95 | 0.95 | 1.00 |
| Satd. Flow (prot) | | 3236 | | | 1750 | 1449 | | | | 1564 | 1564 | 1449 |
| Flt Permitted | | 1.00 | | | 1.00 | 1.00 | | | | 0.95 | 0.95 | 1.00 |
| Satd. Flow (perm) | | 3236 | | | 1750 | 1449 | | | | 1564 | 1564 | 1449 |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 0 | 922 | 99 | 0 | 891 | 135 | 0 | 0 | 0 | 698 | 0 | 266 |
| RTOR Reduction (vph) | 0 | 6 | 0 | 0 | 0 | 45 | 0 | 0 | 0 | 0 | 0 | 126 |
| Lane Group Flow (vph) | 0 | 1015 | 0 | 0 | 891 | 90 | 0 | 0 | 0 | 349 | 349 | 140 |
| Confl. Peds. (#/hr) | 2 | | 2 | 2 | | 2 | | | | | | |
| Confl. Bikes (#/hr) | | | 2 | | | 3 | | | | | | 4 |
| Heavy Vehicles (%) | 0% | 1% | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 1% | 0% | 0% |
| Turn Type | | NA | | | NA | Perm | | | | Perm | NA | Perm |
| Protected Phases | | 2 | | | 6 | | | | | | 4 | |
| Permitted Phases | | | | | | 6 | | | | 4 | | 4 |
| Actuated Green, G (s) | | 79.1 | | | 79.1 | 79.1 | | | | 30.9 | 30.9 | 30.9 |
| Effective Green, g (s) | | 80.1 | | | 80.1 | 80.1 | | | | 31.9 | 31.9 | 31.9 |
| Actuated g/C Ratio | | 0.67 | | | 0.67 | 0.67 | | | | 0.27 | 0.27 | 0.27 |
| Clearance Time (s) | | 5.0 | | | 5.0 | 5.0 | | | | 5.0 | 5.0 | 5.0 |
| Vehicle Extension (s) | | 3.5 | | | 4.5 | 4.5 | | | | 3.0 | 3.0 | 3.0 |
| Lane Grp Cap (vph) | | 2160 | | | 1168 | 967 | | | | 415 | 415 | 385 |
| v/s Ratio Prot | | 0.31 | | | c0.51 | | | | | | | |
| v/s Ratio Perm | | | | | | 0.06 | | | | c0.22 | 0.22 | 0.10 |
| v/c Ratio | | 0.47 | | | 0.76 | 0.09 | | | | 0.84 | 0.84 | 0.36 |
| Uniform Delay, d1 | | 9.7 | | | 13.5 | 7.1 | | | | 41.7 | 41.7 | 35.8 |
| Progression Factor | | 1.00 | | | 0.77 | 1.19 | | | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | | 0.7 | | | 4.5 | 0.2 | | | | 14.2 | 14.2 | 0.6 |
| Delay (s) | | 10.4 | | | 15.0 | 8.6 | | | | 55.9 | 55.9 | 36.4 |
| Level of Service | | B | | | B | A | | | | E | E | D |
| Approach Delay (s) | | 10.4 | | | 14.2 | | | 0.0 | | | 50.5 | |
| Approach LOS | | B | | | B | | | A | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 24.5 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.78 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 8.0 |
| Intersection Capacity Utilization | 75.7% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 0 | 885 | 95 | 0 | 855 | 130 | 0 | 0 | 0 | 670 | 0 | 255 |
| Future Volume (veh/h) | 0 | 885 | 95 | 0 | 855 | 130 | 0 | 0 | 0 | 670 | 0 | 255 |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | | | | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | 1.00 | | 0.98 | 1.00 | | 0.98 | | | | 1.00 | | 0.98 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | | 1.00 | 1.00 | 1.00 |
| Work Zone On Approach | | No | | | No | | | | | | No | |
| Adj Sat Flow, veh/h/ln | 0 | 1736 | 1736 | 0 | 1750 | 1750 | | | | 1736 | 1750 | 1750 |
| Adj Flow Rate, veh/h | 0 | 922 | 90 | 0 | 891 | 135 | | | | 454 | 341 | 211 |
| Peak Hour Factor | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | | | | 0.96 | 0.96 | 0.96 |
| Percent Heavy Veh, % | 0 | 1 | 1 | 0 | 0 | 0 | | | | 1 | 0 | 0 |
| Cap, veh/h | 0 | 1699 | 166 | 0 | 981 | 812 | | | | 616 | 373 | 231 |
| Arrive On Green | 0.00 | 0.56 | 0.55 | 0.00 | 1.00 | 1.00 | | | | 0.37 | 0.37 | 0.36 |
| Sat Flow, veh/h | 0 | 3116 | 296 | 0 | 1750 | 1448 | | | | 1654 | 1001 | 619 |
| Grp Volume(v), veh/h | 0 | 502 | 510 | 0 | 891 | 135 | | | | 454 | 0 | 552 |
| Grp Sat Flow(s),veh/h/ln | 0 | 1650 | 1675 | 0 | 1750 | 1448 | | | | 1654 | 0 | 1620 |
| Q Serve(g_s), s | 0.0 | 23.1 | 23.1 | 0.0 | 0.0 | 0.0 | | | | 28.5 | 0.0 | 38.9 |
| Cycle Q Clear(g_c), s | 0.0 | 23.1 | 23.1 | 0.0 | 0.0 | 0.0 | | | | 28.5 | 0.0 | 38.9 |
| Prop In Lane | 0.00 | | 0.18 | 0.00 | | 1.00 | | | | 1.00 | | 0.38 |
| Lane Grp Cap(c), veh/h | 0 | 925 | 939 | 0 | 981 | 812 | | | | 616 | 0 | 604 |
| V/C Ratio(X) | 0.00 | 0.54 | 0.54 | 0.00 | 0.91 | 0.17 | | | | 0.74 | 0.00 | 0.91 |
| Avail Cap(c_a), veh/h | 0 | 925 | 939 | 0 | 981 | 812 | | | | 661 | 0 | 648 |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 2.00 | 2.00 | | | | 1.00 | 1.00 | 1.00 |
| Upstream Filter(I) | 0.00 | 1.00 | 1.00 | 0.00 | 0.81 | 0.81 | | | | 1.00 | 0.00 | 1.00 |
| Uniform Delay (d), s/veh | 0.0 | 16.6 | 16.7 | 0.0 | 0.0 | 0.0 | | | | 32.6 | 0.0 | 36.0 |
| Incr Delay (d2), s/veh | 0.0 | 2.3 | 2.3 | 0.0 | 11.5 | 0.4 | | | | 4.0 | 0.0 | 17.0 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 0.0 | 9.2 | 9.4 | 0.0 | 3.1 | 0.1 | | | | 12.0 | 0.0 | 18.0 |
| Unsig. Movement Delay, s/veh | | | | | | | | | | | | |
| LnGrp Delay(d),s/veh | 0.0 | 18.9 | 19.0 | 0.0 | 11.5 | 0.4 | | | | 36.6 | 0.0 | 53.0 |
| LnGrp LOS | A | B | B | A | B | A | | | | D | A | D |
| Approach Vol, veh/h | | 1012 | | | 1026 | | | | | | 1006 | |
| Approach Delay, s/veh | | 18.9 | | | 10.0 | | | | | | 45.6 | |
| Approach LOS | | B | | | A | | | | | | D | |

| Timer - Assigned Phs | | 2 | | 4 | | 6 | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Phs Duration (G+Y+Rc), s | | 71.3 | | 48.7 | | 71.3 | | | | | | |
| Change Period (Y+Rc), s | | 5.0 | | 5.0 | | 5.0 | | | | | | |
| Max Green Setting (Gmax), s | | 63.0 | | 47.0 | | 63.0 | | | | | | |
| Max Q Clear Time (g_c+I1), s | | 25.1 | | 40.9 | | 2.0 | | | | | | |
| Green Ext Time (p_c), s | | 10.7 | | 2.8 | | 20.0 | | | | | | |

| Intersection Summary | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HCM 6th Ctrl Delay | | | 24.7 | | | | | | | | | |
| HCM 6th LOS | | | C | | | | | | | | | |

**Notes**

User approved volume balancing among the lanes for turning movement.

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 0 | 1285 | 270 | 0 | 860 | 350 | 125 | 0 | 125 | 0 | 0 | 0 |
| Future Volume (veh/h) | 0 | 1285 | 270 | 0 | 860 | 350 | 125 | 0 | 125 | 0 | 0 | 0 |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | |
| Ped-Bike Adj(A_pbT) | 1.00 | | 0.98 | 1.00 | | 1.00 | 1.00 | | 1.00 | | | |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | |
| Work Zone On Approach | | No | | | No | | | No | | | | |
| Adj Sat Flow, veh/h/ln | 0 | 1736 | 1736 | 0 | 1750 | 1723 | 1750 | 0 | 1723 | | | |
| Adj Flow Rate, veh/h | 0 | 1367 | 265 | 0 | 915 | 321 | 133 | 0 | 67 | | | |
| Peak Hour Factor | 0.92 | 0.94 | 0.94 | 0.94 | 0.94 | 0.92 | 0.94 | 0.92 | 0.94 | | | |
| Percent Heavy Veh, % | 0 | 1 | 1 | 0 | 0 | 2 | 0 | 0 | 2 | | | |
| Cap, veh/h | 0 | 1904 | 363 | 0 | 1671 | 584 | 403 | 0 | 353 | | | |
| Arrive On Green | 0.00 | 0.69 | 0.69 | 0.00 | 0.69 | 0.69 | 0.24 | 0.00 | 0.24 | | | |
| Sat Flow, veh/h | 0 | 2839 | 524 | 0 | 2504 | 844 | 1667 | 0 | 1460 | | | |
| Grp Volume(v), veh/h | 0 | 810 | 822 | 0 | 628 | 608 | 133 | 0 | 67 | | | |
| Grp Sat Flow(s),veh/h/ln | 0 | 1650 | 1627 | 0 | 1663 | 1598 | 1667 | 0 | 1460 | | | |
| Q Serve(g_s), s | 0.0 | 35.7 | 37.8 | 0.0 | 22.5 | 22.7 | 7.9 | 0.0 | 4.4 | | | |
| Cycle Q Clear(g_c), s | 0.0 | 35.7 | 37.8 | 0.0 | 22.5 | 22.7 | 7.9 | 0.0 | 4.4 | | | |
| Prop In Lane | 0.00 | | 0.32 | 0.00 | | 0.53 | 1.00 | | 1.00 | | | |
| Lane Grp Cap(c), veh/h | 0 | 1141 | 1126 | 0 | 1150 | 1105 | 403 | 0 | 353 | | | |
| V/C Ratio(X) | 0.00 | 0.71 | 0.73 | 0.00 | 0.55 | 0.55 | 0.33 | 0.00 | 0.19 | | | |
| Avail Cap(c_a), veh/h | 0 | 1141 | 1126 | 0 | 1150 | 1105 | 403 | 0 | 353 | | | |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | |
| Upstream Filter(I) | 0.00 | 0.70 | 0.70 | 0.00 | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | | | |
| Uniform Delay (d), s/veh | 0.0 | 11.2 | 11.5 | 0.0 | 9.2 | 9.2 | 37.5 | 0.0 | 36.2 | | | |
| Incr Delay (d2), s/veh | 0.0 | 2.6 | 3.0 | 0.0 | 1.9 | 2.0 | 2.2 | 0.0 | 1.2 | | | |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | |
| %ile BackOfQ(50%),veh/ln | 0.0 | 12.9 | 13.6 | 0.0 | 8.3 | 8.1 | 3.5 | 0.0 | 1.7 | | | |
| Unsig. Movement Delay, s/veh | | | | | | | | | | | | |
| LnGrp Delay(d),s/veh | 0.0 | 13.8 | 14.5 | 0.0 | 11.0 | 11.2 | 39.7 | 0.0 | 37.4 | | | |
| LnGrp LOS | A | B | B | A | B | B | D | A | D | | | |
| Approach Vol, veh/h | | 1632 | | | 1236 | | | 200 | | | | |
| Approach Delay, s/veh | | 14.2 | | | 11.1 | | | 38.9 | | | | |
| Approach LOS | | B | | | B | | | D | | | | |

| Timer - Assigned Phs | 2 | 4 | 8 |
|---|---|---|---|
| Phs Duration (G+Y+Rc), s | 33.0 | 87.0 | 87.0 |
| Change Period (Y+Rc), s | 4.0 | 4.0 | 4.0 |
| Max Green Setting (Gmax), s | 29.0 | 83.0 | 83.0 |
| Max Q Clear Time (g_c+I1), s | 9.9 | 39.8 | 24.7 |
| Green Ext Time (p_c), s | 0.4 | 16.1 | 10.2 |

| Intersection Summary | |
|---|---|
| HCM 6th Ctrl Delay | 14.5 |
| HCM 6th LOS | B |

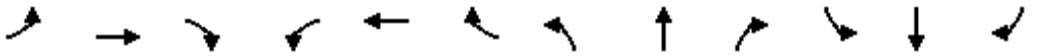
| Intersection | |
|---|---|
| Int Delay, s/veh | 0.5 |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 0 | 760 | 650 | 0 | 1170 | 0 | 0 | 0 | 50 | 0 | 0 | 40 |
| Future Vol, veh/h | 0 | 760 | 650 | 0 | 1170 | 0 | 0 | 0 | 50 | 0 | 0 | 40 |
| Conflicting Peds, #/hr | 2 | 0 | 2 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Free | Free | Stop | Stop | Stop | Stop | Stop | Stop |
| RT Channelized | - | - | None | - | - | None | - | - | Stop | - | - | None |
| Storage Length | - | - | - | - | - | - | - | - | 0 | - | - | 0 |
| Veh in Median Storage, # | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Grade, % | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Peak Hour Factor | 97 | 97 | 97 | 97 | 97 | 97 | 97 | 97 | 97 | 97 | 97 | 97 |
| Heavy Vehicles, % | 3 | 1 | 1 | 0 | 1 | 2 | 0 | 0 | 4 | 33 | 0 | 0 |
| Mvmt Flow | 0 | 784 | 670 | 0 | 1206 | 0 | 0 | 0 | 52 | 0 | 0 | 41 |

| Major/Minor | Major1 | | | Major2 | | | Minor1 | | | Minor2 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Conflicting Flow All | - | 0 | 0 | - | - | 0 | - | - | 729 | - | - | 605 |
| Stage 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| Stage 2 | - | - | - | - | - | - | - | - | - | - | - | - |
| Critical Hdwy | - | - | - | - | - | - | - | - | 6.98 | - | - | 6.9 |
| Critical Hdwy Stg 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| Critical Hdwy Stg 2 | - | - | - | - | - | - | - | - | - | - | - | - |
| Follow-up Hdwy | - | - | - | - | - | - | - | - | 3.34 | - | - | 3.3 |
| Pot Cap-1 Maneuver | 0 | - | - | 0 | - | - | 0 | 0 | 361 | 0 | 0 | 446 |
| Stage 1 | 0 | - | - | 0 | - | - | 0 | 0 | - | 0 | 0 | - |
| Stage 2 | 0 | - | - | 0 | - | - | 0 | 0 | - | 0 | 0 | - |
| Platoon blocked, % | | - | - | | - | - | | | | | | |
| Mov Cap-1 Maneuver | - | - | - | - | - | - | - | - | 360 | - | - | 445 |
| Mov Cap-2 Maneuver | - | - | - | - | - | - | - | - | - | - | - | - |
| Stage 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| Stage 2 | - | - | - | - | - | - | - | - | - | - | - | - |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| HCM Control Delay, s | 0 | 0 | 16.7 | 13.9 |
| HCM LOS | | | C | B |

| Minor Lane/Major Mvmt | NBLn1 | EBT | EBR | WBT | WBR | SBLn1 |
|---|---|---|---|---|---|---|
| Capacity (veh/h) | 360 | - | - | - | - | 445 |
| HCM Lane V/C Ratio | 0.143 | - | - | - | - | 0.093 |
| HCM Control Delay (s) | 16.7 | - | - | - | - | 13.9 |
| HCM Lane LOS | C | - | - | - | - | B |
| HCM 95th %tile Q(veh) | 0.5 | - | - | - | - | 0.3 |

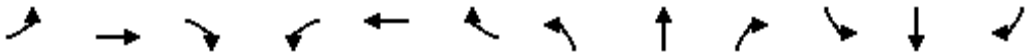


| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 160 | 555 | 85 | 260 | 520 | 190 | 365 | 780 | 275 | 205 | 850 | 195 |
| Future Volume (vph) | 160 | 555 | 85 | 260 | 520 | 190 | 365 | 780 | 275 | 205 | 850 | 195 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 2.0 | | 3.0 | 2.0 | | 3.0 | 2.0 | | 3.0 | 2.0 | 3.0 |
| Lane Util. Factor | 1.00 | 0.95 | | 1.00 | 0.95 | | 1.00 | 0.95 | | 1.00 | 0.95 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 0.99 | | 1.00 | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 0.98 | | 1.00 | 0.96 | | 1.00 | 0.96 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 1787 | 3473 | | 1787 | 3405 | | 1787 | 3380 | | 1787 | 3574 | 1599 |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 1787 | 3473 | | 1787 | 3405 | | 1787 | 3380 | | 1787 | 3574 | 1599 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 160 | 555 | 85 | 260 | 520 | 190 | 365 | 780 | 275 | 205 | 850 | 195 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 160 | 640 | 0 | 260 | 710 | 0 | 365 | 1055 | 0 | 205 | 850 | 195 |
| Confl. Peds. (#/hr) | 1 | | 8 | 8 | | 1 | 6 | | 2 | 2 | | 6 |
| Confl. Bikes (#/hr) | | | 5 | | | 7 | | | 12 | | | 2 |
| Heavy Vehicles (%) | 1% | 1% | 5% | 1% | 1% | 2% | 1% | 2% | 2% | 1% | 1% | 1% |
| Turn Type | Prot | NA | | Prot | NA | | Prot | NA | | Prot | NA | Over |
| Protected Phases | 13 | 8 | | 7 | 14 | | 5 | 12 | | 11 | 6 | 13 |
| Permitted Phases | | | | | | | | | | | | |
| Actuated Green, G (s) | 14.5 | 32.0 | | 15.0 | 32.5 | | 22.0 | 33.6 | | 11.0 | 26.8 | 14.5 |
| Effective Green, g (s) | 16.5 | 35.0 | | 17.0 | 35.5 | | 24.0 | 36.6 | | 13.0 | 29.8 | 16.5 |
| Actuated g/C Ratio | 0.14 | 0.29 | | 0.14 | 0.30 | | 0.20 | 0.31 | | 0.11 | 0.25 | 0.14 |
| Clearance Time (s) | 5.0 | 5.0 | | 5.0 | 5.0 | | 5.0 | 5.0 | | 5.0 | 5.0 | 5.0 |
| Vehicle Extension (s) | 2.5 | 2.5 | | 2.5 | 2.5 | | 2.5 | 4.3 | | 2.5 | 4.3 | 2.5 |
| Lane Grp Cap (vph) | 245 | 1012 | | 253 | 1007 | | 357 | 1030 | | 193 | 887 | 219 |
| v/s Ratio Prot | 0.09 | 0.18 | | c0.15 | c0.21 | | c0.20 | c0.31 | | 0.11 | 0.24 | 0.12 |
| v/s Ratio Perm | | | | | | | | | | | | |
| v/c Ratio | 0.65 | 0.63 | | 1.03 | 0.71 | | 1.02 | 1.02 | | 1.06 | 0.96 | 0.89 |
| Uniform Delay, d1 | 49.0 | 36.9 | | 51.5 | 37.6 | | 48.0 | 41.7 | | 53.5 | 44.5 | 50.9 |
| Progression Factor | 1.12 | 0.80 | | 1.00 | 1.00 | | 1.22 | 0.99 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 4.1 | 0.8 | | 63.9 | 4.1 | | 45.4 | 29.7 | | 82.2 | 21.6 | 32.9 |
| Delay (s) | 59.2 | 30.2 | | 115.4 | 41.7 | | 103.9 | 71.0 | | 135.7 | 66.1 | 83.8 |
| Level of Service | E | C | | F | D | | F | E | | F | E | F |
| Approach Delay (s) | | 36.0 | | | 61.5 | | | 79.5 | | | 80.3 | |
| Approach LOS | | D | | | E | | | E | | | F | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 67.9 | HCM 2000 Level of Service | E |
| HCM 2000 Volume to Capacity ratio | 0.95 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 91.2% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 85 | 345 | 270 | 55 | 25 | 480 | 30 | 855 | 50 | 230 | 940 | 25 |
| Future Volume (vph) | 85 | 345 | 270 | 55 | 25 | 480 | 30 | 855 | 50 | 230 | 940 | 25 |
| Ideal Flow (vphpl) | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 |
| Total Lost time (s) | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | | 2.5 | 2.5 | | 2.5 | 2.5 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 0.98 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 0.86 | | 1.00 | 0.99 | | 1.00 | 1.00 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1646 | 1716 | 1488 | 1630 | 1456 | | 1498 | 3262 | | 1630 | 3291 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1646 | 1716 | 1488 | 1630 | 1456 | | 1498 | 3262 | | 1630 | 3291 | |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 85 | 345 | 270 | 55 | 25 | 480 | 30 | 855 | 50 | 230 | 940 | 25 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 297 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 85 | 345 | 270 | 55 | 208 | 0 | 30 | 905 | 0 | 230 | 965 | 0 |
| Confl. Peds. (#/hr) | 3 | | 1 | 1 | | 3 | | | 2 | 2 | | |
| Confl. Bikes (#/hr) | | | 4 | | | 3 | | | 1 | | | 4 |
| Heavy Vehicles (%) | 1% | 2% | 0% | 2% | 5% | 1% | 11% | 1% | 0% | 2% | 0% | 22% |
| Turn Type | Prot | NA | Over | Prot | NA | | Prot | NA | | Prot | NA | |
| Protected Phases | 13 | 8 | 5 | 7 | 14 | | 5 | 12 | | 11 | 6 | |
| Permitted Phases | | | | | | | | | | | | |
| Actuated Green, G (s) | 6.5 | 28.3 | 22.8 | 5.6 | 23.2 | | 22.8 | 45.6 | | 18.8 | 41.6 | |
| Effective Green, g (s) | 8.0 | 30.3 | 24.8 | 7.1 | 25.2 | | 24.8 | 47.6 | | 20.8 | 43.6 | |
| Actuated g/C Ratio | 0.07 | 0.25 | 0.21 | 0.06 | 0.21 | | 0.21 | 0.40 | | 0.17 | 0.36 | |
| Clearance Time (s) | 4.0 | 4.5 | 4.5 | 4.0 | 4.5 | | 4.5 | 4.5 | | 4.5 | 4.5 | |
| Vehicle Extension (s) | 3.0 | 2.5 | 2.5 | 3.0 | 2.5 | | 2.5 | 4.3 | | 2.5 | 4.3 | |
| Lane Grp Cap (vph) | 109 | 433 | 307 | 96 | 305 | | 309 | 1293 | | 282 | 1195 | |
| v/s Ratio Prot | c0.05 | c0.20 | c0.18 | 0.03 | 0.14 | | 0.02 | c0.28 | | 0.14 | c0.29 | |
| v/s Ratio Perm | | | | | | | | | | | | |
| v/c Ratio | 0.78 | 0.80 | 0.88 | 0.57 | 0.68 | | 0.10 | 0.70 | | 0.82 | 0.81 | |
| Uniform Delay, d1 | 55.1 | 42.0 | 46.2 | 55.0 | 43.7 | | 38.5 | 30.2 | | 47.8 | 34.4 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.06 | 1.02 | |
| Incremental Delay, d2 | 28.9 | 9.5 | 23.5 | 8.0 | 5.6 | | 0.1 | 3.2 | | 6.6 | 2.3 | |
| Delay (s) | 84.0 | 51.5 | 69.6 | 63.0 | 49.3 | | 38.6 | 33.4 | | 57.0 | 37.3 | |
| Level of Service | F | D | E | E | D | | D | C | | E | D | |
| Approach Delay (s) | | 62.4 | | | 50.7 | | | 33.6 | | | 41.1 | |
| Approach LOS | | E | | | D | | | C | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 45.0 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.84 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 93.6% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 160 | 555 | 85 | 260 | 520 | 190 | 365 | 780 | 275 | 205 | 850 | 195 |
| Future Volume (vph) | 160 | 555 | 85 | 260 | 520 | 190 | 365 | 780 | 275 | 205 | 850 | 195 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 2.0 | | 3.0 | 2.0 | | 3.0 | 2.0 | | 3.0 | 2.0 | |
| Lane Util. Factor | 1.00 | 0.95 | | 1.00 | 0.95 | | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 0.99 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.98 | | 1.00 | 0.96 | | 1.00 | 0.96 | | 1.00 | 0.97 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1787 | 3473 | | 1787 | 3405 | | 1787 | 3380 | | 1787 | 3460 | |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1787 | 3473 | | 1787 | 3405 | | 1787 | 3380 | | 1787 | 3460 | |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 160 | 555 | 85 | 260 | 520 | 190 | 365 | 780 | 275 | 205 | 850 | 195 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 160 | 640 | 0 | 260 | 710 | 0 | 365 | 1055 | 0 | 205 | 1045 | 0 |
| Confl. Peds. (#/hr) | 1 | | 8 | 8 | | 1 | 6 | | 2 | 2 | | 6 |
| Confl. Bikes (#/hr) | | | 5 | | | 7 | | | 12 | | | 2 |
| Heavy Vehicles (%) | 1% | 1% | 5% | 1% | 1% | 2% | 1% | 2% | 2% | 1% | 1% | 1% |
| Turn Type | Prot | NA | | Prot | NA | | Prot | NA | | Prot | NA | |
| Protected Phases | 13 | 8 | | 7 | 14 | | 5 | 12 | | 11 | 6 | |
| Permitted Phases | | | | | | | | | | | | |
| Actuated Green, G (s) | 11.6 | 32.0 | | 14.0 | 34.0 | | 21.0 | 33.6 | | 12.0 | 28.8 | |
| Effective Green, g (s) | 13.6 | 35.0 | | 16.0 | 37.0 | | 23.0 | 36.6 | | 14.0 | 31.8 | |
| Actuated g/C Ratio | 0.11 | 0.29 | | 0.13 | 0.31 | | 0.19 | 0.31 | | 0.12 | 0.27 | |
| Clearance Time (s) | 5.0 | 5.0 | | 5.0 | 5.0 | | 5.0 | 5.0 | | 5.0 | 5.0 | |
| Vehicle Extension (s) | 2.5 | 2.5 | | 2.5 | 2.5 | | 2.5 | 4.3 | | 2.5 | 4.3 | |
| Lane Grp Cap (vph) | 202 | 1012 | | 238 | 1049 | | 342 | 1030 | | 208 | 916 | |
| v/s Ratio Prot | 0.09 | 0.18 | | c0.15 | c0.21 | | c0.20 | 0.31 | | 0.11 | c0.30 | |
| v/s Ratio Perm | | | | | | | | | | | | |
| v/c Ratio | 0.79 | 0.63 | | 1.09 | 0.68 | | 1.07 | 1.02 | | 0.99 | 1.14 | |
| Uniform Delay, d1 | 51.8 | 36.9 | | 52.0 | 36.3 | | 48.5 | 41.7 | | 52.9 | 44.1 | |
| Progression Factor | 1.13 | 0.81 | | 1.00 | 1.00 | | 1.22 | 0.95 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 14.1 | 0.8 | | 85.2 | 3.5 | | 59.6 | 29.7 | | 57.8 | 76.6 | |
| Delay (s) | 72.5 | 30.6 | | 137.2 | 39.8 | | 118.6 | 69.3 | | 110.7 | 120.7 | |
| Level of Service | E | C | | F | D | | F | E | | F | F | |
| Approach Delay (s) | | 39.0 | | | 65.9 | | | 82.0 | | | 119.0 | |
| Approach LOS | | D | | | E | | | F | | | F | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 81.1 | HCM 2000 Level of Service | F |
| HCM 2000 Volume to Capacity ratio | 0.96 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 97.6% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

# MOVEMENT SUMMARY

## Site: 101 [Reed Market Road/3rdSt - Original Vols - Slip Lanes (Site Folder: Post-Workshop Testing)]

New Site
Site Category: (None)
Roundabout

**Vehicle Movement Performance**

| Mov ID | Turn | INPUT VOLUMES [ Total veh/h | HV ] % | DEMAND FLOWS [ Total veh/h | HV ] % | Deg. Satn v/c | Aver. Delay sec | Level of Service | 95% BACK OF QUEUE [ Veh. veh | Dist ] m | Prop. Que | Effective Stop Rate | Aver. No. Cycles | Aver. Speed km/h |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| South: SE 3rd St | | | | | | | | | | | | | | |
| 1 | L2 | 365 | 1.0 | 365 | 1.0 | 1.033 | 103.4 | LOS F | 30.0 | 218.5 | 1.00 | 2.80 | 6.48 | 21.3 |
| 2 | T1 | 780 | 12.0 | 780 | 12.0 | 1.033 | 103.5 | LOS F | 30.2 | 233.5 | 1.00 | 2.93 | 6.69 | 21.7 |
| 3 | R2 | 275 | 2.0 | 275 | 2.0 | 0.379 | 9.8 | LOS A | 1.7 | 12.4 | 0.65 | 0.64 | 0.79 | 46.3 |
| Approach | | 1420 | 7.2 | 1420 | 7.2 | 1.033 | 85.4 | LOS F | 30.2 | 233.5 | 0.93 | 2.45 | 5.50 | 24.0 |
| East: Reed Market Road | | | | | | | | | | | | | | |
| 4 | L2 | 260 | 1.0 | 260 | 1.0 | 1.012 | 99.2 | LOS F | 19.3 | 136.5 | 1.00 | 2.30 | 5.51 | 21.9 |
| 5 | T1 | 600 | 1.0 | 600 | 1.0 | 1.012 | 99.3 | LOS F | 19.3 | 136.5 | 1.00 | 2.30 | 5.51 | 22.1 |
| 6 | R2 | 110 | 2.0 | 110 | 2.0 | 1.012 | 99.6 | LOS F | 19.3 | 136.3 | 1.00 | 2.30 | 5.51 | 22.1 |
| Approach | | 970 | 1.1 | 970 | 1.1 | 1.012 | 99.3 | LOS F | 19.3 | 136.5 | 1.00 | 2.30 | 5.51 | 22.1 |
| North: SE 3rd St | | | | | | | | | | | | | | |
| 7 | L2 | 205 | 1.0 | 205 | 1.0 | 1.007 | 92.4 | LOS F | 21.0 | 148.0 | 1.00 | 2.78 | 5.58 | 20.1 |
| 8 | T1 | 850 | 1.0 | 850 | 1.0 | 1.007 | 92.4 | LOS F | 21.0 | 148.0 | 1.00 | 2.78 | 5.58 | 20.2 |
| 9 | R2 | 195 | 1.0 | 195 | 1.0 | 0.305 | 9.6 | LOS A | 1.1 | 7.7 | 0.61 | 0.64 | 0.68 | 35.9 |
| Approach | | 1250 | 1.0 | 1250 | 1.0 | 1.007 | 79.5 | LOS F | 21.0 | 148.0 | 0.94 | 2.44 | 4.82 | 21.6 |
| West: Reed Market Road | | | | | | | | | | | | | | |
| 10 | L2 | 160 | 1.0 | 160 | 1.0 | 0.832 | 42.0 | LOS E | 5.9 | 41.9 | 0.91 | 1.25 | 2.07 | 32.7 |
| 11 | T1 | 555 | 1.0 | 555 | 1.0 | 0.832 | 42.1 | LOS E | 5.9 | 41.9 | 0.91 | 1.25 | 2.07 | 33.2 |
| 12 | R2 | 85 | 5.0 | 85 | 5.0 | 0.832 | 43.3 | LOS E | 5.9 | 41.7 | 0.91 | 1.25 | 2.08 | 33.2 |
| Approach | | 800 | 1.4 | 800 | 1.4 | 0.832 | 42.2 | LOS E | 5.9 | 41.9 | 0.91 | 1.25 | 2.07 | 33.1 |
| All Vehicles | | 4440 | 3.1 | 4440 | 3.1 | 1.033 | 79.0 | LOS F | 30.2 | 233.5 | 0.95 | 2.20 | 4.69 | 24.0 |

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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Organisation: DKS ASSOCIATES | Licence: PLUS / Enterprise | Processed: Tuesday, January 17, 2023 8:03:09 AM
Project: X:\Projects\2022\P22129-001 (ODOT US97 at Reed Market Ops & Safety Study)\Analysis\Sidra\ReedMarketRoad_BrookswoodBlvd_ADB Review_9.1.sip9

# HCS Roundabouts Report

## General Information

| | |
|---|---|
| Analyst | |
| Agency or Co. | |
| Date Performed | 3/21/2023 |
| Analysis Year | 2040 |
| Time Analyzed | |
| Project Description | No Build |

## Site Information

| | |
|---|---|
| Intersection | Reed Market & Bond/Brook... |
| E/W Street Name | Reed Market |
| N/S Street Name | Bond/Brookswood |
| Analysis Time Period, hrs | 0.25 |
| Peak Hour Factor | 0.92 |
| Jurisdiction | |

## Volume Adjustments and Site Characteristics

| Approach | EB | | | | WB | | | | NB | | | | SB | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Movement | U | L | T | R | U | L | T | R | U | L | T | R | U | L | T | R |
| Number of Lanes (N) | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 |
| Lane Assignment | | | LTR | | | | LTR | | | | LTR | | | | LTR | |
| Volume (V), veh/h | 0 | 65 | 445 | 210 | 0 | 70 | 360 | 425 | 0 | 195 | 470 | 70 | 0 | 395 | 470 | 70 |
| Percent Heavy Vehicles, % | 5 | 5 | 5 | 5 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 |
| Flow Rate ($v_{PCE}$), pc/h | 0 | 74 | 508 | 240 | 0 | 78 | 403 | 476 | 0 | 218 | 526 | 78 | 0 | 438 | 521 | 78 |
| Right-Turn Bypass | None | | | | None | | | | None | | | | None | | | |
| Conflicting Lanes | 1 | | | | 1 | | | | 1 | | | | 1 | | | |
| Pedestrians Crossing, p/h | 0 | | | | 0 | | | | 0 | | | | 0 | | | |
| Proportion of CAVs | 0 | | | | | | | | | | | | | | | |

## Critical and Follow-Up Headway Adjustment

| Approach | EB | | | WB | | | NB | | | SB | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane | Left | Right | Bypass | Left | Right | Bypass | Left | Right | Bypass | Left | Right | Bypass |
| Critical Headway, s | | 4.9763 | | | 4.9763 | | | 4.9763 | | | 4.9763 | |
| Follow-Up Headway, s | | 2.6087 | | | 2.6087 | | | 2.6087 | | | 2.6087 | |

## Flow Computations, Capacity and v/c Ratios

| Approach | EB | | | WB | | | NB | | | SB | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane | Left | Right | Bypass | Left | Right | Bypass | Left | Right | Bypass | Left | Right | Bypass |
| Entry Flow ($v_e$), pc/h | | 822 | | | 957 | | | 822 | | | 1037 | |
| Entry Volume, veh/h | | 783 | | | 929 | | | 798 | | | 1017 | |
| Circulating Flow ($v_c$), pc/h | 1037 | | | 818 | | | 1020 | | | 699 | | |
| Exiting Flow ($v_{ex}$), pc/h | 1024 | | | 699 | | | 1076 | | | 839 | | |
| Capacity ($c_{pce}$), pc/h | | 479 | | | 599 | | | 488 | | | 676 | |
| Capacity (c), veh/h | | 456 | | | 582 | | | 473 | | | 663 | |
| v/c Ratio (x) | | 1.72 | | | 1.60 | | | 1.69 | | | 1.53 | |

## Delay and Level of Service

| Approach | EB | | | WB | | | NB | | | SB | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane | Left | Right | Bypass | Left | Right | Bypass | Left | Right | Bypass | Left | Right | Bypass |
| Lane Control Delay (d), s/veh | | 352.7 | | | 295.6 | | | 338.9 | | | 265.0 | |
| Lane LOS | | F | | | F | | | F | | | F | |
| 95% Queue, veh | | 47.0 | | | 50.4 | | | 47.0 | | | 51.6 | |
| Approach Delay, s/veh \| LOS | 352.7 | F | | 295.6 | F | | 338.9 | F | | 265.0 | F | |
| Intersection Delay, s/veh \| LOS | 309.3 | | | | | | F | | | | | |

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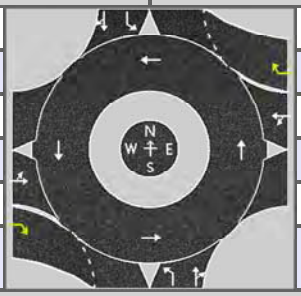
# HCS Roundabouts Report

## General Information

| | |
|---|---|
| Analyst | |
| Agency or Co. | |
| Date Performed | 3/21/2023 |
| Analysis Year | 2040 |
| Time Analyzed | |
| Project Description | Build |



## Site Information

| | |
|---|---|
| Intersection | Reed Market & Bond/Brook... |
| E/W Street Name | Reed Market |
| N/S Street Name | Bond/Brookswood |
| Analysis Time Period, hrs | 0.25 |
| Peak Hour Factor | 0.92 |
| Jurisdiction | |

## Volume Adjustments and Site Characteristics

| Approach | EB | | | | WB | | | | NB | | | | SB | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Movement | U | L | T | R | U | L | T | R | U | L | T | R | U | L | T | R |
| Number of Lanes (N) | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 |
| Lane Assignment | | | LT | | | | LT | | L | | TR | | L | | TR | |
| Volume (V), veh/h | 0 | 65 | 445 | 210 | 0 | 70 | 360 | 425 | 0 | 195 | 470 | 70 | 0 | 395 | 470 | 70 |
| Percent Heavy Vehicles, % | 5 | 5 | 5 | 5 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 |
| Flow Rate ($v_{PCE}$), pc/h | 0 | 74 | 508 | 240 | 0 | 78 | 403 | 476 | 0 | 218 | 526 | 78 | 0 | 438 | 521 | 78 |
| Right-Turn Bypass | Yielding | | | | Yielding | | | | None | | | | None | | | |
| Conflicting Lanes | 1 | | | | 1 | | | | 1 | | | | 1 | | | |
| Pedestrians Crossing, p/h | 0 | | | | 0 | | | | 0 | | | | 0 | | | |
| Proportion of CAVs | 0 | | | | | | | | | | | | | | | |

## Critical and Follow-Up Headway Adjustment

| Approach | EB | | | WB | | | NB | | | SB | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane | Left | Right | Bypass | Left | Right | Bypass | Left | Right | Bypass | Left | Right | Bypass |
| Critical Headway, s | | 4.9763 | 4.9763 | | 4.9763 | 4.9763 | 4.5436 | 4.5436 | | 4.5436 | 4.5436 | |
| Follow-Up Headway, s | | 2.6087 | 2.6087 | | 2.6087 | 2.6087 | 2.5352 | 2.5352 | | 2.5352 | 2.5352 | |

## Flow Computations, Capacity and v/c Ratios

| Approach | EB | | | WB | | | NB | | | SB | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane | Left | Right | Bypass | Left | Right | Bypass | Left | Right | Bypass | Left | Right | Bypass |
| Entry Flow ($v_e$), pc/h | | 582 | 240 | | 481 | 476 | 218 | 604 | | 438 | 599 | |
| Entry Volume, veh/h | | 554 | 229 | | 467 | 462 | 212 | 586 | | 429 | 587 | |
| Circulating Flow ($v_c$), pc/h | 1037 | | | 818 | | | 1020 | | | 699 | | |
| Exiting Flow ($v_{ex}$), pc/h | 1024 | | | 699 | | | 600 | | | 599 | | |
| Capacity ($c_{pce}$), pc/h | | 479 | 749 | | 599 | 748 | 561 | 561 | | 752 | 752 | |
| Capacity (c), veh/h | | 456 | 713 | | 582 | 727 | 545 | 545 | | 737 | 737 | |
| v/c Ratio (x) | | 1.21 | 0.32 | | 0.80 | 0.64 | 0.39 | 1.08 | | 0.58 | 0.80 | |

## Delay and Level of Service

| Approach | EB | | | WB | | | NB | | | SB | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane | Left | Right | Bypass | Left | Right | Bypass | Left | Right | Bypass | Left | Right | Bypass |
| Lane Control Delay (d), s/veh | | 142.7 | 9.0 | | 30.7 | 16.4 | 12.7 | 87.8 | | 14.4 | 25.1 | |
| Lane LOS | | F | A | | D | C | B | F | | B | D | |
| 95% Queue, veh | | 21.8 | 1.4 | | 7.9 | 4.6 | 1.8 | 17.6 | | 3.8 | 8.2 | |
| Approach Delay, s/veh \| LOS | 103.6 | F | | 23.6 | C | | 67.9 | F | | 20.6 | C | |
| Intersection Delay, s/veh \| LOS | 50.5 | | | | | | F | | | | | |

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# APPENDIX C: ALTERNATIVE COST ESTIMATES

**REED MARKET ROAD/US 97 SOUTHBOUND RAMP TERMINAL – ALTERNATIVE 1**

## Description of Alternative

Add SB right turn lane at SB ramp terminal. General intersection improvements

| Item | Qty | Unit | Unit Cost | Total | Notes |
|---|---|---|---|---|---|
| Asphalt | 5,584 | *TON* | $ 140.00 | $ 781,761.75 | *Includes asphalt (11 inches)* |
| Aggregate Base | 4,512 | *TON* | $ 40.00 | $ 180,493.33 | *Assume 12"* |
| Concrete Curb, Standard | 2,590 | *FOOT* | $ 45.00 | $ 116,550.00 | *assume mountable/standard the same (same cost)* |
| Concrete Islands | - | *SQFT* | $ 20.00 | $ - | |
| Concrete Walks | 14,758 | *SQFT* | $ 18.00 | $ 265,644.00 | *Includes sidewalk and aggregate base* |
| Curb Ramps | 6 | *EACH* | $ 5,000.00 | $ 30,000.00 | |
| Sound Wall | 5,230 | *SQFT* | $ 70.00 | $ 366,100.00 | *Assume 10' high sound wall* |
| Signal | 1 | *EACH* | $ 425,000.00 | $ 425,000.00 | *assume all new signal equipment* |
| **Subtotal** | | | | **$ 2,165,549** | |
| *Permanent Striping/Signing* | | | 5% | $ 108,277 | *Bicycle markers, arrows, lane striping, pavement bar* |
| *Drainage and Sewers* | | | 5% | $ 108,277 | |
| *Landscaping* | | | 5% | $ 108,277 | |
| *Temporary Traffic Control* | | | 10% | $ 216,555 | |
| *Illumination* | | | 10% | $ 216,555 | |
| *Erosion Control* | | | 2% | $ 43,310.98 | |
| *Site Preparation* | | | 2% | $ 43,310.98 | *Includes pavement removal, clearing and grubbing, removal of obstacles* |
| *Construction Survey Work* | | | 2% | $ 43,311 | |
| **Construction Subtotal** | | | | **$ 3,053,424** | |
| ***Design & Construction Management*** | | | 25% | $ 763,356 | |
| ***Mobilization*** | | | 10% | $ 305,342 | |
| ***ROW*** | 1 | *EACH* | $ 50,000 | $ 50,000 | *Estimate for empty parcel* |
| ***Contingency*** | | | 50% | $ 1,526,712 | |
| **Total** | | | | **$ 5,698,835** | |

$$\left[\frac{11\text{in}}{12in} \times xft^2\right]\left[\frac{1yd^3}{27ft^3}\right]\frac{2.025\text{ tons}}{1yd^3}$$

**REED MARKET ROAD/US 97 SOUTHBOUND RAMP TERMINAL – ALTERNATIVE 2**

## Description of Alternative

Shift SB 97 alignment towards NB 97 to provide room to extend deceleration lane. Install jersey barrier in median of 97.

| Item | Qty | Unit | Unit Cost | Total | Notes |
|---|---|---|---|---|---|
| Asphalt | 4,087 | *TON* | $ 140.00 | $ 572,138.88 | *Includes asphalt (11 inches)* |
| Aggregate Base | 3,302 | *TON* | $ 40.00 | $ 132,095.56 | *Assume 12"* |
| Concrete Curb, Standard | 1,162 | *FOOT* | $ 45.00 | $ 52,290.00 | *assume mountable/standard the same (same cost)* |
| Concrete Islands | - | *SQFT* | $ 20.00 | $ - | |
| Concrete Walks | 2,290 | *SQFT* | $ 18.00 | $ 41,220.00 | *Includes sidewalk and aggregate base* |
| Barrier | 1,162 | *FOOT* | $ 60.00 | $ 69,720.00 | |
| Signal | - | *EACH* | $ 425,000.00 | $ - | *assume all new signal equipment* |
| **Subtotal** | | | | **$ 867,464** | |
| *Permanent Striping/Signing* | | | 5% | $ 43,373 | *Bicycle markers, arrows, lane striping, pavement bar* |
| *Drainage and Sewers* | | | 5% | $ 43,373 | |
| *Landscaping* | | | 5% | $ 43,373 | |
| *Temporary Traffic Control* | | | 15% | $ 130,120 | |
| *Illumination* | | | 10% | $ 86,746 | |
| *Erosion Control* | | | 2% | $ 17,349.29 | |
| *Site Preparation* | | | 2% | $ 17,349.29 | *Includes pavement removal, clearing and grubbing, removal of obstacles* |
| *Construction Survey Work* | | | 2% | $ 17,349 | |
| **Construction Subtotal** | | | | **$ 1,266,498** | |
| ***Design & Construction Management*** | | | 25% | $ 316,625 | |
| ***Mobilization*** | | | 10% | $ 126,650 | |
| ***ROW*** | | | 0% | $ - | *Assume ROW is owned by ODOT (not impacting soundwall)* |
| ***Contingency*** | | | 50% | $ 633,249 | |
| **Total** | | | | **$ 2,343,021** | |

**REED MARKET ROAD/US 97 NORTHBOUND RAMP TERMINAL/DIVISION STREET – ALTERNATIVE 1**

## Description of Alternative

Signalize the NB 97 Ramp at Reed Market Road

| Item | Qty | Unit | Unit Cost | Total | Notes |
|---|---|---|---|---|---|
| Asphalt | 4,518 | *TON* | $ 140.00 | $ 632,545.38 | *Includes asphalt (11 inches)* |
| Aggregate Base | 3,651 | *TON* | $ 40.00 | $ 146,042.22 | *Assume 12"* |
| Concrete Curb, Standard | 1,922 | *FOOT* | $ 45.00 | $ 86,490.00 | *assume mountable/standard the same (same cost)* |
| Concrete Islands | 603 | *SQFT* | $ 20.00 | $ 12,060.00 | |
| Concrete Walks | 10,785 | *SQFT* | $ 18.00 | $ 194,130.00 | *Includes sidewalk and aggregate base* |
| Curb Ramps | 4 | *EACH* | $ 5,000.00 | $ 20,000.00 | |
| Signal | 1 | *EACH* | $ 425,000.00 | $ 425,000.00 | *assume all new signal equipment* |
| **Subtotal** | | | | **$ 1,516,267.60** | |
| *Permanent Striping/Signing* | | | 5% | $ 75,813.38 | *Bicycle markers, arrows, lane striping, pavement bar* |
| *Drainage and Sewers* | | | 5% | $ 75,813.38 | |
| *Landscaping* | | | 5% | $ 75,813.38 | |
| *Temporary Traffic Control* | | | 10% | $ 151,626.76 | |
| *Illumination* | | | 10% | $ 151,626.76 | |
| *Erosion Control* | | | 2% | $ 30,325.35 | |
| *Site Preparation* | | | 2% | $ 30,325.35 | *Includes pavement removal, clearing and grubbing, removal of obstacles* |
| *Construction Survey Work* | | | 2% | $ 30,325.35 | |
| **Construction Subtotal** | | | | **$ 2,137,937.31** | |
| ***Design & Construction Management*** | | | 25% | $ 534,484.33 | |
| ***Mobilization*** | | | 10% | $ 213,793.73 | |
| ***ROW*** | | | | $ - | |
| ***Contingency*** | | | 50% | $ 1,068,968.66 | |
| **Total** | | | | **$ 3,955,184.03** | |

**REED MARKET ROAD/US 97 NORTHBOUND RAMP TERMINAL/DIVISION STREET – ALTERNATIVE 2**

## Description of Alternative

Realign the NB ramp from Division to the current NB ramp terminal. Signalize the NB ramp terminal

| Item | Qty | Unit | Unit Cost | Total | Notes |
|---|---|---|---|---|---|
| Aggregate Base | 5,273 | *TON* | $ 40.00 | $ 210,931.11 | *Assume 12"* |
| Full Depth Asphalt | 6,526 | *TON* | $ 140.00 | $ 913,595.38 | *Includes asphalt (11 inches)* |
| Concrete Curb, Standard | 1,920 | *FOOT* | $ 45.00 | $ 86,400.00 | *assume mountable/standard the same (same cost)* |
| Concrete Islands | 603 | *SQFT* | $ 20.00 | $ 12,060.00 | |
| Concrete Walks | 10,719 | *SQFT* | $ 18.00 | $ 192,942.00 | *Includes sidewalk and aggregate base* |
| Curb Ramps | 4 | *EACH* | $ 5,000.00 | $ 20,000.00 | |
| Signal | 1 | *EACH* | $ 425,000.00 | $ 425,000.00 | *assume all new signal equipment* |
| Gas Station Remediation | 1 | *EACH* | $ 600,000.00 | $ 600,000.00 | *Includes hazmat, tank removal, testing* |
| **Subtotal** | | | | **$ 2,460,928.49** | |
| *Permanent Striping/Signing* | | | 5% | $ 123,046.42 | *Bicycle markers, arrows, lane striping, pavement bar* |
| *Drainage and Sewers* | | | 5% | $ 123,046.42 | |
| *Landscaping* | | | 5% | $ 123,046.42 | |
| *Temporary Traffic Control* | | | 10% | $ 246,092.85 | |
| *Illumination* | | | 10% | $ 246,092.85 | |
| *Erosion Control* | | | 2% | $ 49,218.57 | |
| *Site Preparation* | | | 2% | $ 49,218.57 | *Includes pavement removal, clearing and grubbing, removal of obstacles* |
| *Construction Survey Work* | | | 2% | $ 49,218.57 | |
| **Construction Subtotal** | | | | **$ 3,469,909.17** | |
| ***Design & Construction Management*** | | | 25% | $ 867,477.29 | |
| ***ROW*** | 1 | *EACH* | $ 3,000,000 | $ 3,000,000.00 | *Based on Deschutes County DIAL real market value* |
| ***Mobilization*** | | | 10% | $ 346,990.92 | |
| ***Contingency*** | | | 50% | $ 1,734,954.58 | |
| **Total** | | | | **$ 9,419,331.96** | |

$$\left[\frac{11\text{in}}{12in} \times xft^2\right]\left[\frac{1yd^3}{27ft^3}\right]\frac{2.025\text{ tons}}{1yd^3}$$

**REED MARKET ROAD/3RD STREET – ALTERNATIVE 1**

## Description of Alternative

Adds left turn lanes to Reed Market Road at 3rd Street intersection.

| Item | Qty | Unit | Unit Cost | Total | Notes |
|---|---|---|---|---|---|
| Asphalt | 8,022 | *TON* | $ 140.00 | $ 1,123,025.75 | *Includes asphalt (11 inches)* |
| Aggregate Base | 6,482 | *TON* | $ 40.00 | $ 259,284.44 | *Assume 12"* |
| Concrete Curb, Standard | 3,120 | *FOOT* | $ 45.00 | $ 140,400.00 | *assume mountable/standard the same (same cost)* |
| Concrete Islands | - | *SQFT* | $ 20.00 | $ - | |
| Concrete Walks | 17,036 | *SQFT* | $ 18.00 | $ 306,648.00 | *Includes sidewalk and aggregate base* |
| Curb Ramps | 8 | *EACH* | $ 5,000.00 | $ 40,000.00 | |
| Signal | 1 | *EACH* | $ 425,000.00 | $ 425,000.00 | *assume all new signal equipment* |
| **Subtotal** | | | | **$ 2,294,358.19** | |
| *Permanent Striping/Signing* | | | 5% | $ 114,717.91 | *Bicycle markers, arrows, lane striping, pavement bar* |
| *Drainage and Sewers* | | | 5% | $ 114,717.91 | |
| *Landscaping* | | | 5% | $ 114,717.91 | |
| *Temporary Traffic Control* | | | 10% | $ 229,435.82 | |
| *Illumination* | | | 10% | $ 229,435.82 | |
| *Erosion Control* | | | 2% | $ 45,887.16 | |
| *Site Preparation* | | | 2% | $ 45,887.16 | *Includes pavement removal, clearing and grubbing, removal of obstacles* |
| *Construction Survey Work* | | | 2% | $ 45,887.16 | |
| **Construction Subtotal** | | | | **$ 3,235,045.05** | |
| ***Design & Construction Management*** | | | 25% | $ 808,761.26 | |
| ***Mobilization*** | | | 10% | $ 323,504.51 | |
| ***ROW*** | 1 | EACH | $ 1,000,000 | $ 1,000,000.00 | *Estimate scaled from ODOT estimate for Alt 2* |
| ***Contingency*** | | | 50% | $ 1,617,522.53 | |
| **Total** | | | | **$ 6,984,833.35** | |

**REED MARKET ROAD/3RD STREET – ALTERNATIVE 2**

## Description of Alternative

Create protected intersection at Reed Market/3rd Street Intersection. Realign 3rd street to avoid impacts to SE corner of intersection. Add left turn lanes to Reed Market Rd and southbound right turn lane to 3rd Street

| Item | Qty | Unit | Unit Cost | Total | Notes |
|---|---|---|---|---|---|
| Asphalt | 10,142 | *TON* | $ 140.00 | $ 1,419,812.63 | *Includes asphalt (11 inches)* |
| Aggregate Base | 4,512 | *TON* | $ 40.00 | $ 180,493.33 | *Assume 12"* |
| Concrete Curb, Standard | 4,150 | *FOOT* | $ 45.00 | $ 186,750.00 | *assume mountable/standard the same (same cost)* |
| Concrete Islands | 4,349 | *SQFT* | $ 20.00 | $ 86,980.00 | *Assumes islands and truck apron square footage* |
| Concrete Walks | 24,002 | *SQFT* | $ 18.00 | $ 432,036.00 | *Includes sidewalk and aggregate base* |
| Curb Ramps | 8 | *EACH* | $ 5,000.00 | $ 40,000.00 | |
| Green Bicycle Paint at Intersection | 7,008 | *SQFT* | $ 2.00 | $ 14,016.00 | |
| Signal | 1 | *EACH* | $ 425,000.00 | $ 425,000.00 | *assume all new signal equipment* |
| **Subtotal** | | | | **$ 2,785,087.96** | |
| *Permanent Striping/Signing* | | | 5% | $ 139,254.40 | *Bicycle markers, arrows, lane striping, pavement bar* |
| *Drainage and Sewers* | | | 5% | $ 139,254.40 | |
| *Landscaping* | | | 5% | $ 139,254.40 | |
| *Temporary Traffic Control* | | | 10% | $ 278,508.80 | |
| *Illumination* | | | 10% | $ 278,508.80 | |
| *Erosion Control* | | | 2% | $ 55,701.76 | |
| *Site Preparation* | | | 2% | $ 55,701.76 | *Includes pavement removal, clearing and grubbing, removal of obstacles* |
| *Construction Survey Work* | | | 2% | $ 55,701.76 | |
| **Construction Subtotal** | | | | **$ 3,926,974.02** | |
| ***Design & Construction Management*** | | | 25% | $ 981,743.51 | |
| ***Mobilization*** | | | 10% | $ 392,697.40 | |
| ***ROW*** | 1 | EACH | $ 3,000,000 | $ 3,000,000.00 | *Per ODOT ROW estimate* |
| ***Contingency*** | | | 50% | $ 1,963,487.01 | |
| **Total** | | | | **$ 10,264,901.94** | |

**REED MARKET ROAD/3RD STREET – ALTERNATIVE 3**

## Description of Alternative

Convert signalized intersection at 3rd and Reed Market to a 2 lane roundabout with right turn bypass lanes for the northbound and southbound right turns.

| Item | Qty | Unit | Unit Cost | Total | Notes |
|---|---|---|---|---|---|
| Asphalt | 8,012 | *TON* | $ 140.00 | $ 1,121,639.75 | *Includes asphalt (11 inches)* |
| Aggregate Base | 6,474 | *TON* | $ 40.00 | $ 258,964.44 | *Assume 12"* |
| Concrete Curb, Standard | 3,549 | *FOOT* | $ 45.00 | $ 159,705.00 | *assume mountable/standard the same (same cost)* |
| Concrete Islands | 2,765 | *SQFT* | $ 20.00 | $ 55,300.00 | |
| Concrete Walks | 32,678 | *SQFT* | $ 18.00 | $ 588,204.00 | *Includes sidewalk and aggregate base* |
| Curb Ramps | 8 | *EACH* | $ 5,000.00 | $ 40,000.00 | |
| RRFB | 4 | *EACH* | $ 75,000.00 | $ 300,000.00 | |
| Signal | - | *EACH* | $ 425,000.00 | $ - | *assume all new signal equipment* |
| **Subtotal** | | | | **$ 2,523,813.19** | |
| *Permanent Striping/Signing* | | | 5% | $ 126,190.66 | *Bicycle markers, arrows, lane striping, pavement bar* |
| *Drainage and Sewers* | | | 5% | $ 126,190.66 | |
| *Landscaping* | | | 5% | $ 126,190.66 | |
| *Temporary Traffic Control* | | | 15% | $ 378,571.98 | |
| *Illumination* | | | 10% | $ 252,381.32 | |
| *Erosion Control* | | | 2% | $ 50,476.26 | |
| *Site Preparation* | | | 2% | $ 50,476.26 | *Includes pavement removal, clearing and grubbing, removal of obstacles* |
| *Construction Survey Work* | | | 2% | $ 50,476.26 | |
| **Construction Subtotal** | | | | **$ 3,684,767.26** | |
| ***Design & Construction Management*** | | | 25% | $ 921,191.82 | |
| ***Mobilization*** | | | 10% | $ 368,476.73 | |
| ***ROW*** | 1 | EACH | $ 4,000,000.00 | $ 4,000,000.00 | *Per ODOT ROW estimate* |
| ***Contingency*** | | | 50% | $ 1,842,383.63 | |
| **Total** | | | | **$ 10,816,819.44** | |

# APPENDIX D: REED MARKET ROAD/BROOKSWOOD BOULEVARD SIMULATION MODEL DEVELOPMENT AND CALIBRATION MEMORANDUM

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P 541.312.8300

# TECHNICAL MEMORANDUM

**Intersection Alternatives Analysis - Reed Market Road & Brookswood Boulevard**

Analysis of Roundabout Metering Signal

**2019 Existing Conditions – VISSIM Calibration**

| | | |
|---|---|---|
| Date: | November 26, 2019 | Project #: 17453 |
| To: | Project File | |
| From: | Ryan Casburn | |

## INTRODUCTION

Kittelson & Associates, Inc. (Kittelson) has been retained by the City of Bend to evaluate the operations of the roundabout located at the SW Reed Market Road and Brookswood Boulevard/ SW Bond Street intersection in Bend, Oregon. An alternative to improve operations at the study roundabout include adding metering signals at the approaches. Analysis of this roundabout is being completed in VISSIM version 11.00-07. This memorandum documents the VISSIM calibration process and existing condition results for the evaluation of this roundabout.

## STUDY LIMITS & ANALYSIS SCENARIOS

The study limits of this evaluation include the main study intersection of SW Reed Market Road and Brookwood Boulevard/ SW Bond Street and upstream intersections including:

- SW Reed Market Road and Brookswood Boulevard/ SW Bond Street
- Driveway access to Urgent Care complex
- SW Bond Street and Columbia Street

The analysis scenarios include both morning and evening peak periods using existing traffic counts. The larger of the two peak periods (evening) will be used to test several metering alternatives, and the best performing metering alternative will be used for the morning and evening peak period trials. This memo documents the calibration for both peak periods.

The morning peak period analyzed traffic conditions from 7:00 am to 10:00 am. The evening peak period analyzed traffic conditions from 3:00 pm to 6:00 pm.

# VOLUME DEVELOPMENT

Intersection turning movement counts (TMCs) were collected at the main study intersection and at Bond Street & Columbia Street on 6/25/2019 from 7:00 am to 10:00 am and from 3:00 pm to 6:00pm. Driveway In/Out counts were collected at the Urgent Care driveway on the same day. These In/Out counts were assigned to directions based on the relative flow of north- and southbound traffic with adjustments made to balance between Columbia Street and Reed Market Road along Bond Street. These volumes were used directly within VISSIM with no further adjustment.

# BASE VISSIM MODEL

The base VISSIM model was developed in accordance with guidance provided in the 2011 ODOT Protocol for VISSIM Simulation. VISSIM 11.00-07 was used for this project.

## Link Geometry

Standard link-geometry coding practices were used throughout the VISSIM network. Links on the edge of the network were expanded to accommodate expected queueing.

## Driver Behavior

The default Wiedemann 74 car following model was used with an adjustment to the number of interaction objects to 10 (default of 4 objects). An adjustment to the number of interaction objects is commonly done with modeling roundabouts due to the larger than normal number of interaction objects (conflict areas, priority rules, reduced speed areas, desired speed decisions, etc.). Increasing this parameter affects how well vehicles in the network can predict other vehicles' movements and react accordingly. In the case of the Reed Market Road and Brookswood Boulevard intersection, there are several interaction objects such as priority rules, desired speed decisions, reduced speed areas, etc. and would benefit from an increase in the number of interaction objects. The same driving behavior will be carried forward into the metering condition models.

## Yielding

The stop-controlled intersections of Columbia Street and the Urgent Care driveway was modelled using stop signs and conflict areas to model the appropriate yielding behavior. At the study intersection, priority rules were used to model the appropriate yielding behavior. Due to the slight skew angle of the intersection, conflict areas had difficulty correctly modeling the yielding. Separate priority rules were created for passenger vehicles and trucks to model the increased gaps required for the larger vehicles (trucks). These conditions will remain constant in the metering condition models.

## Speeds

All roads within the study limit have a posted speed limit of 25 mph. A speed distribution was created with a linear profile of ± 5 mph of the posted speed limit. Additional speed distributions were created for the roundabout entry radius speed and circulating speed. These also have a linear profile. Desired speed decisions were not explicitly placed at each input link into the model but were instead included in the vehicle compositions of the vehicle inputs. The speed assigned to the vehicle composition at each vehicle input is consistent with the posted speed along the input link. This accomplishes the same as placing the desired speed decisions along the input links without redundant coding in the model. Reduced speed areas were coded along the radii of left-turn and right-turns at the stop-controlled intersections. Reduced speed areas with the roundabout entry radius distribution was placed near the entrance of the roundabout and desired speed decisions were placed just after the reduced speed area with the roundabout circulating speed distribution. Finally, a desired speed decision with the 25 mph posted speed distribution was placed just downstream of the roundabout to return vehicles to their previous speeds. The desired speed distributions can be found in **Table 1**.

**Table 1: Desired Speed Distributions**

| Name | Lower Bound | Upper Bound |
|---|---|---|
| 25 MPH | 20 | 30 |
| Left Turn | 10 | 20 |
| Right Turn | 9 | 15 |
| Roundabout Entry Radius | 15 | 20 |
| Roundabout Circulating Speed | 17 | 22 |

## Vehicle Inputs

Vehicle inputs and routes were coded in 15-minute increments for the entire three-hour analysis period plus 15-minute warm up and 15-minute cool down periods. Some adjustments from the raw data was made to the routes to correct vehicle calibration.

The North American Default vehicle types were used, but to better represent the vehicle mix in the study area, multiunit trucks percentages were halved.

## Pedestrians

Pedestrian crosswalks were analyzed at the roundabout and at the Columbia Street intersection. Bicycles were included in the pedestrian demand.

# CALIBRATION

## Volume Calibration (GEH Statistic)

Calibration of the model was primarily focused on volumes using the GEH statistic and visual inspection. The GEH statistic was calculated for all study segments, entry and exit volumes, and all turning movement volumes based on the formula below:

$$GEH = \sqrt{\frac{2(m-c)^2}{m+c}}$$

Notes:
$m$ = output traffic volume from the simulation model (vph)
$c$ = input traffic volume (vph)

The two calibration criteria used for the volumes were:

- All intersection turn movements greater than 100 vehicles per hour: GEH <5
- All intersection turn movements: GEH <10

A GEH Statistic was calculated for each hour within the analysis.

## Delay

The study intersection was also analyzed for existing conditions in Vistro following the procedures set forth in the Highway Capacity Manual. The delay reported by Vistro was compared for general consistency with the delays reported by VISSIM. Delay from a deterministic approach, such as Vistro is not expected to match VISSIM delays exactly, but general patterns should be consistent. The delay reported from VISSIM occurred in the middle of each analysis (5400-6300 simulation seconds), 8:30-8:45 AM and 4:30-4:45 PM.

## Queuing

Queuing measurements were collected by drone on 8/7/2019. Queue measurements at the roundabout and the eastbound movement of Columbia Street are compared to field measurements. Values are reported for the average queue in one 15-minute period which lines up with when the field queue measurements were recorded.

## Visual Inspection

The model was visually inspected to check whether the model is accurately replicating field conditions. No major differences were identified between the model and the peak season peak hour conditions at the study intersection.

### Number of Runs

For calibration purposes, 10 simulation runs were conducted. Based on these calibration results, the number of runs for the metering scenarios may be increased.

The minimum number of simulation runs was calculated using the formula below provided in Section 6.9 of the ODOT Protocol for VISSIM Simulation. The value reported is rounded up to the next integer

$$N = \left( 2 * t_{0.025,N-1} \frac{s}{R} \right)^2$$

R = 95-percent confidence interval for the true mean

$t_{0.025,N-1}$ = Student's t-statistic for two-sided error of 2.5 percent (totals 5 percent) with N-1 degrees of freedom

s = standard deviation of about the mean for selected MOE

N = number of required simulation runs

The key measure of effectiveness (MOE) used for the determination of the minimum number of runs was:

- Overall Node Delay at the study roundabout for each hour

## AM CALIBRATION

### Volume Calibration (GEH Statistic)

Volume calibration using the GEH calibration criteria for the AM peak period is shown in **Table 2**. All calculated GEH values are shown in Appendix A. **Figure 1** shows a comparison of field and VISSIM volumes. The black line marks where volumes are equal. Points above the line have a higher volume in the VISSIM model; points below the line have a lower volume in the VISSIM model. The yellow line marks where GEH is equal to 5; the red line marks where the GEH equals 10.

**Table 2: AM GEH Calibration Criteria Summary**

| Acceptance Target | Criteria | Number of Measurements | Number unacceptable | Percent acceptable |
|---|---|---|---|---|
| All Intersection Turn movements greater than 100 vehicles per hour | GEH < 5.0 | 38 | 0 | 100% |
| All Intersection Turn Movements | GEH < 10.0 | 82 | 0 | 100% |

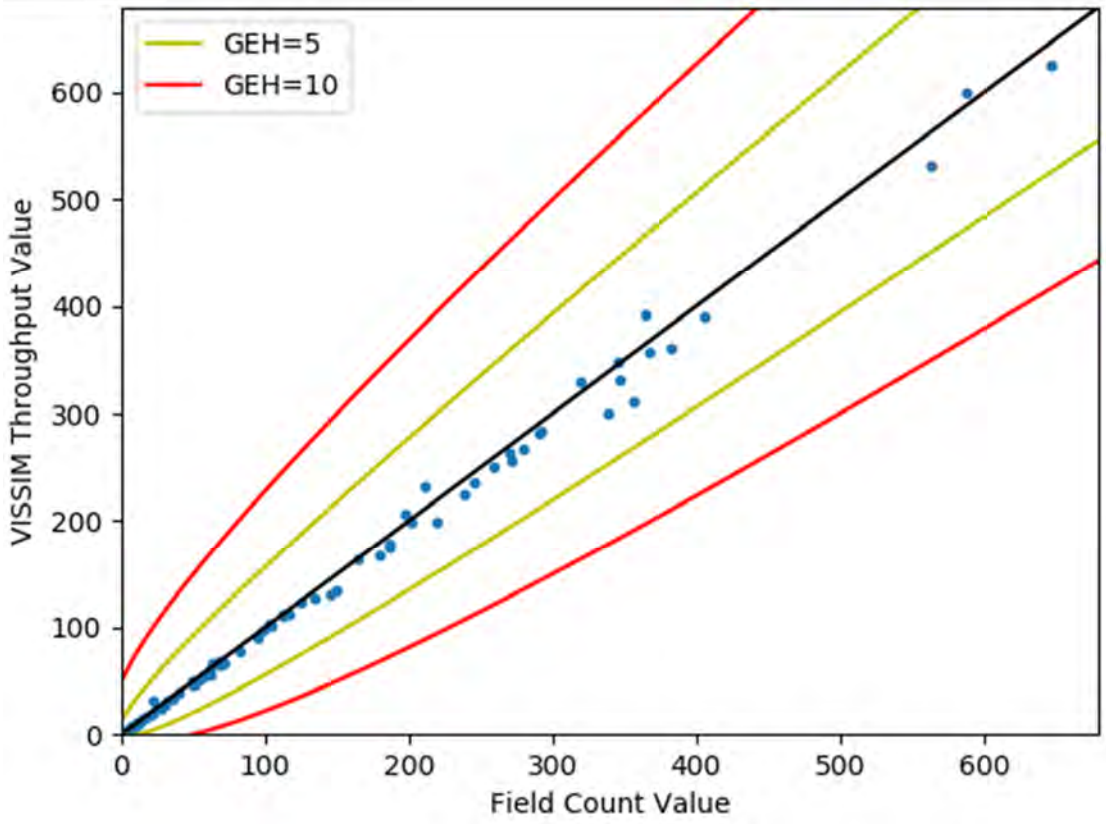


**Figure 1: AM GEH Chart**

## Delay

Delay comparison of Vistro results and VISSIM results are shown in **Table 3**.

**Table 3: AM Delay Comparison**

| Movement | Vistro delay | VISSIM Delay |
|---|---|---|
| NB | 28.74 | 52.84 |
| EB | 10.37 | 11.17 |
| SB | 12.25 | 8.39 |
| WB | 62.34 | 248.24 |

## Queuing

Queuing comparison during the AM peak period is shown in **Table 4**. The queues from the model are the average queues during the 15-minute period between 8:00 am and 8:15 am. This time period aligns closely to when the AM queue measurements were recorded.

**Table 4: AM Queue Comparison**

| Movement | Field Measured | VISSIM Queue |
|---|---|---|
| NB | 1,125 | 947.6 |
| EB | N/A | 147.5 |
| SB | N/A | 136.6 |
| WB | 1,925 | 2176.3 |

## Number of Runs Required

The calibration process was conducted with 10 simulation runs (seeds). Based on the overall node delay MOE, the number of runs required was calculated. Based on these values and the values in the PM, the results will be based on 15 simulation runs. While this does not cover all MOEs for all time periods, it covers the majority.

**Table 5: Number of Runs Required (AM)**

| | HOUR 1 | HOUR 2 | HOUR 3 |
|---|---|---|---|
| **OVERALL NODE DELAY** | 10 | 7 | 26 |
| **SB QUEUE** | 17 | 5 | 27 |
| **WB QUEUE** | 37 | 14 | 30 |

# PM CALIBRATION

## Volume Calibration (GEH Statistic)

Volume calibration using the GEH calibration criteria for the PM peak period is shown in **Table 2**. All calculated GEH values are shown in Appendix A. **Figure 2** shows a comparison of field and VISSIM volumes. The black line marks where volumes are equal. Points above the line have a higher volume in the VISSIM model; points below the line have a lower volume in the VISSIM model. The yellow line marks where GEH is equal to 5; the red line marks where the GEH equals 10.

**Table 6: PM GEH Calibration Criteria Summary**

| Acceptance Target | Criteria | Number of Measurements | Number unacceptable | Percent acceptable |
|---|---|---|---|---|
| All Intersection Turn movements greater than 100 vehicles per hour | GEH < 5.0 | 43 | 0 | 100% |
| All Intersection Turn Movements | GEH < 10.0 | 81 | 0 | 100% |

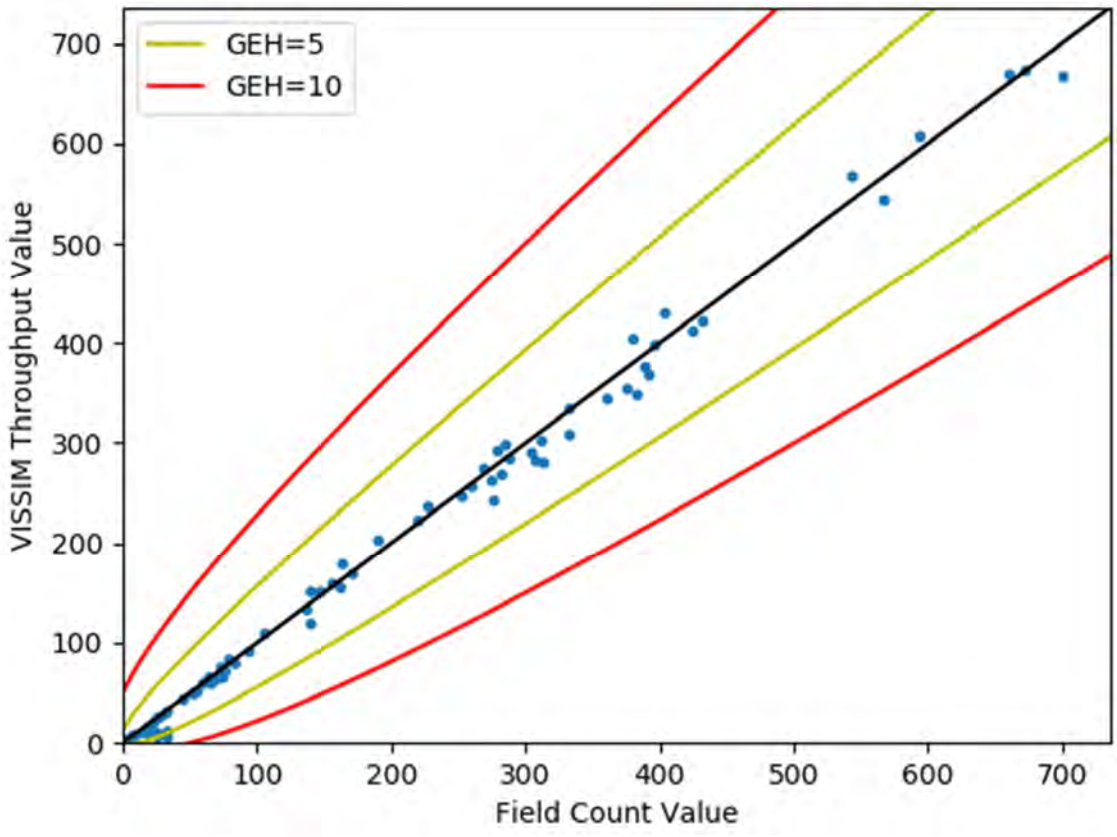


**Figure 2: PM GEH Chart**

## Delay

Delay comparison of SIDRA results and VISSIM results are shown in **Table 7**.

**Table 7: PM Delay Comparison**

| Movement | Vistro delay | VISSIM Delay |
|---|---|---|
| NB | 26.36 | 272.23 |
| EB | 53.40 | 165.18 |
| SB | 49.58 | 39.92 |
| WB | 18.66 | 31.41 |

## Queuing

Queuing comparison during the PM peak period is shown in **Table 8** below. The queues from the model are the average queues during the 15-minute period between 5:00 pm and 5:15 pm. This aligns closely to when the PM queue measurements were recorded.

**Table 8: PM Queue Comparison**

| Movement | Field Measured (feet) | VISSIM Queue (feet) |
|---|---|---|
| NB | N/A | 1222.9 |
| EB | 1,325 | 1779.4 |
| SB | 1,900 | 514.4 |
| WB | 1,025 | 579.1 |

Number of Runs Required

The calibration process was conducted with 10 simulation runs (seeds). Based on the overall node delay MOE, the number of runs required was calculated and is shown in **Table 9**. Based on these values and the values in the AM, the results will be based on 15 simulation runs. While this does not cover all MOEs for all time periods, it covers the majority.

**Table 9: Number of Runs Required (PM)**

| | HOUR 1 | HOUR 2 | HOUR 3 |
|---|---|---|---|
| **OVERALL NODE DELAY** | 12 | 32 | 19 |
| **SB QUEUE** | 6 | 5 | 6 |
| **WB QUEUE** | 17 | 9 | 55 |

# Appendix A GEH Values per Movement

^ - volume in VISSIM higher than field (only shown for movements with >100 vehicles)

v - volume in VISSIM higher than field (only shown for movements with >100 vehicles)

AM:

| Hour - | 1 | 2 | 3 |
|---|---|---|---|
| 1-EBL - | 1.85 | 0.21 | 0.10 |
| 1-EBR - | 0.37 | 0.46 | 0.07v |
| 1-EBT - | 0.70v | 0.37v | 0.12^ |
| 1-EBU - | 0.43 | 0.00 | 0.18 |
| 1-NBL - | 0.89v | 0.49v | 0.53^ |
| 1-NBR - | 0.13 | 0.51 | 0.45 |
| 1-NBT - | 1.15v | 0.76v | 0.63^ |
| 1-NBU - | 0.21 | 0.00 | 0.21 |
| 1-SBL - | 0.38 | 0.24v | 1.27v |
| 1-SBR - | 0.73 | 0.42 | 0.75 |
| 1-SBT - | 0.41 | 0.01 | 1.19v |
| 1-SBU - | 0.21 | 0.60 | 0.20 |
| 1-WBL - | 0.50 | 0.55 | 0.45 |
| 1-WBR - | 0.61v | 1.37v | 0.86v |
| 1-WBT - | 0.65v | 2.15v | 0.83v |
| 1-WBU - | 0.06 | 0.52 | 0.28 |
| 2-EBL - | 0.47 | 0.27 | 0.02 |
| 2-EBR - | 0.36 | 0.28 | 0.57 |
| 2-NBL - | 0.05 | 0.72 | 0.08 |
| 2-NBT - | 1.34v | 0.85v | 0.46^ |
| 2-SBR - | 0.12 | 0.50 | 0.30 |
| 2-SBT - | 0.89v | 0.75v | 2.47v |
| 3-EBL - | 0.59 | 0.36 | 0.01 |
| 3-EBR - | 0.02 | 0.05^ | 0.55v |
| 3-NBL - | 0.89v | 0.52v | 1.36^ |
| 3-NBT - | 0.50v | 0.47v | 1.42^ |
| 3-SBR - | 0.09^ | 0.20v | 0.39 |
| 3-SBT - | 0.49v | 0.10v | 0.13v |

Node 3 - none
PM:

| Hour - | 1 | 2 | 3 |
|---|---|---|---|
| 1-EBL - | 0.33 | 0.27 | 0.20 |
| 1-EBR - | 0.36v | 0.30^ | 0.50v |
| 1-EBT - | 1.13v | 0.10^ | 0.49v |
| 1-EBU - | 0.00 | 0.15 | 0.30 |
| 1-NBL - | 1.72v | 0.42^ | 0.98^ |
| 1-NBR - | 0.82 | 0.48 | 0.30 |
| 1-NBT - | 2.01v | 0.80^ | 0.80^ |
| 1-NBU - | 0.00 | 0.00 | 0.10 |
| 1-SBL - | 0.87v | 1.89v | 0.32v |
| 1-SBR - | 0.97 | 0.37 | 0.09 |
| 1-SBT - | 1.37v | 1.77v | 0.56v |
| 1-SBU - | 0.00 | 0.17 | 0.00 |
| 1-WBL - | 0.09 | 0.20 | 0.29^ |
| 1-WBR - | 0.63^ | 0.17^ | 0.17v |
| 1-WBT - | 0.41^ | 0.22v | 0.72v |
| 1-WBU - | 0.00 | 0.49 | 0.18 |
| 2-EBL - | 0.11 | 0.07 | 0.11 |
| 2-EBR - | 0.04 | 0.47 | 0.17 |
| 2-NBL - | 3.61 | 2.02 | 5.07 |
| 2-NBT - | 1.01v | 1.04^ | 0.57^ |
| 2-SBR - | 4.33 | 3.17 | 5.81 |
| 2-SBT - | 0.03^ | 1.25v | 0.37^ |
| 3-EBL - | 0.47 | 0.34 | 0.29 |
| 3-EBR - | 0.62v | 1.33v | 0.70v |
| 3-NBL - | 0.11v | 1.29^ | 0.89^ |
| 3-NBT - | 0.17^ | 1.22^ | 1.34^ |
| 3-SBR - | 0.15 | 0.73 | 0.38 |
| 3-SBT - | 0.46v | 1.21v | 0.53v |

# ATTACHMENT F: TECHNICAL MEMORANDUM #5

## PREFERRED ALTERNATIVES

DKS 1050 SW 6TH AVENUE, SUITE 600 • PORTLAND, OR 97204 • 503.243.3500 • DKSASSOCIATES.COM

# TECHNCIAL MEMORANDUM 5

DATE: July 19, 2023

TO: Project Team

FROM: Eileen Chai, EIT; Kayla Fleskes-Lane, PE; John Bosket, PE | DKS Associates

SUBJECT: US 97 at Reed Market Road Operations and Safety Study
Preferred Alternatives

Project #22129-001

This memorandum documents the process of developing and evaluating the preferred alternatives within the study area for the US 97 at Reed Market Road Operations and Safety Study. A set of preferred alternatives was selected for each of the study intersections based on input from the project advisory committees. These alternatives were then evaluated using a microsimulation model to assess the compatibility and effectiveness of the study intersection improvements within the overall network. The network performance of the evaluated alternatives and key findings from the analysis are discussed in more detail below.

## PROCESS FOR DEVELOPING AND EVALUATING CONCEPTS

Based on the needs identified in *Technical Memoranda #1-3* and prior planning project recommendations, the project team developed an initial set of concepts at each of the study intersections. An initial screening against the goals, objectives, and evaluation criteria from *Technical Memorandum #1: Study Background and Goals and Objectives* resulted in a set of alternatives selected for further refinement and evaluation. Additionally, alternatives that either have few merits based on the full range of evaluation criteria or have costs that would likely exceed current funding expectations were removed from further consideration. Based on the refinement and evaluation documented in *Technical Memorandum #4: Alternatives Development and Evaluation*, a set of preferred alternatives was then recommended by the Technical Advisory Committee and Stakeholder Advisory Committee.

## PREFERRED ALTERNATIVES

Table 1 summarizes the preferred alternatives recommended at each of the study intersections. For concept figures and more details about the preferred alternatives, see the attached prospectus sheets in Appendix A.

**TABLE 1: PREFERRED ALTERNATIVES AT EACH STUDY INTERSECTION IN THE REED MARKET ROAD CORRIDOR**

| INTERSECTION | RECOMMENDATION | KEY CONSIDERATIONS FOR FUTURE DESIGN TEAM |
|---|---|---|
| **REED MARKET RD & BROOKSWOOD BLVD** | Multilane Roundabout (Alt 1) | • Include a conduit to support future implementation of roundabout metering (Alt 2)<br>• Install rectangular rapid flashing beacons (RRFBs) to facilitate pedestrian crossings on the dual entry lanes. |
| **REED MARKET RD & US 97 SOUTHBOUND RAMP** | Add Exclusive Southbound Right-turn Lane and Improve Westbound Bike Travel (Alt 1) | • Dedicated westbound bicycle signal.<br>• Include a blank-out sign[A] for right turn on red (RTOR) restrictions in conjunction with considering bicycle signal indications.<br>• Investigate opportunities for a multiuse path for westbound people biking who are approaching the intersection. |
| **REED MARKET RD & US 97 NORTHBOUND RAMP** | Signalized Intersection (Alt 1) | • Investigate access modifications at the north end of Division St to begin US 97 on-ramp acceleration earlier.<br>• Design the signal to allow for a future phase where Alt 2 (on-ramp realignment) can be implemented. |
| **REED MARKET RD & 3RD ST** | Protected Intersection with Eastbound and Westbound Left Turn Lanes (Alt 2A) | • Remove the southbound right-turn lane from the proposed design to reduce costs and limit right-of-way impacts.<br>• Consider a multiuse path approaching the intersection (instead of bike lanes) to limit right-of-way impacts.<br>• Consider access management on all approaches at the intersection, particularly the east leg between 3rd St and 4th St.<br>• Explore other cost-saving measures through design. |
| **3RD ST & BROSTERHOUS RD[B]** | Protected Intersection with Lane Reconfiguration (Alt 2) | • Consider how this treatment functions with future improvements along Brosterhous Rd and Parrell Rd to support the implementation of a key walking and biking route (such as widening over the canal bridge for better facilities for people walking and biking).<br>• Consider speed limit reduction along Brosterhous Rd. |
| **REED MARKET RD & CHAMBERLAIN ST** | Crossing Enhancement | • Install a pedestrian crossing on the east leg and implement median cutouts and green pavement marking for people biking.<br>• Install wayfinding and warning signage for people walking and biking.<br>• Remove vegetation in the median and add enhanced lighting for better visibility.<br>• Preserve space for future bus stops. |

[A] The blank out sign is an automated warning sign activated according to different times and conditions.

[B] The intersection has limited funding available for improvements, and the City has planned to implement short-term enhancements at the intersection utilizing all available funding. For more detail on the short-term improvements, see Technical Memorandum #4.

This study also identified that opportunities are limited for people walking and biking to cross US 97 in the vicinity of the Reed Market Road overcrossing. While Reed Market Road is not a designated low-stress route, it is required by the City of Bend standard cross-section to provide low-stress walking and biking facilities when the street is reconstructed. Providing low-stress walking and biking facilities along Reed Market Road would require reconstruction to widen the overall cross-section. However, there currently is no planned or funded reconstruction project. Through the planning process, it is recommended that short-term improvements be compatible with the existing cross-sections while also maintaining forward compatibility with any potential future cross-section changes. Several long-term cross-section designs that may be considered along Reed Market Road in the future are documented in Technical Memorandum #4.

## PREFERRED ALTERNATIVES EVALUATION

The following sections document the safety improvements and operations evaluation for the preferred alternatives.

### SAFETY IMPROVEMENTS

The preferred alternatives are expected to improve overall safety performance within the study area. Potential safety improvements at each of the study intersections with preferred alternatives include:

- Reed Market Road/Brookswood Boulevard
  - The multilane roundabout introduces more conflict points and potentially increases speeds on the approaches. However, the preferred alternative maintains single lane exits at the roundabout, reducing conflicts for people crossing the intersection and facilitating crossings for people with vision impairments.
  - The addition of meters could incorporate emergency vehicle preemption to facilitate emergency response during congestion.
  - The multilane roundabout results in shorter queueing on the westbound approach, which mitigates the problem where queues block the US 97 interchange ramps causing ramp queues onto the US 97 mainline.
- Reed Market Road/US 97 Southbound Ramp
  - The preferred alternative significantly reduces the risk of queues spilling back to the US 97 mainline.
  - Eliminating the crossing of the westbound bike lane and right turn lane, providing a bike signal coupled with RTOR restrictions, and potentially putting people biking westbound on a multiuse path significantly reduces conflicts between people biking and westbound right-turning vehicles, improving bicycle safety and comfort.
  - Adding a southbound right-turn lane has the potential to reduce all types of crashes by four percent[1]. However, it lengthens the crossing distance, increasing exposure for people walking

[1] ODOT Crash Reduction Factor List, 2023, ID: H4.

and biking. A sensitivity test was performed to assess the necessity of adding the exclusive lane and the results are discussed later in this memorandum.

- Reed Market Road/US 97 Northbound Ramp
  - Installing a traffic signal provides a new enhanced crossing for people walking and biking across Reed Market Road, which reduces angle crashes by 67 percent[2], but increases rear-end crashes by 143 percent[3].
  - Converting Division Street to right-in, right-out operations reduces conflict points and prevents left-turning vehicles from blocking through movements. It has the potential to reduce overall crashes by 45 percent[4].
  - The future phase (Alternative 2) that realigns the northbound on-ramp would improve the acceleration distance onto US 97 and mitigate access management conflicts that exist on Division Street with the current ramp placement.
- Reed Market Road/3rd Street
  - The protected intersection design enhances the quality of walking and biking facilities in the following ways:
    - Provides traffic calming via smaller curb radii.
    - Minimizes pedestrian crossing distances and provides a protected bicycle crossing.
    - Improves the level of stress for people walking and biking.
    - Provides extra crossing time associated with leading pedestrian intervals (LPIs) or leading bicycle intervals (LBIs), where LPIs/LBIs have the potential to reduce walking and biking related crashes by up to 37 percent[5].
    - Mitigates conflicts with right-turning vehicles by applying RTOR restrictions, which could reduce walking and biking related crashes by up to 41 percent[6].
- 3rd Street/Brosterhous Road
  - The eastbound road widening lengthens the crossing distance and increases exposure for people walking and biking. However, adding a right-turn lane has the potential to reduce all crashes by up to four percent[7].
  - The protected eastbound and westbound left-turn phase reduces eastbound and westbound left-turning conflicts and ensures protected phasing for people walking and biking. It has a potential to reduce left-turning crashes by up to 99 percent[8].

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[2] ODOT Crash Reduction Factor List, 2023, ID: H22.

[3] ODOT Crash Reduction Factor List, 2023, ID: H23.

[4] Crash Modification Factors (CMF) Clearinghouse, US DOT Federal Highway Administration, CMF ID 9821. Note: This CMF is based on a study of three-leg intersections.

[5] ODOT Crash Reduction Factor List, 2023, ID: BP3.

[6] ODOT Crash Reduction Factor List, 2023, ID: BP25.

[7] ODOT Crash Reduction Factor List, 2023, ID: H4.

[8] ODOT Crash Reduction Factor List, 2023, ID: I9.

- The protected intersection improves the quality of walking and biking facilities as previously mentioned under the Reed Market Road/3rd Street discussion.

- Reed Market Road/Chamberlain Street
  - The installation of enhanced lighting and median vegetation removal improve visibility at the intersection.
  - The new pedestrian crossing on the east leg, as well as the median cutouts and green pavement markings for people biking, provide protection and increase crossing comfort for people walking and biking.
  - The implementation of additional crossing warning signs may further improve safety for people walking and biking.

## OPERATIONS ANALYSIS ASSUMPTIONS

The preferred alternatives were evaluated using Vissim microsimulation to assess the compatibility and effectiveness of the treatments along the entire corridor. The project *Methodology Memorandum*[9] and *Vissim Protocol Calibration and Validation Report*[10] documented the details of model development assumptions. As with the existing conditions model, the Vissim analysis presented in this memorandum used the Oregon Department of Transportation (ODOT) Vissim Protocol as a developing guideline.

Several operational assumptions were made to enhance the system performance and evaluate the impact of the improvements when combined along the corridor:

- Analysis documented in Technical Memorandum #4 indicated that westbound queues were longer at the Reed Market Road/Brookswood Boulevard roundabout with metering. Therefore, the modeling included metering at Reed Market Road/Brookswood Boulevard roundabout to provide a more conservative estimate of potential queueing impacts along Reed Market Road.
- The signalized study intersections were assumed to be coordinated with other signalized intersections within the study area, all using a cycle length of 120 seconds, to enhance corridor operations. Note that the 120 seconds of cycle length is an in-practice cycle length that is commonly used to balance vehicle and non-motorist operations. Some other signal timing strategies were employed, including:
  - Placing the westbound roundabout metering advanced detector closer to Silver Lake Boulevard to keep the westbound queue moving at the Brookswood Boulevard roundabout, limiting queue spillback to the US 97 southbound ramp.
  - Prioritizing northbound and eastbound movements at Reed Market Road/3rd Street to prevent queue spillback into Brosterhous Road and the US 97 ramps. This was achieved by increasing northbound and eastbound green time and implementing leading/lagging left-turn phasing at Reed Market Road/3rd Street and Brosterhous Road/3rd Street intersections.
- The protected intersection design was assumed to include LPIs or LBIs, giving an extra five seconds to people walking and biking to enter the crosswalk before vehicles are given a green

[9] US 97 at Reed Market Road Operations and Safety Study - Technical Memorandum #1, Appendix A - Methodology Memorandum, November 2022.

[10] US 97 at Reed Market Road Operations and Safety Study - Vissim Protocol Calibration and Validation, March 2023.

signal indication. LPIs/LBIs are only activated when detecting people walking and biking. Note that a total number of 10 people walking and 15 people biking per hour are assumed on each leg in the future conditions to account for the anticipated improvements in facilities.

- A bike signal was implemented for bike lanes that are adjacent to dedicated right-turn lanes at the US 97 ramp terminals to ensure protected phases for people biking. This could be implemented in conjunction with a dynamic blank-out sign. Note that bike signals are considered experimental at the time of this study at ODOT intersections, and the implementation will require State Traffic Engineer approval.
- RTOR movements were restricted at protected intersections and approaches with bike signals to remove conflicts between motorists and people walking and biking. However, to help clear the westbound queues at 3rd Street/Brosterhous Road, a dynamic RTOR was implemented that allows vehicles to turn right on a red signal when there are no conflicting pedestrian calls, mimicking a dynamic blank-out sign.

## OPERATIONS EVALUATION RESULTS

The model evaluates the future year (2040) average weekday conditions during the p.m. peak period (4 p.m. to 6 p.m.). Several measures of effectiveness (MOEs) were obtained, including GEH[11], congestion speed plots, average and 95th percentile motor vehicle queue length, and vehicle delay. A summary of system performance compared to a No-Build scenario and MOEs are reported below. A summary of key findings is also provided at the end of this section to discuss key findings for system performance and performance at each of the study intersections.

### SYSTEM PERFORMANCE COMPARED TO NO-BUILD SCENARIO

Under No-Build conditions, several intersections operate over capacity, as documented in *Technical Memorandum #3: Future Baseline (No-Build) Transportation System Conditions.* Given this level of congestion, the No-Build scenario was not evaluated in detail in microsimulation but system performance measures (latent demand, vehicle hours of delay and latent delay) were evaluated for comparison against the preferred alternatives scenario.

Compared to the No-Build scenario, the preferred alternatives:

- Significantly increase system capacity, serving over 1,000 additional vehicles in the network during the peak two-hour period.
- Result in savings of over 1,500 vehicle-hours of delay over the two-hour period.
- Resolve significant queueing on the ramp terminals that spill back onto mainline US 97, as discussed below in more detail.

[11] The GEH statistic is a universal measure to compare model inputs and outputs. This continuous volume tolerance formula was developed to avoid the pitfalls associated with using a simple percentage comparison of a wide range of volumes. ODOT has a criteria/threshold lower than 5.0. GEH results for the modeled area with preferred alternatives can be found in Appendix E.

## CONGESTION

The microsimulation model was used to measure queueing and delay relative to desired speed as an indicator of congestion. Figures 1 and 2 represent the relative delay averaged over 10 simulation runs for the peak 15 minutes under No-Build conditions and with the preferred alternatives, respectively. The colors shown in the figure indicate the following approximate queue states:

- Dark green represents free-flow conditions with no delay.
- Light green represents slight slowing.
- Yellow represents increased slowing, but not yet at the "stop and go" state.
- Orange represents the furthest extent of stop and go queues at any point during the entire 15-minute period (a rough approximation of 95$^{th}$ percentile queues).
- Red represents fluctuation between low-speed flow and stopped queues.
- Dark red represents continuous stop and go queues during the entire 15-minute period.

As shown in the figures, the overall congestion improved with the implementation of the preferred alternatives compared to the No-Build scenario, especially at the US 97 ramp terminals. Even with improvements, substantial congestion is still expected at the Reed Market Road/Brookswood Boulevard roundabout and on the southbound approach at Reed Market Road/3$^{rd}$ Street. However, that congestion is expected to have limited impact on congestion at the US 97 ramp exit approaches. Appendix B includes congestion plots for each 15-minute interval over the two-hour simulation period for the model with preferred alternatives.

## QUEUEING

Table 2 lists the weekday evening peak (from 4:30 p.m. to 5:30 p.m.) average and 95$^{th}$ percentile queues by approach under the future (2040) build network with preferred alternatives for major study intersections. Queueing results for specific movements for the modeled area with preferred alternatives can be found in Appendix C. Similar to the discussion in the Congestion section of this technical memorandum, average and 95$^{th}$ percentile queues are expected to be extensive at Reed Market Road/Brookswood Boulevard and the southbound approach at Reed Market Road/3$^{rd}$ Street.

As analyzed and discussed in Technical Memorandum #4 for the Reed Market Road/Brookswood Boulevard roundabout, the southbound and westbound approaches experienced relatively short queueing, whereas the northbound approach experienced extremely long queueing. The implementation of metering helps distribute the queues more evenly across each approach, reducing queues on the northbound approach but increasing queues on southbound and westbound approaches. However, even with the roundabout metering included in the analysis, the average westbound queues shown in this analysis are still able to stay well clear of the ramp terminals (extending 450 feet). Even with spikes in the 95$^{th}$ percentile queues in the westbound direction just extending to the ramp terminal, the queues on the ramp approaches are able to stay less than 325 feet long, well short of the 670 feet of queue storage available before encroaching on the safe stopping distance.

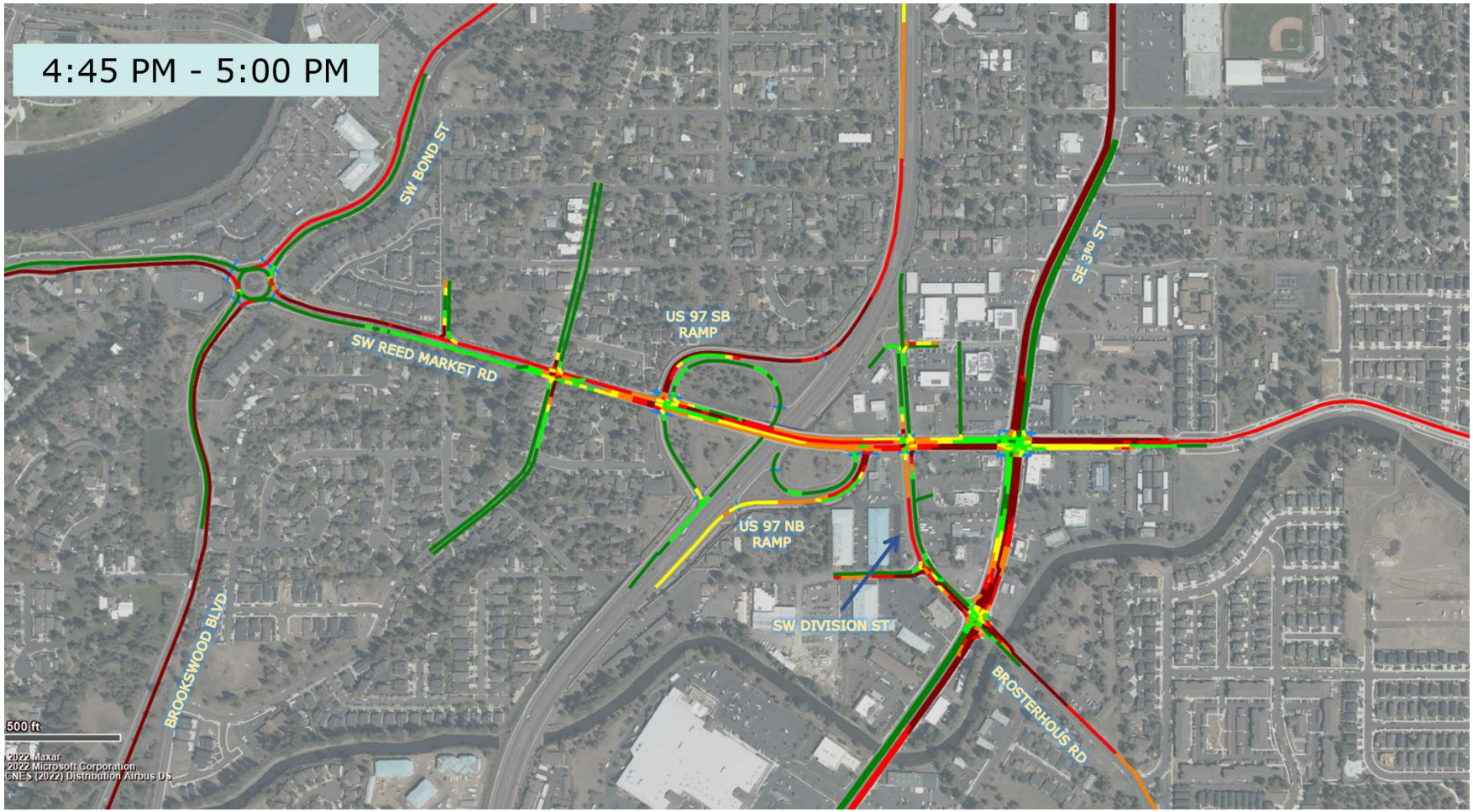


**FIGURE 1. FUTURE NO-BUILD PEAK 15 MINUTE (4:45 P.M. TO 5:00 P.M.) CONGESTION PLOT WITHIN THE STUDY AREA**

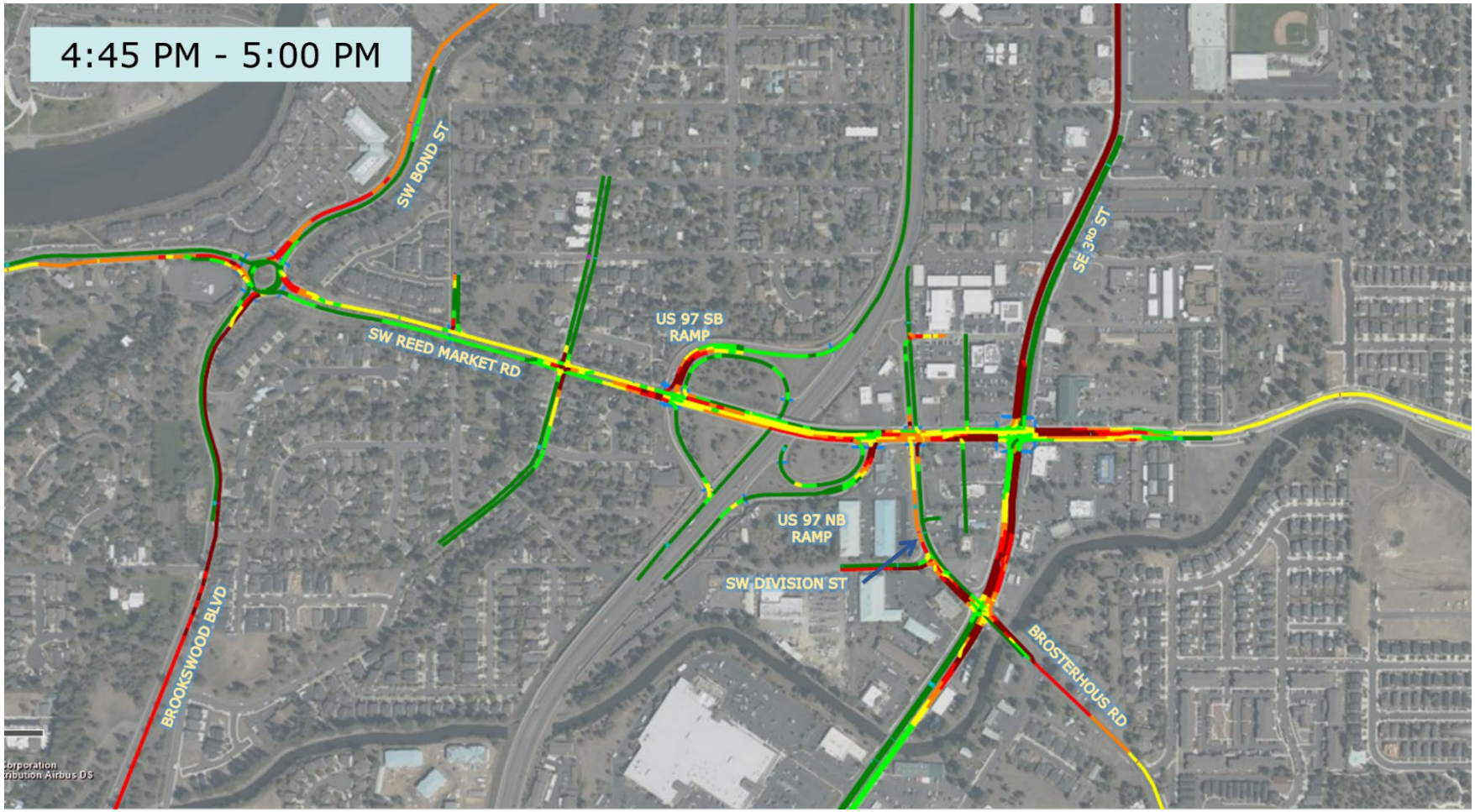


**FIGURE 2. PEAK 15 MINUTE (4:45 P.M. TO 5:00 P.M.) CONGESTION PLOT WITHIN THE STUDY AREA WITH PREFERRED ALTERNATIVES**

**TABLE 2. AVERAGE AND 95TH PERCENTILE QUEUE LENGTHS AT MAJOR STUDY INTERSECTIONS WITH PREFERRED ALTERNATIVES**

| INTERSECTION | APPROACH | APPROXIMATE DISTANCE TO NEXT MAJOR INTERSECTION | QUEUE (FT)[A] | |
|---|---|---|---|---|
| | | | Average | 95th Percentile |
| REED MARKET RD & BROOKSWOOD BLVD | NB | 550' to Blakely Rd | **>2500** | **>3000** |
| | SB | 450' to Columbia St | **>2000** | **>3500** |
| | EB | 1175' to Alderwood Cir | 750 | **>2000** |
| | WB | 775' to Chamberlain St | 450 | **1850** |
| REED MARKET RD & US 97 SOUTHBOUND RAMP | SB | 675' to the safe stopping distance | 200 | 325 |
| | EB | 425' to Silver Lake Blvd | 275 | **625** |
| | WB | 725' to US 97 NB Ramp | 425 | **875** |
| REED MARKET RD & US 97 NORTHBOUND RAMP | NB | 800' to the safe stopping distance | 100 | 175 |
| | EB | 725' to US 97 SB Ramp | 650 | **875** |
| | WB | 550' to 3rd St | 275 | **700** |
| REED MARKET RD & 3RD ST | NB | 650' to Brosterhous Rd | 650 | **800** |
| | SB | 675' to Cleveland Ave | **>2500** | **>3500** |
| | EB | 550' to US 97 NB Ramp | 425 | **650** |
| | WB | 800' to 4th St | 675 | **>2500** |
| 3RD ST & BROSTERHOUS RD | NB | 1700' to Meyer Dr | 450 | 1375 |
| | SB | 650' to 3rd St | 300 | 475 |
| | EB | 750' to Reed Market Rd | 600 | **>1000** |
| | WB | 275' to Parrell Rd | **775** | **>1000** |

[A] **Bold** numbers indicate that the queue exceeds the approximate distance to the next major intersection.

### DELAY

As discussed above, the average vehicle hours of delay within the simulation network significantly decrease (more than 1,500 vehicle-hours) with the preferred alternatives compared to No-Build conditions. Detailed vehicle delay results for the modeled area with preferred alternatives can be found in Appendix D. With the preferred alternatives:

- Average delay at the US 97 northbound and southbound ramp terminals is relatively limited (less than 35 seconds on any approach).
- Average delay is higher at the intersections on 3rd Street, which are closely spaced (leading to queue spillback) and include leading pedestrian intervals, which increase delay for all movements. However, the average delay for all approaches (except the southbound approach at Reed Market Road/3rd Street) is expected to be less than 80 seconds. Significant delay (greater than 5 minutes) occurs on the southbound approach at Reed Market Road/3rd Street.
- Northbound and southbound approaches at the Reed Market Road/Brookswood Boulevard roundabout still experience long delays (greater than 5 minutes) with improvements but, as discussed in Technical Memorandum #4, **delays are reduced by over 80 percent compared to No-Build conditions** with the multilane roundabout compared to the single lane roundabout.

## KEY OPERATOINS ANALYSIS FINDINGS

The following summarizes key analysis findings for the overall system and for individual intersections.

### SYSTEM PERFORMANCE

Based on the analysis results, the preferred alternatives at each of the intersections can operate well together as a system, greatly improving traffic operations along Reed Market Road compared to the No-Build condition while simultaneously improving conditions for people walking and biking (as noted in the evaluation in Tech Memo #4). However, queueing and congestion are still significant in the area, given Reed Market Road serves as a key east-west connection through Bend and provides a direct crossing of the Deschutes River, US 97, and the railroad.

To help reduce vehicle demand along Reed Market Road, other system-wide improvements could be considered:

- Bend's Transportation System Plan (TSP) identifies the need to study a new southern river crossing between Powers Road and Murphy Road to improve connectivity. This would help relieve vehicle demand on Reed Market Road by providing an alternate route for motor vehicle travel.
- 3rd Street is identified as a key walking and biking route and is designated as part of the City's low-stress bicycle network. While the protected intersection design with leading pedestrian intervals enhances protection for people walking and biking, it can result in more vehicle delay. However, investments in the multimodal transportation network on 3rd Street and other City facilities in the area have the potential to encourage people to choose a different mode, reducing vehicle demand.

- As noted in *Technical Memorandum #3: Future Baseline (No-Build) Transportation System Operations Memorandum,* many of the goals and policies in the City's TSP are intended to reduce vehicle miles traveled by encouraging the use of bicycling, walking and transit. Other citywide policies and investments could result in less growth in vehicle demand on Reed Market Road in the future.

### REED MARKET ROAD AND BROOKSWOOD BOULEVARD

As previously described in *Technical Memorandum #3: Future Baseline (No-Build) Transportation System Operations Memorandum*, the intersection operates significantly over capacity under No-Build conditions (worst approach volume-to-capacity [v/c] ratio of 1.16), leading to queues spilling back to nearby major intersections. With the preferred alternative, there is still significant congestion and queuing approaching the roundabout; however, the alternative using a multilane roundabout with metering provides better flexibility to control queueing on specific approaches and to account for different travel patterns during the a.m. and midday peak periods. The longest queues occur with northbound and southbound movements under 95$^{th}$ percentile conditions. This is due to the high volume of conflicting traffic circulating the roundabout that prevents traffic from being fully served. These queues are also slightly impacted by the roundabout meter operation assumption in this analysis, which was designed to prioritize keeping westbound queues away from the US 97 interchange.

While the 95$^{th}$ percentile westbound queue extends just into the US 97 southbound ramp, reducing the throughput at that intersection and leading to longer westbound queue spillback through the interchange area and towards 3$^{rd}$ Street, the queues on the ramp exits are able to remain shorter than the safe stopping distance. This westbound queueing could be managed by prioritizing the westbound approach at the roundabout even more heavily when metering.

Based on the analysis results documented above and in Technical Memorandum #4, the implementation of the multilane roundabout will significantly reduce delay and reduce the risk of queue spillback impacting the US 97 southbound ramp. The implementation of metering in the future can be considered as the City and ODOT monitor congestion and queueing on Reed Market Road.

### REED MARKET ROAD AND US 97 SOUTHBOUND RAMP

Overall, there are minimal delays at this intersection. While 95$^{th}$ percentile queues in the future spillback on the eastbound and westbound approaches, no significant queues are expected on the ramp approach (less than 350 feet). Southbound queues do not spill back into the US 97 mainline and do not exceed the safe stopping distance of 670 feet. The eastbound queue spills beyond Silver Lake Boulevard but does not extend to the Brookswood Boulevard roundabout. The 95$^{th}$ percentile westbound queue spills beyond the US 97 northbound ramp to Division Street, due in part to occasional queue spillback at the Brookswood Boulevard roundabout and friction associated with last-minute merging due to the right-turn lane drop at the intersection.

The improvements at adjacent study intersections (particularly at Brookswood Boulevard) have the potential to reduce the risk of queue spillback into the US 97 southbound ramp, reducing the need for widening the southbound right-turn lane. To better understand the need for it, a sensitivity test

was conducted without the southbound right-turn lane. The results indicated that the southbound movement without the right-turn lane experienced an average queue length of 350 feet (compared to 200 feet) and a 95th percentile queue length of 475 feet (compared to 325 feet). This is approximately 150 feet before extending into the safe stopping distance, indicating that **widening to add a southbound right-turn lane to manage queueing on the ramp may not be needed under Year 2040 average weekday conditions.**

ODOT should continue to monitor queueing to assess when widening for a right-turn lane may be needed. It should be noted that improvements to bicycle facilities (realigning the bike lane adjacent the curb to move the conflict with the westbound right-turn lane to the signal) at the Reed Market Road/US 97 Southbound Ramp intersection should still remain a priority. This portion of the preferred alternative could be implemented concurrently with the improvements at the Reed Market Road/ US 97 Northbound Ramp intersection.

### REED MARKET ROAD AND US 97 NORTHBOUND RAMP

As noted in Technical Memorandum #4, the signal at Reed Market Road/US 97 Northbound Ramp intersection significantly reduces delay on the ramp approach and will improve safety for northbound left-turning vehicles (crash reduction factor of 67 percent for angle crashes). The intersection experiences some queueing on the eastbound and westbound approaches, but overall vehicle delays at the intersection are minimal. The eastbound queue is primarily caused by queues spilling back from Reed Market Road/3rd Street and friction associated with the high volume of traffic turning right onto Division Street, with queues at Brosterhous Road/3rd Street occasionally spilling back onto Reed Market Road. It should be noted that the 95th percentile westbound queues spill beyond 3rd Street but average queues do not.

### REED MARKET ROAD AND 3RD STREET

As noted in Technical Memorandum #4, the improvements at Reed Market Road are expected to result in a significant improvement in intersection capacity. However, even with improvements, the intersection is expected to operate just under capacity (v/c ratio of 0.96). This results in substantial queueing on all approaches to the intersections, with particularly long queues on the southbound and westbound approaches (>3,500 feet). It should be noted that the GEH statistic threshold was met at all locations except for the entry southbound movement at this study intersection. This indicates that the demand for that approach will exceed the capacity with the high growth in future traffic volumes, preventing southbound vehicle demand from being fully served. This could be improved slightly with the addition of a southbound right-turn lane, particularly since through-moving vehicles would no longer be delayed by a leading pedestrian interval. But long queues would still be expected without broader system improvements to help reduce vehicle demand as discussed above in the system performance key findings.

### 3RD STREET AND BROSTERHOUS ROAD

At 3rd Street/Brosterhous Road, there is substantial queuing on the eastbound and westbound approaches. The implementation of a protected intersection design with a leading pedestrian interval is expected to result in longer vehicle queuing and delays. In addition, the northbound left-turn queues spill back to Brosterhous Road, resulting in longer queues at 3rd Street and Brosterhous Road. However, the additional eastbound right-turn lane helps mitigate eastbound queuing so that queues rarely extend back to Reed Market Road. The westbound movement experiences a long queue, primarily due to the high right-turn volume.

# TECHNICAL MEMORANDUM #5 - APPENDIX

# APPENDIX

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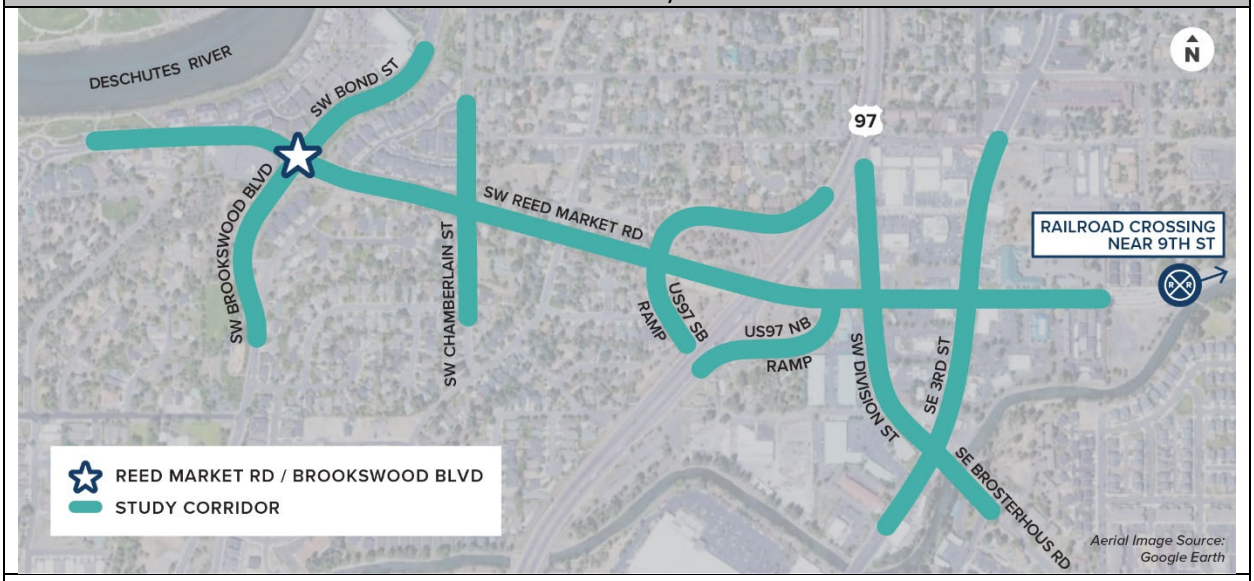
# APPENDIX A: PROSPECTUS SHEETS

# Prospectus Sheets

**Intersection:** Reed Market and Brookswood Boulevard/Bond Street




**Problem Statement:** The existing single-lane roundabout at SW Brookswood Boulevard/SW Bond Street/SW Reed Market Road experiences capacity deficiencies during the average weekday morning, midday, and evening peak hours, resulting in queues and delays. These deficiencies are due, in part, to the highly directional flow of traffic during these time periods. Vehicle queues resulting from these deficiencies impact adjacent roadways (e.g. SW Columbia Street and US 97 Southbound Ramps). In the future (year 2040), assuming the existing single-lane configuration, the intersection fails to meet mobility targets and vehicle queues are forecast to grow exponentially longer.

As an example of the existing capacity deficiencies, the yellow line in the following figure shows the heavy and relatively unimpeded movement from northbound SW Brookswood Boulevard during the morning peak period, which makes it challenging for drivers entering the roundabout from westbound SW Reed Market Road to find an adequate gap in conflicting traffic.

**Preferred Alternative Description**

**Widen roundabout (with option to meter in the future):**

- Alternative 1 (Short-Term): Converting existing single-lane roundabout to a multilane roundabout by adding left-turn lanes on the northbound and southbound approaches and right-turn lanes on the eastbound and westbound approaches.
- Alternative 2 (Long-Term): Converting to the multilane geometry in Alternative 1 plus the addition of metering signals. The metering signals are placed upstream of the lane additions and are intended to operate independently from the roundabout

**Rough Cost Estimate Summary (2023 Dollars)[1]**

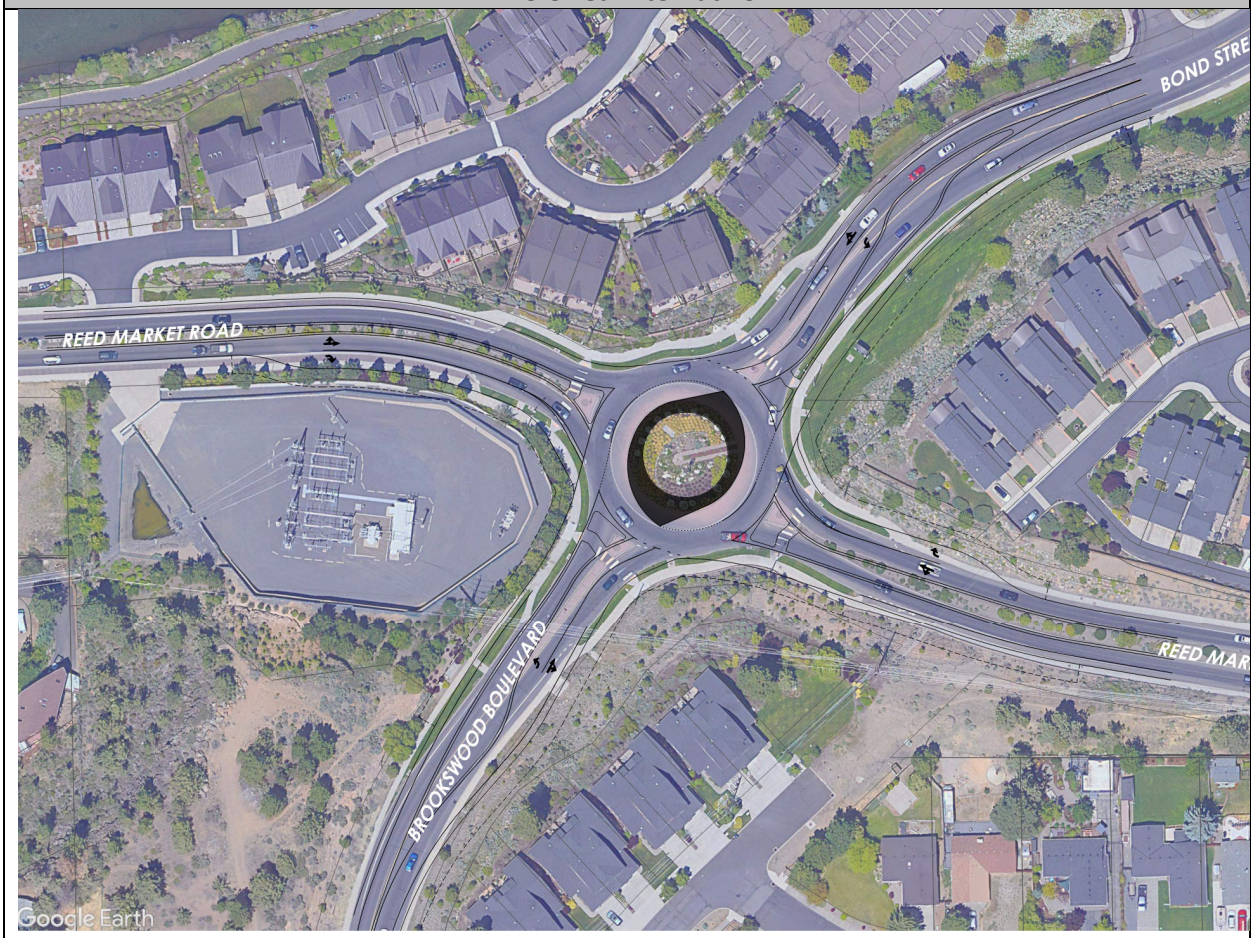
**Alternative 1: 4.0 Million**
**Alternative 2: 4.7 Million** *(inclusive of costs associated with Alternative 1)*

[1]Cost estimate includes design and construction management, mobilization, and contingency. Cost does not include right-of-way costs.

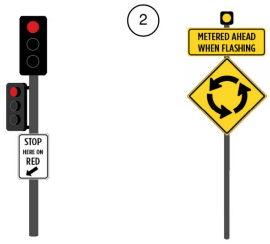
**Summary of Benefits or Tradeoffs of Preferred Alt**

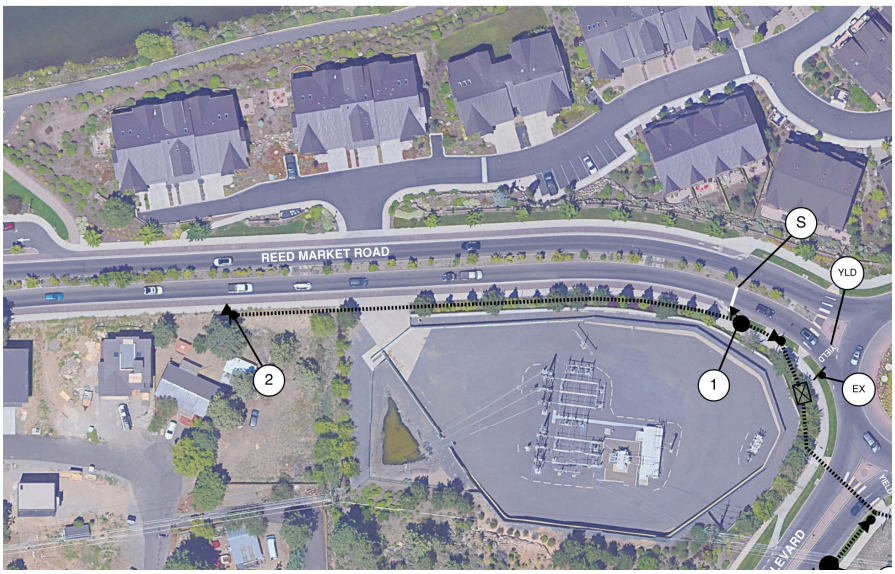
- While it does not address all congestion at the intersection, this alternative significantly reduces delay and queuing through intersection widening.
- This alternative was selected to maintain single lane exits at the roundabout, reducing conflicts for people crossing the intersection while limiting right-of-way impacts.
- The alternatives summarized in this analysis allow for phasing with the option to construct the multilane alternative and then add metering when the incremental operational benefits justify the additional cost.

**Preferred Alternative**




Alternative 1




S Install stop bar

YLD Install YIELD legend

EX Maintain existing YIELD sign

Install conduit and wiring

Install signal control cabinet and controller

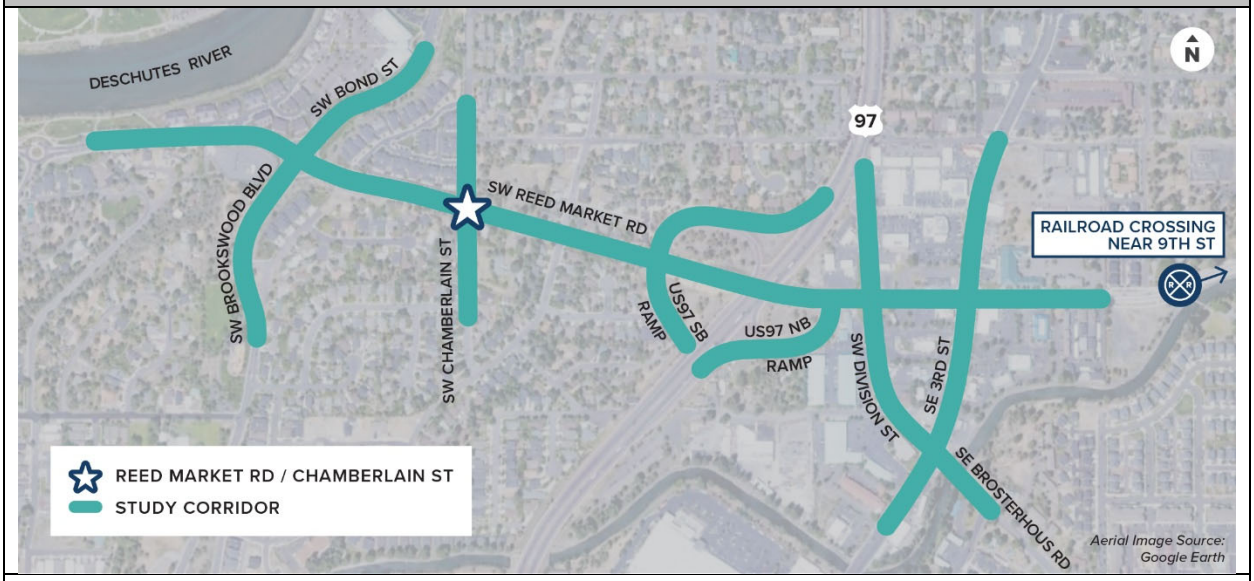
Install radar or video detection unit

Alternative 2 *(Example of potential metering concept originally developed for April 2020 evaluation. Additional development of concept needed to place queue detection and operational zones.)*

| Design/Construction Constraints and Opportunities |
| --- |
| • If the roundabout is expanded to include multilane approaches and active treatments (i.e. pedestrian signals or beacons) are added to the pedestrian crossings, consideration should be given to potential interaction with future metering signals.<br>• The metering alternative will require further development of the operational logic and queue detection strategies developed from the April 2020 pilot test.<br>• The addition of meters could incorporate emergency vehicle preemption to facilitate emergency response during queued conditions. |

# Prospectus Sheets

**Intersection:** Reed Market Road and Chamberlain Street




**Problem Statement:** Chamberlain Street has been identified as a key walking and biking route in the Bend TSP. The City has approximately $250,000 in the Neighborhood Street Safety Program to pave a portion of Chamberlain Street and install crossing enhancements at Reed Market Road. Chamberlain Street is two-way stop controlled and does not have a through movement at Reed Market Road. There is a marked pedestrian crossing on the west side of the intersection.

**Preferred Alternative Description**

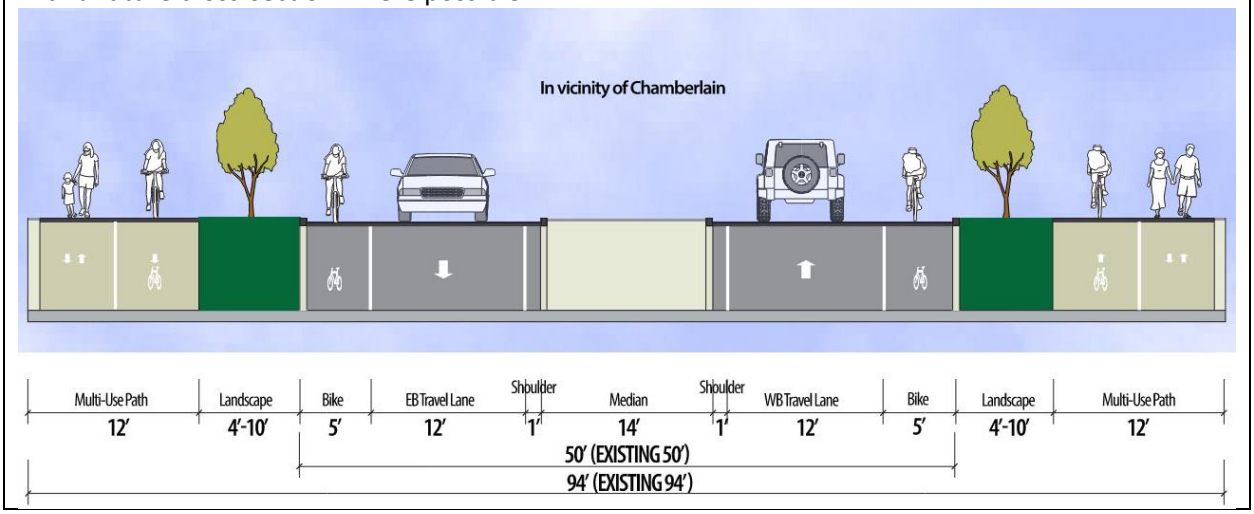
- New pedestrian crossing on the east leg.
- Wayfinding signage for people walking and biking.
- Median cutouts for a bicycle crossing and green pavement markings. Any green striping is subject to ODOT traffic approval and funding to maintain.
- Additional pedestrian and bicycle crossing warning signage.
- Improve visibility of and for pedestrians by removing vegetation in the median.
- Preserving space for future bus stops along Reed Market Road.
- Adding enhanced lighting at the intersection.

**Preferred Alternative Example**

Example of preferred alternative median bicycle crossing

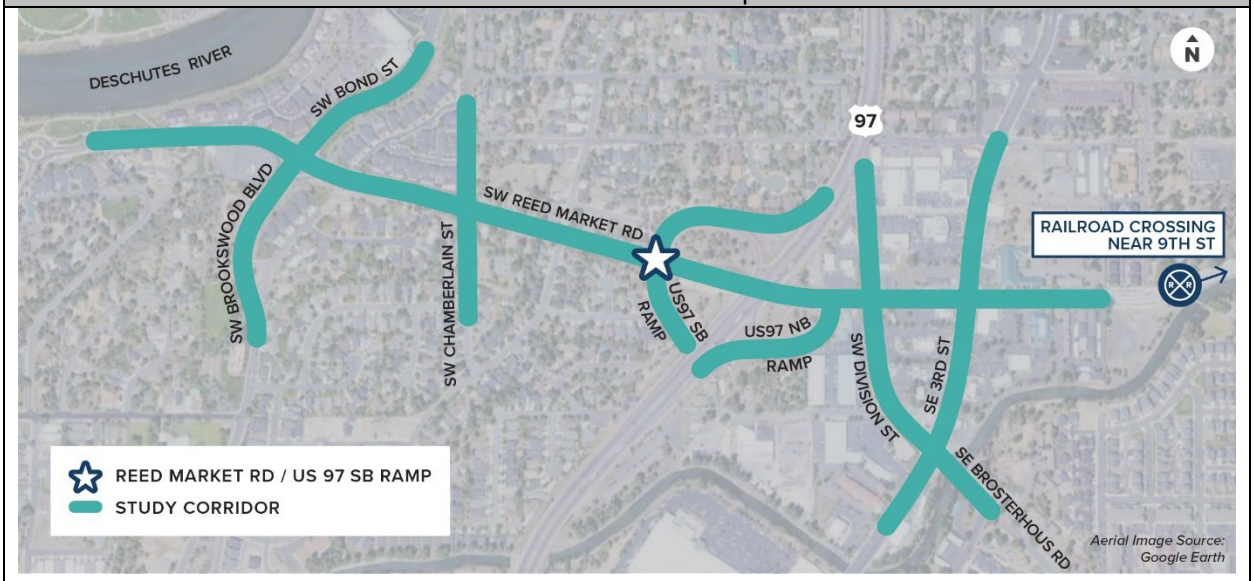
**Typical Proposed Street Sections**

The following cross section is not currently funded and represents a potential ultimate cross section along Reed Market in the vicinity of Chamberlain Street. The preferred alternative could be constructed to be consistent with the existing cross section while maintaining forward compatibility with a future cross-section where possible.



# Prospectus Sheets

**Intersection:** Reed Market Road and US 97 Southbound Ramps




**Problem Statement:** The Reed Market Road and US 97 southbound ramp terminal is currently signalized and has a southbound left turn lane and shared left-through-right turn lane. Congestion at the intersection is projected to exceed the adopted mobility target, with the intersection operating near capacity. In addition, even today, westbound queues from the Reed Market Road/Brookswood Boulevard intersection spill back through the southbound ramp terminal, making the actual level of congestion experienced worse than calculated. If these conditions are not mitigated, the southbound exit ramp queue could spill back into the portion of the ramp needed for safe deceleration and stopping. Other issues to be addressed include conflicts with the westbound right turn lane drop and the westbound bike lane crossover, and some reported challenges for heavy vehicles attempting to make the westbound right turn to the southbound loop ramp.

**Preferred Alternative Description**

**Signal and bicycle improvements:**

- Provide an additional southbound dedicated right turn lane and improve westbound bicycle safety by shifting the bike lane adjacent to the curb and adding a bike signal at the intersection, with blank out signs for no right turn on red.

**Rough Cost Estimate Summary (2023 Dollars)[1]**

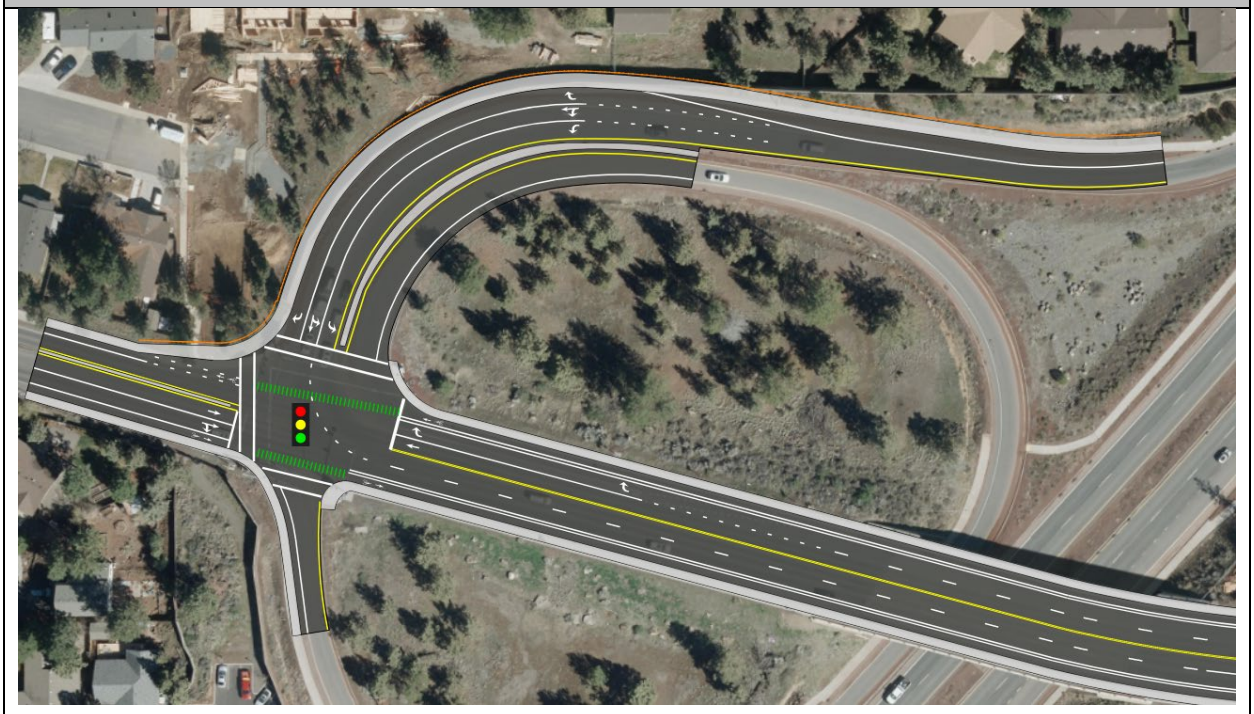
**Preferred Alternative:** $5.7 Million

[1]Cost estimate includes design and construction management, mobilization, right-of-way, and contingency.

**Summary of Benefits or Tradeoffs of Preferred Alternative**

- Adding a southbound right turn lane would require widening along the US 97 off-ramp, but would fit within the existing ROW. This would greatly reduce the overall intersection v/c ratio and delay for the eastbound and westbound movements.
- Providing a bike signal and either a multiuse path or bike lane would minimize conflicts at the westbound right turn.
- Bicycle safety and comfort would be improved with buffered bike lanes and multi-use path on the ramp.
- The crosswalk on the east leg of the intersection is recommended to remain closed (as existing).

**Preferred Alternative**

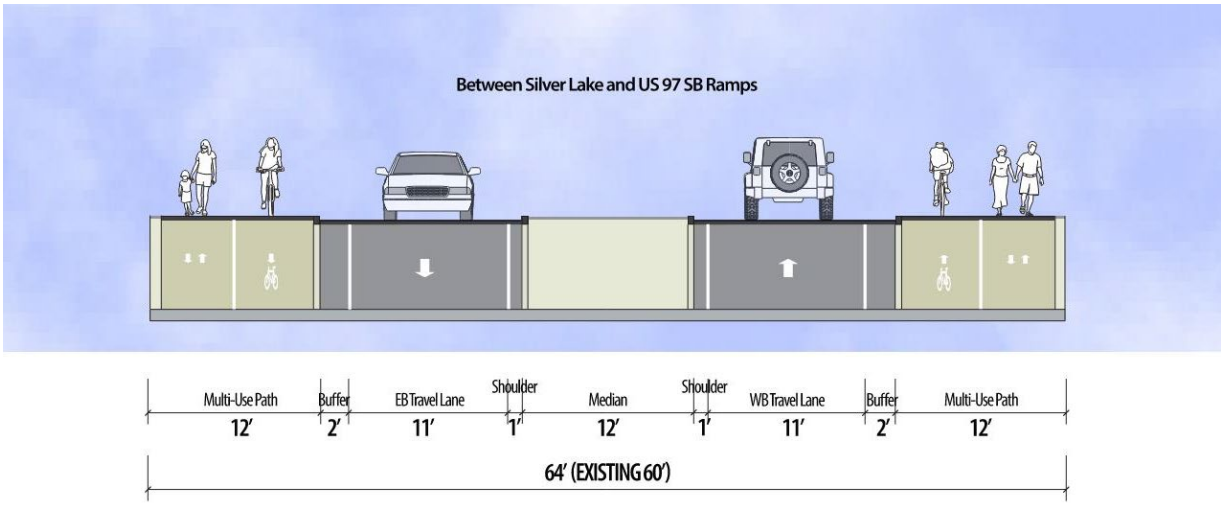


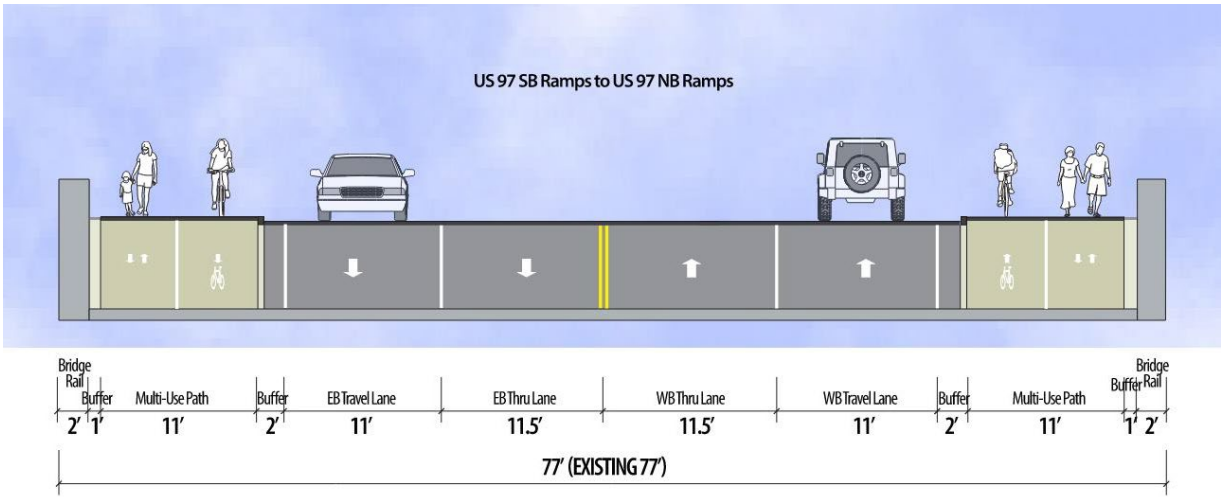
**Design/Construction Constraints and Opportunities**

- Widening may not be needed until later in the planning horizon if improvements are made at Reed Market Road/Brookswood Boulevard. Consider phasing the bicycle improvements with the US 97 Northbound Ramp and/or cross section improvements across the US 97 overpass in the short-term.
- Consider multi-use path approaching intersection to provide greater protection for people walking and biking.
- Consider additional improvements to make the westbound right turn movement easier for trucks while protecting people walking and biking.
- Concept elements may require ODOT approval prior to implementation.

**Typical Street Sections**

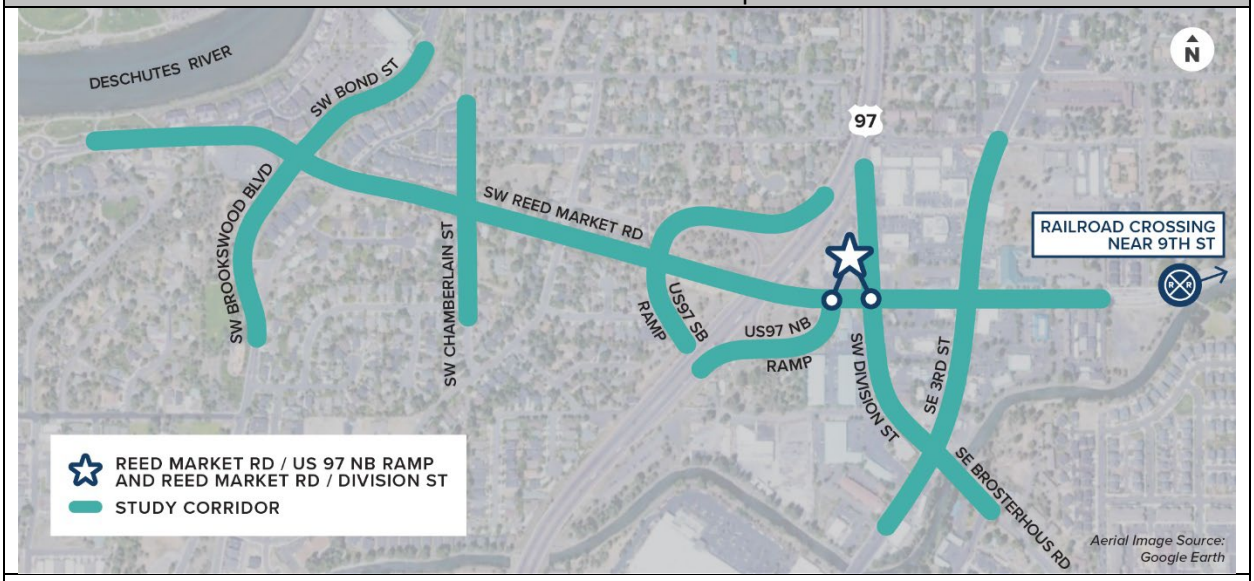
The following cross section is not currently funded and represents a potential, ultimate road cross section. The preferred alternative utilizes short term restriping to reduce vehicle travel lane widths and provide a buffered bike lane, as shown in the concept figures. MAC coordination will be required for narrowing through lanes at this location.



# Prospectus Sheets

**Intersection:** Reed Market Road and US 97 Northbound Ramps




**Problem Statement:** The Reed Market Road/US 97 northbound ramp terminal intersection is currently two-way stop controlled. It can be challenging to turn northbound left during peak hours due to traffic and geometric constraints limiting sight distance. Additionally, the sight line for right turning vehicles may be blocked by left turning traffic. The Reed Market Road and Division Street intersection, located 150 feet east of the US 97 northbound ramp terminal, is also two-way stop controlled. Division Street allows two-way traffic to serve local properties, with the US 97 northbound entrance ramp located at the north terminus of Division Street. This is inconsistent with ODOT's access spacing standards and results in a shorter than standard acceleration lane onto US 97. Currently, there are non-buffered on street bike lanes in both the east and west direction.

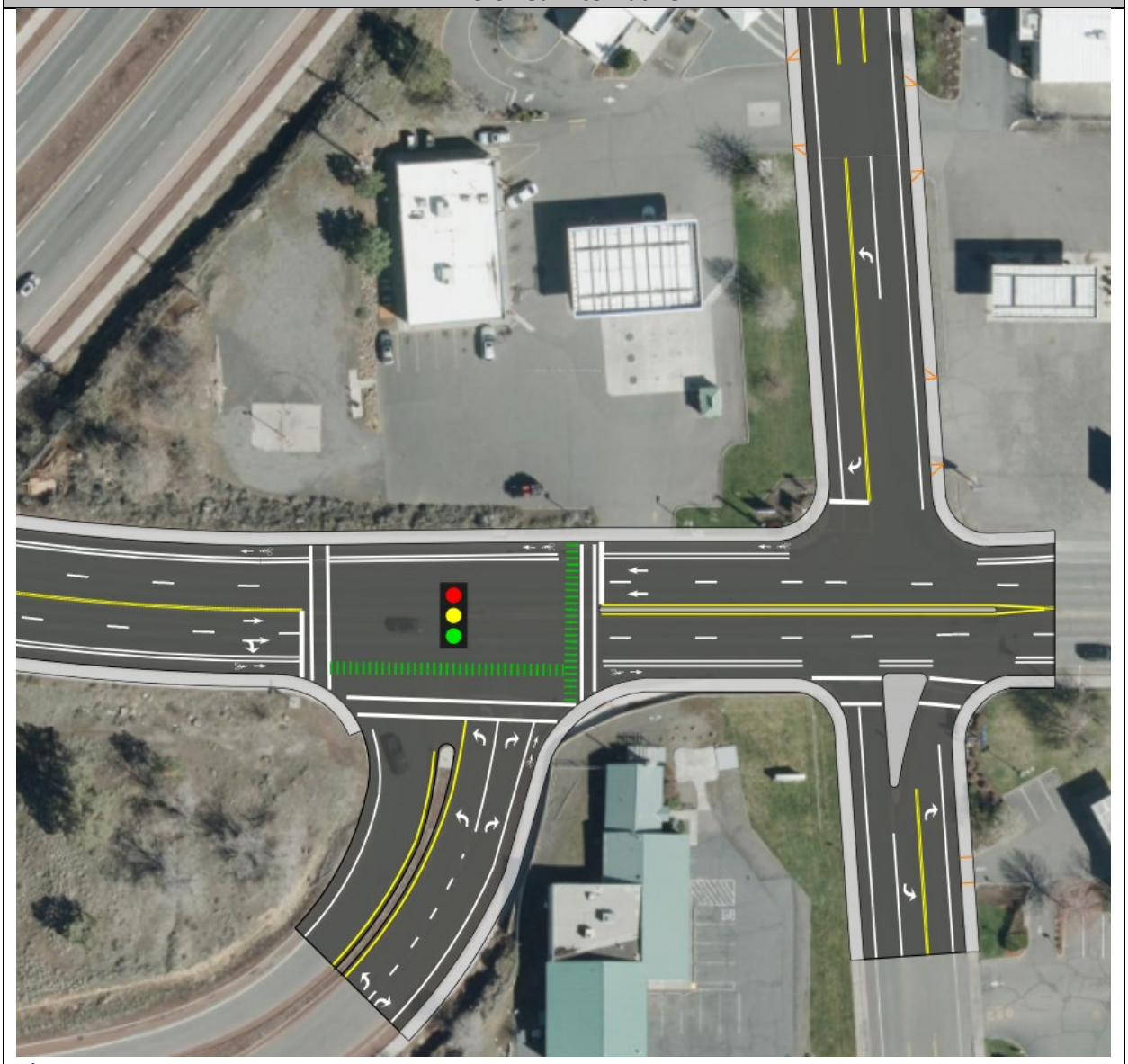
**Preferred Alternative Description**

**Signalize ramp terminal (with option to realign in the long-term):** The preferred alternative is a phased implementation of Alternatives 1 and 2. Phase 1 would construct the traffic signal and convert Division Street to right-in and right-out only, as shown in Alternative 1. The remaining elements of Alternative 2 would be constructed in a future phase or phases.

- Alternative 1 (Short-Term):
  - Construct a traffic signal at the US 97 northbound ramp terminal and provide a bike signal.
  - Convert Division Street to right-in and right-out only by implementing a narrow raised median.
  - Investigate any access modifications needed at the north end of Division Street to provide increased acceleration distance for the US 97 on-ramp.
- Alternative 2 (Long-Term):
  - Separate the northbound entrance ramp from Division Street and align the new entrance ramp with the Reed Market Road/US 97 northbound ramp signalized intersection.
  - Convert the south leg of Division Street to right-in and right-out only by implementing a narrow raised median.

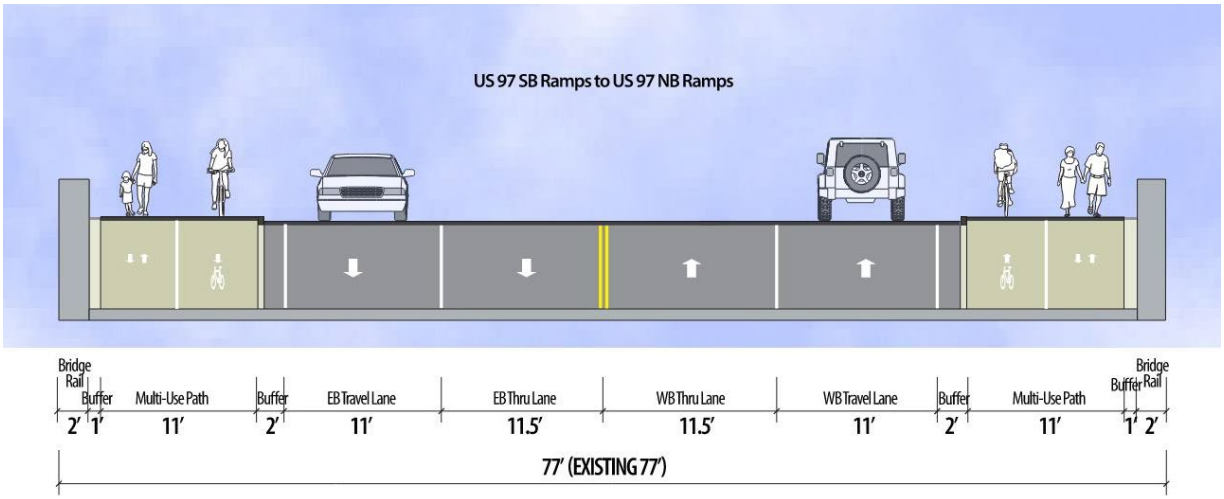
| Rough Cost Estimate Summary (2023 Dollars)[1] |
| --- |
| **Alternative 1: $4.0 Million**<br>**Alternative 2: $9.4 Million** *(inclusive of costs associated with Alternative 1)*<br>[1]Cost estimate includes design and construction management, mobilization, right-of-way, and contingency. |
| **Summary of Benefits or Tradeoffs of Preferred Alternative** |
| • A traffic signal at this intersection would provide a significant improvement to traffic operations.<br>• Converting Division Street to right-in and right-out would reduce conflict points and prevent left turning vehicles from blocking through movements.<br>• The signalized intersection would reduce impacts to adjacent businesses and buildings compared to a roundabout.<br>• Alternative 2 would provide an acceptable acceleration distance onto US 97 and mitigate access management conflicts that exist on Division Street with the current ramp placement. |

**Preferred Alternative**



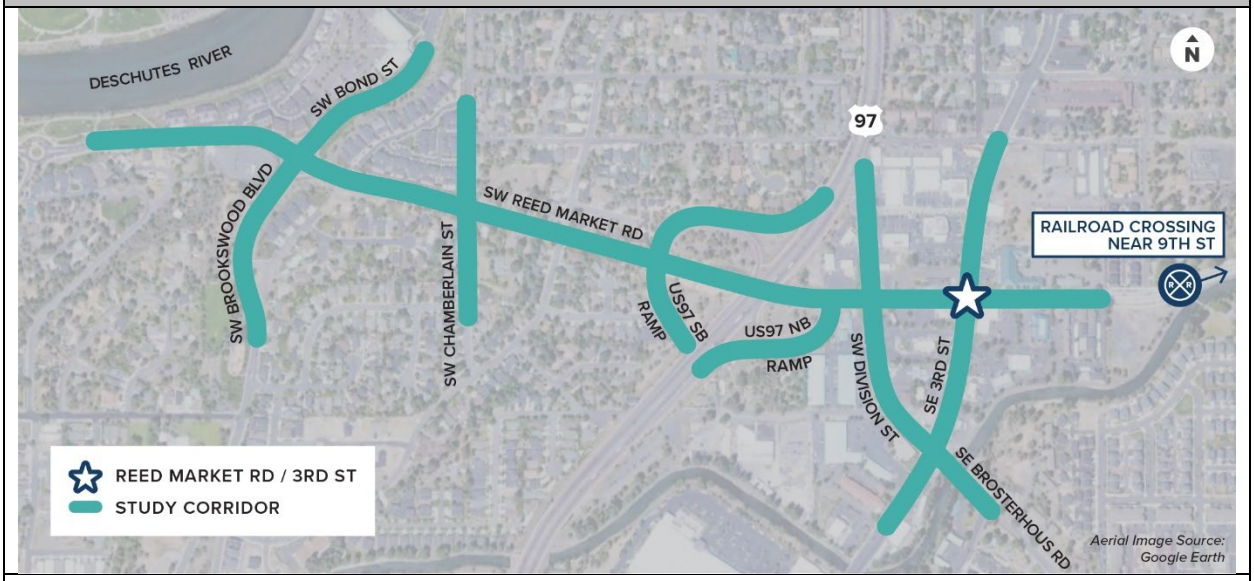
Phase 1

Future phase or phases

| Design/Construction Constraints and Opportunities |
|---|
| • Existing driveway access on Reed Market Road will need to be evaluated and coordinated during design.<br>• Concept elements may require ODOT approval prior to implementation.<br>• Pedestrian and bicycle crossing treatments of the on-ramp acceleration lane should be refined during design. |
| **Typical Proposed Street Sections** |
| This cross section is not currently funded and represents a potential ultimate road cross section. The preferred alternative utilizes short-term restriping to reduce vehicle travel lane widths and provide a buffered bike lane, as shown in the concept figures. MAC coordination will be required for narrowing through lanes at this location.<br>  |

# Prospectus Sheets

**Intersection:** Reed Market Road and 3rd Street




**Problem Statement:** The intersection of Reed Market Road and 3rd Street is at the confluence of two major arterial roadways in Bend and serves high traffic volumes on all approaches. The existing demand volumes exceed the intersection capacity (v/c ratio of 1.05), and the future demand volumes will increase the v/c ratio to 1.26 by 2040. A major contributor to this congestion is the lack of separate eastbound and westbound left turn lanes, which limits signal operations to using split phasing. The existing intersection currently has non-buffered bike lanes on the east and west approaches and buffered bike lanes on the north and south approaches. Additionally, there are several businesses and buildings built close to the right-of-way at the four corners of the intersection.

**Preferred Alternative Description**

**Protected signalized intersection:**

- Construct a protected intersection with added eastbound and westbound left turn lanes.

**Rough Cost Estimate Summary (2023 Dollars)[1]**

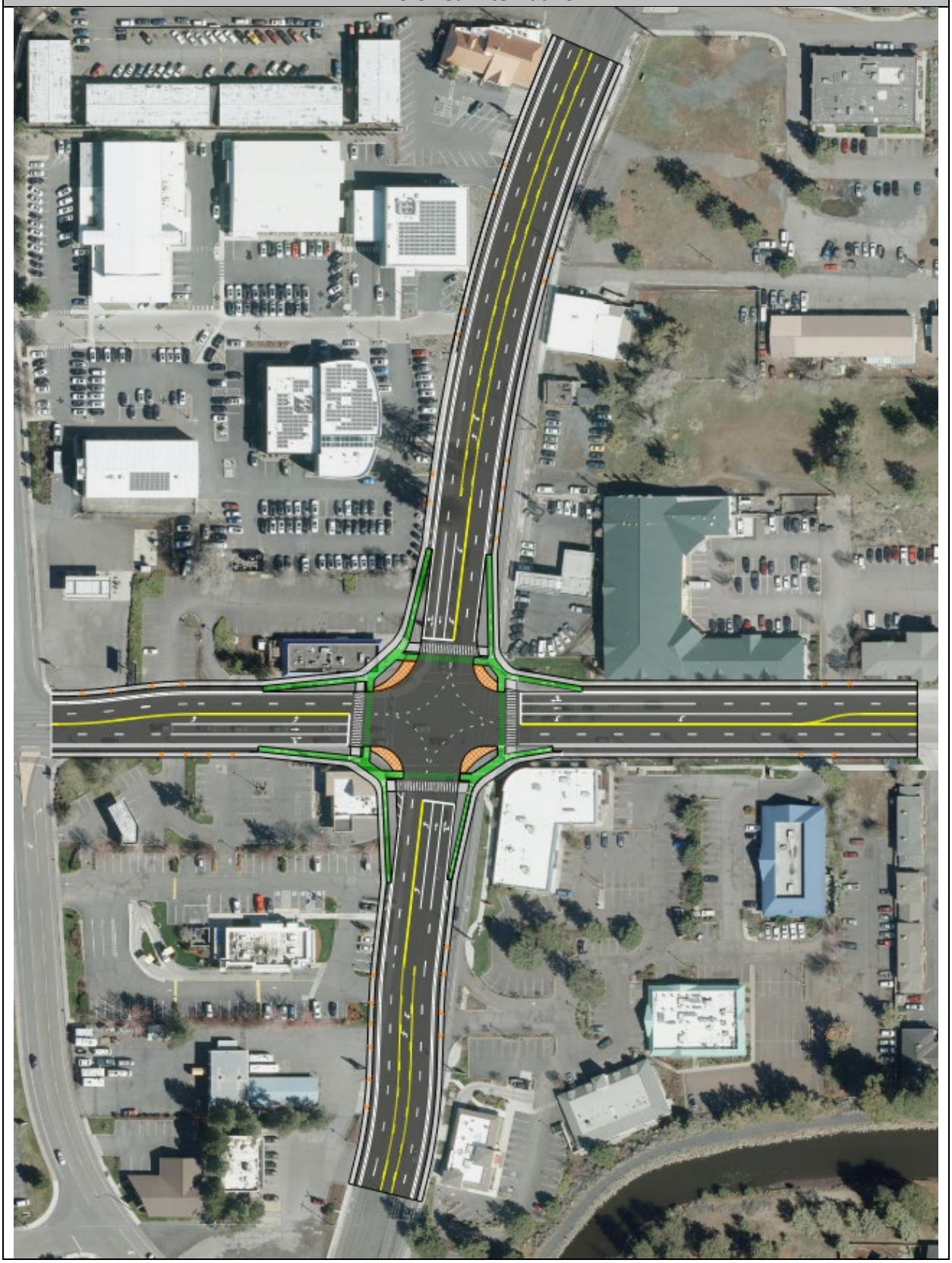
**Preferred Alternative:** $10.3 Million

[1]Cost estimate includes design and construction management, mobilization, right-of-way, and contingency.

**Summary of Benefits or Tradeoffs of Preferred Alternative**

- The protected intersection design would minimize ROW impacts while providing traffic calming via smaller curb radii, minimize pedestrian crossing distance, and provide a protected bicycle crossing.
- The protected intersection would improve the level of traffic stress for people walking and biking.
- Adding eastbound and westbound left turn lanes would provide greater flexibility in traffic signal timing and reduce overall intersection delay.

**Preferred Alternative**

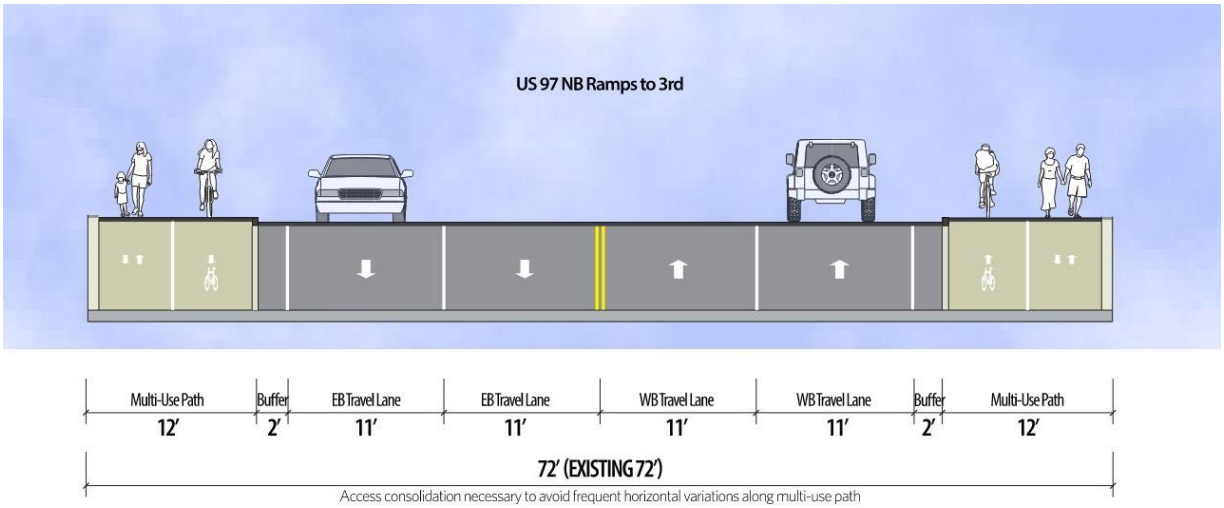


## Design/Construction Constraints and Opportunities

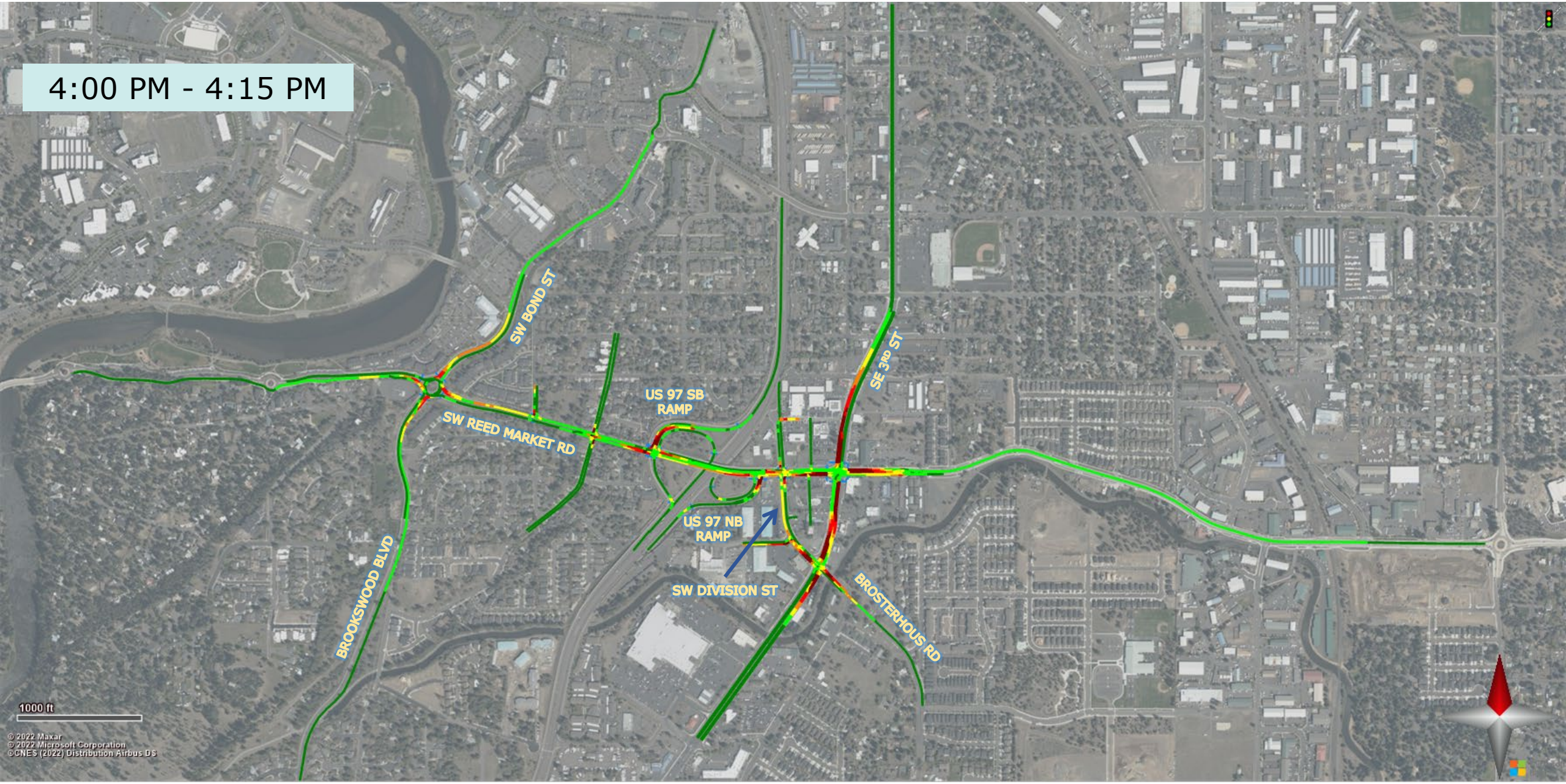
- Intersection concept design shows roadway centerline offset to the west to avoid impacts to building in the southeast corner. This could be refined on the south approach to reduce the length of property impacts.
- Design refinements should consider treatments to reduce impacts to utility lines on the south and east side of the intersection.
- Consider utilizing multi-use paths approaching the intersection instead of at-grade bike lanes to limit ROW impacts (see example cross section below).
- Investigate and revise access management, if necessary, near the intersection – particularly on the east leg.
- Refine intersection design and explore other cost saving measures during design. For example, current cost estimates assume full depth pavement reconstruction for entire project extents shown in the concept figures.
- Adding a southbound right turn lane could improve intersection operations but was not considered as part of the preferred alternative due to costs exceeding available funding and ROW impacts.

## Typical Street Sections

The following cross section is not currently funded and represents a potential ultimate cross section along Reed Market. The preferred alternative utilizes short term restriping (shown in preferred alternative figure) along Reed Market to narrow travel lanes to 11’ and provide a buffered bike lane.



# APPENDIX B: VISSIM MODEL QUEUE PLOTS FOR THE PREFERRED ALTERNATIVES


4:00 PM - 4:15 PM
SW BOND ST
SW REED MARKET RD
US 97 SB RAMP
US 97 NB RAMP
SW DIVISION ST
SE 3RD ST
BROOKSWOOD BLVD
BROSTERHOUS RD
1000 ft
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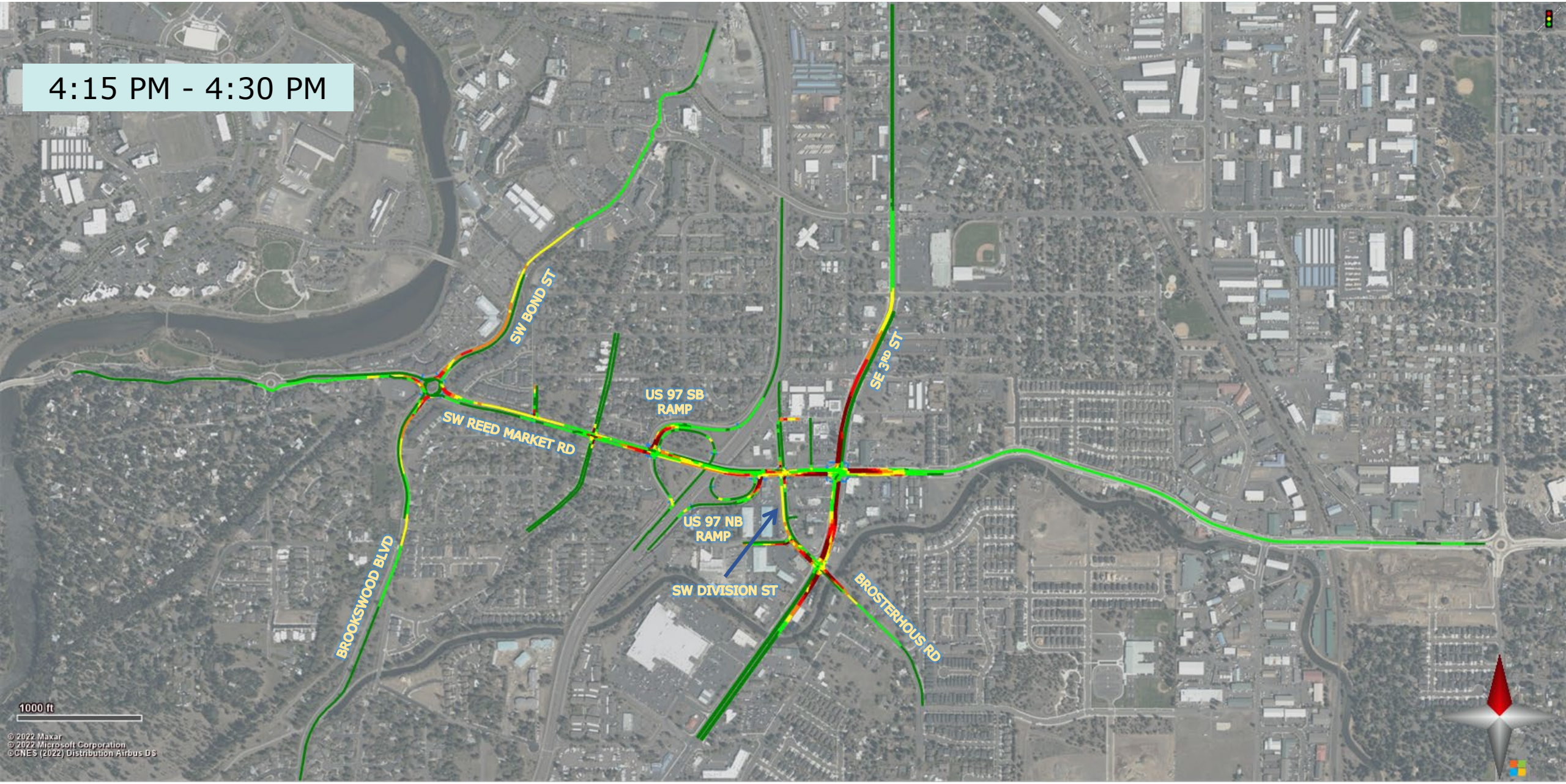
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SW REED MARKET RD
SE 3RD ST
US 97 NB RAMP
SW DIVISION ST
BROOKSWOOD BLVD
BROSTERHOUS RD
1000 ft
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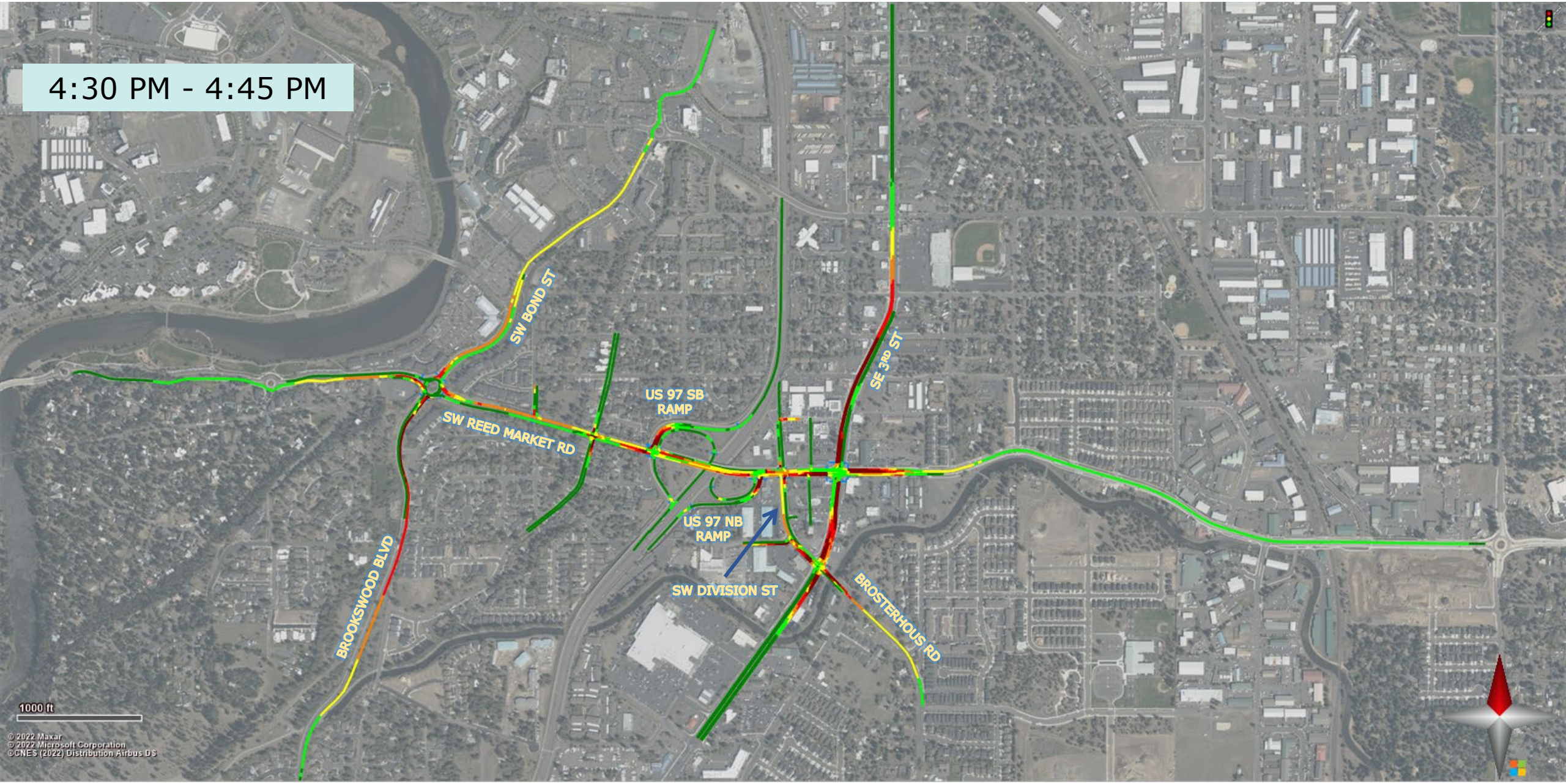
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1000 ft
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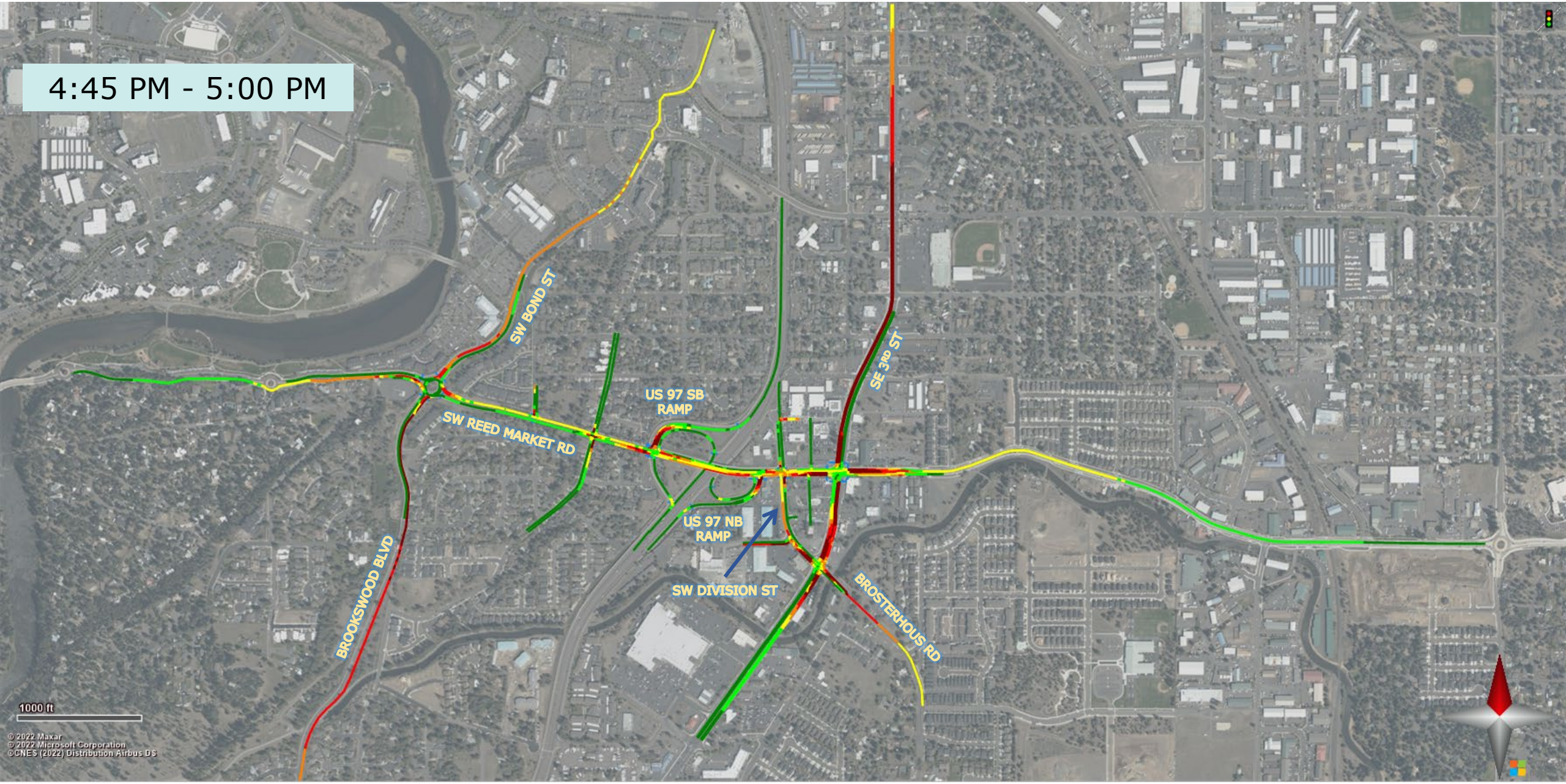
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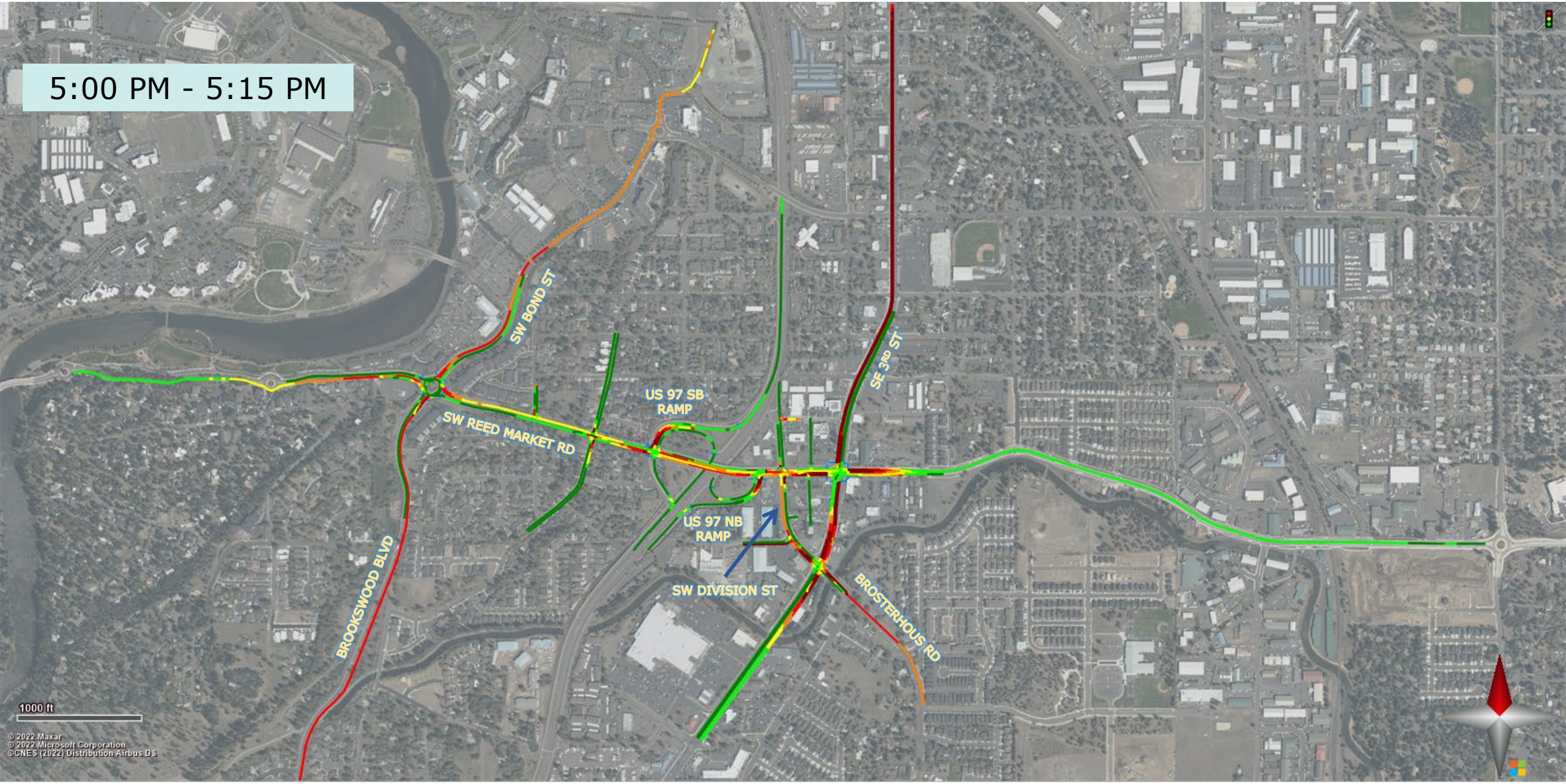
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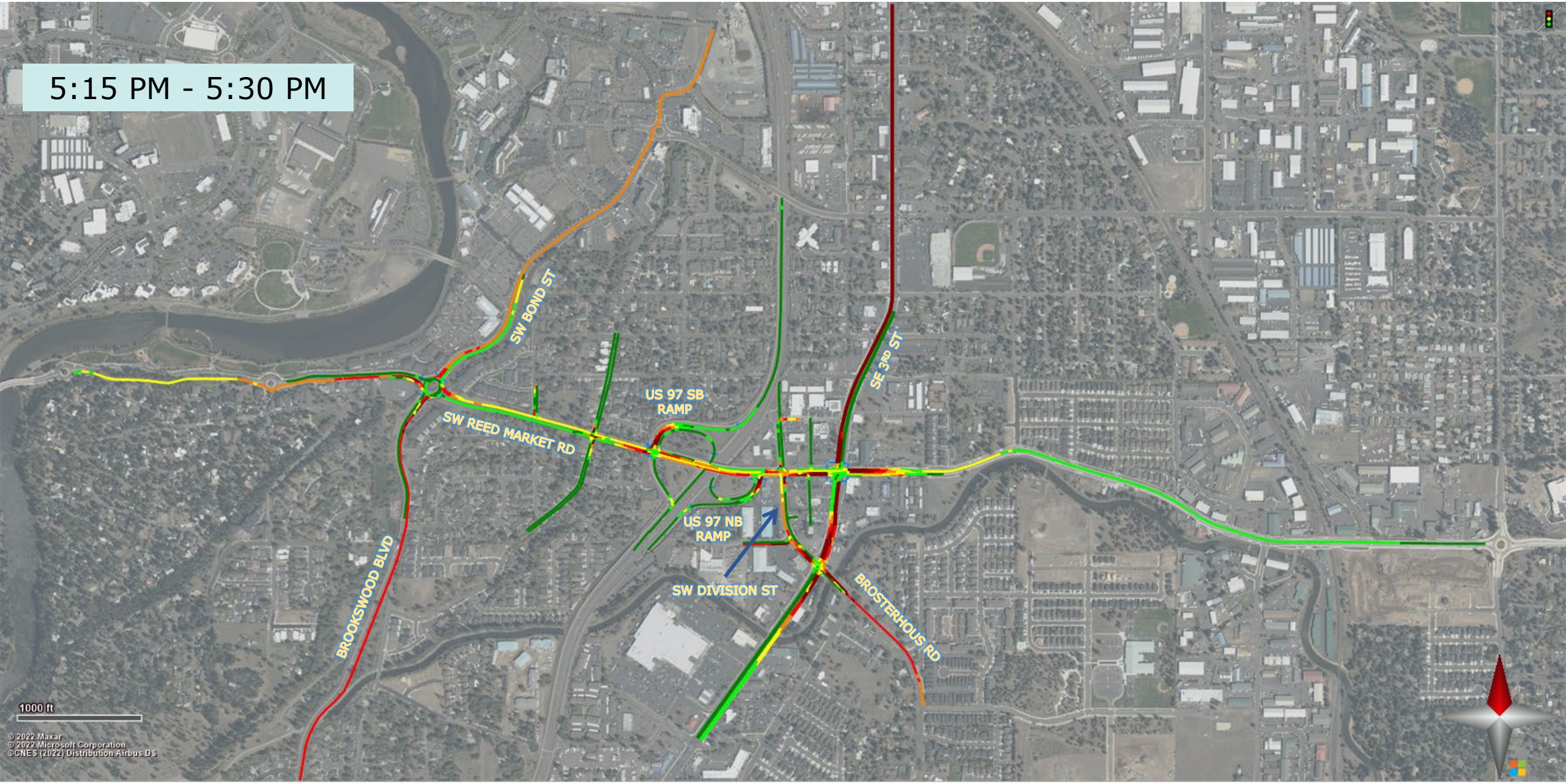
5:15 PM - 5:30 PM
SW BOND ST
US 97 SB RAMP
SW REED MARKET RD
SE 3RD ST
US 97 NB RAMP
SW DIVISION ST
BROOKSWOOD BLVD
BROSTERHOUS RD
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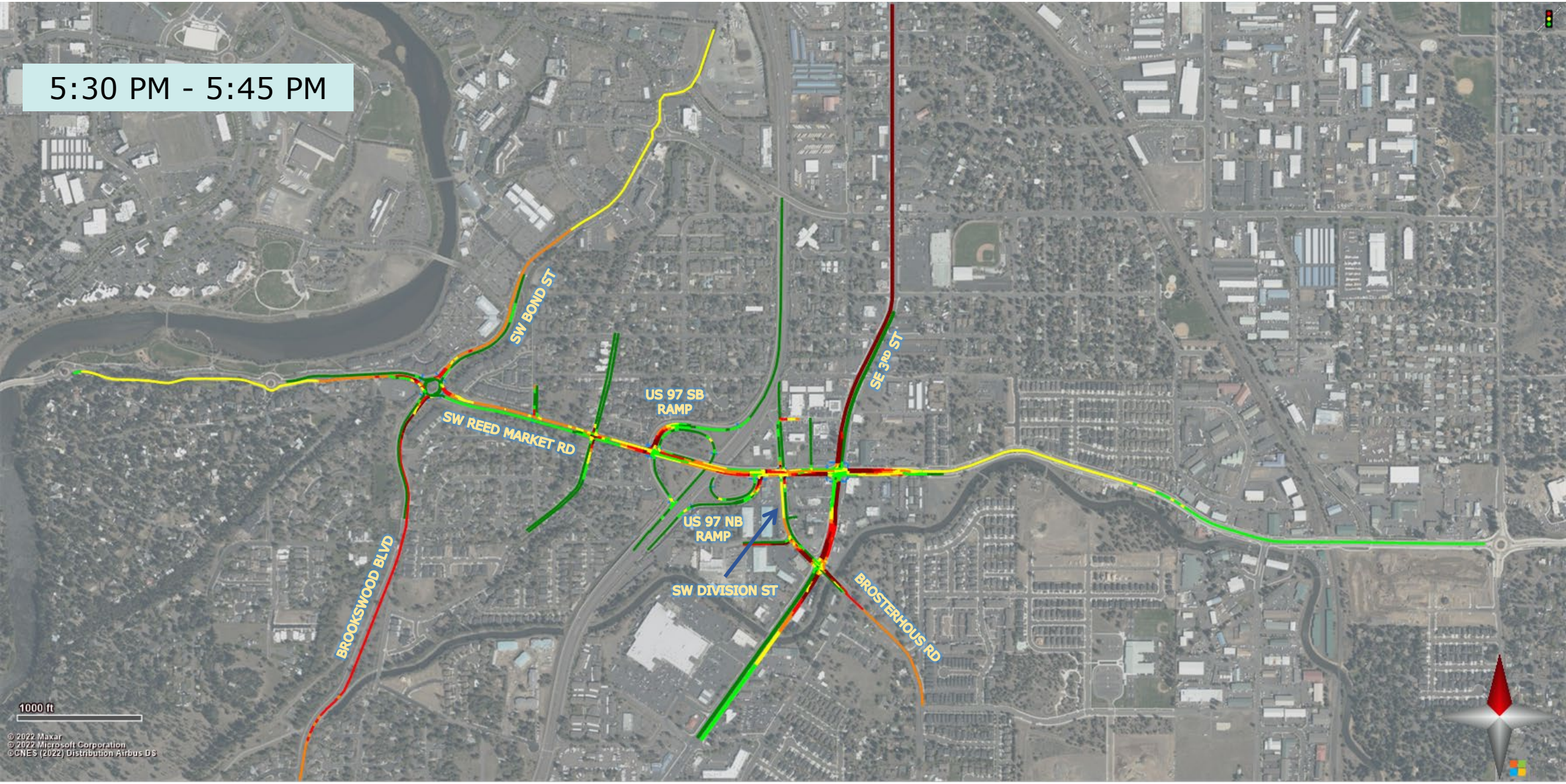
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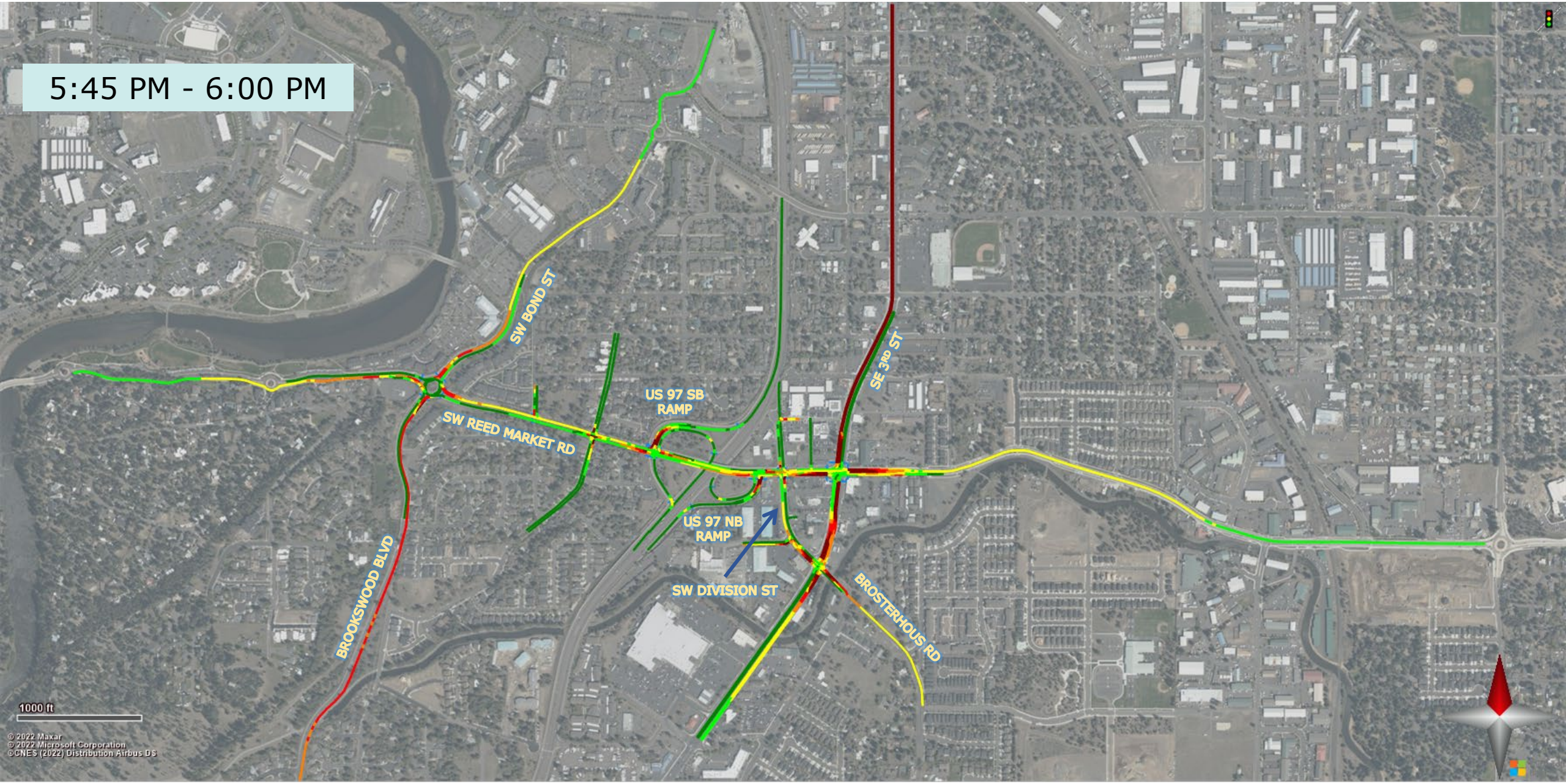
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SW REED MARKET RD
US 97 SB RAMP
US 97 NB RAMP
SW DIVISION ST
SE 3RD ST
BROSTERHOUS RD
BROOKSWOOD BLVD
1000 ft
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# APPENDIX C: VISSIM MODEL VEHICLE QUEUE TABLE FOR THE PREFERRED ALTERNATIVES

## TABLE: QUEUE COUNTERS

| Movement | Average Queue | Std Dev | Max Queue | 95th Percentile Queue |
|---|---|---|---|---|
| Reed Market Road and Brookswood Boulevard/Bond Street:NBT | 2865 | 796 | 3455 | 3420 |
| Reed Market Road and Brookswood Boulevard/Bond Street:NBL | 2790 | 945 | 3445 | 3415 |
| Reed Market Road and Brookswood Boulevard/Bond Street:SBT | 2300 | 1457 | 3890 | 3860 |
| Reed Market Road and Brookswood Boulevard/Bond Street:SBL | 2240 | 1503 | 3870 | 3840 |
| Reed Market Road and Brookswood Boulevard/Bond Street:EBT | 750 | 694 | 2915 | 2260 |
| Reed Market Road and Brookswood Boulevard/Bond Street:EBR | 75 | 121 | 1170 | 155 |
| Reed Market Road and Brookswood Boulevard/Bond Street:WBT | 445 | 605 | 1865 | 1865 |
| Reed Market Road and Brookswood Boulevard/Bond Street:WBR | 355 | 548 | 1855 | 1855 |
| Reed Market Road and US 97 SB Ramp:SBT | 215 | 50 | 385 | 320 |
| Reed Market Road and US 97 SB Ramp:EBT | 275 | 287 | 2045 | 625 |
| Reed Market Road and US 97 SB Ramp:WBT | 430 | 299 | 910 | 885 |
| Reed Market Road and US 97 NB Ramp:NBR | 55 | 37 | 165 | 145 |
| Reed Market Road and US 97 NB Ramp:NBL | 95 | 43 | 280 | 165 |
| Reed Market Road and US 97 NB Ramp:EBT | 640 | 179 | 870 | 865 |
| Reed Market Road and US 97 NB Ramp:WBT | 275 | 210 | 705 | 705 |
| Reed Market Road and Division:NBR | 20 | 18 | 105 | 60 |
| Reed Market Road and Division:SBT | 10 | 11 | 45 | 25 |
| Reed Market Road and 3rd Street:NBT | 645 | 159 | 830 | 795 |
| Reed Market Road and 3rd Street:NBL | 625 | 186 | 825 | 795 |
| Reed Market Road and 3rd Street:SBT | 2985 | 999 | 3835 | 3805 |
| Reed Market Road and 3rd Street:SBL | 2985 | 1002 | 3840 | 3805 |
| Reed Market Road and 3rd Street:EBT | 420 | 169 | 710 | 640 |
| Reed Market Road and 3rd Street:EBL | 315 | 210 | 710 | 640 |
| Reed Market Road and 3rd Street:WBT | 685 | 842 | 3835 | 2775 |
| Reed Market Road and 3rd Street:WBL | 735 | 861 | 3890 | 2925 |
| 3rd Street and Brosterhous Road:NBT | 455 | 323 | 1670 | 1365 |
| 3rd Street and Brosterhous Road:NBL | 270 | 397 | 1670 | 1365 |
| 3rd Street and Brosterhous Road:SBT | 310 | 89 | 805 | 480 |
| 3rd Street and Brosterhous Road:SBL | 320 | 90 | 815 | 490 |
| 3rd Street and Brosterhous Road:EBL | 385 | 349 | 1080 | 1040 |
| 3rd Street and Brosterhous Road:EBT | 600 | 333 | 1080 | 1045 |
| 3rd Street and Brosterhous Road:EBR | 385 | 341 | 1080 | 1035 |
| 3rd Street and Brosterhous Road:WBT | 780 | 520 | 1445 | 1390 |
| 3rd Street and Brosterhous Road:WBL | 120 | 306 | 1385 | 1360 |

# APPENDIX D: VISSIM MODEL AVERAGE DELAY TABLE FOR THE PREFERRED ALTERNATIVES

# Delay Table

Future (2040) PM Peak
4:30 PM - 5:30 PM

## TABLE: AVERAGE DELAY

| Intersection | Approach | Movement | Volume | Average Delay (s) |
|---|---|---|---|---|
| Reed Market Road and Brookswood Boulevard/Bond Street | NB | Left | 175 | 308 |
| | | Through | 422 | 331 |
| | | Right | 65 | 329 |
| | | U-Turn | - | - |
| | | **Total** | **662** | **324** |
| | SB | Left | 415 | 136 |
| | | Through | 477 | 136 |
| | | Right | 70 | 134 |
| | | U-Turn | - | - |
| | | **Total** | **962** | **136** |
| | EB | Left | 65 | 94 |
| | | Through | 439 | 94 |
| | | Right | 212 | 73 |
| | | U-Turn | - | - |
| | | **Total** | **716** | **88** |
| | WB | Left | 75 | 43 |
| | | Through | 366 | 41 |
| | | Right | 397 | 39 |
| | | U-Turn | - | - |
| | | **Total** | **838** | **40** |
| | | **Total** | **3178** | **139** |
| Reed Market Road and US 97 SB Ramp | NB | Left | - | - |
| | | Through | - | - |
| | | Right | - | - |
| | | U-Turn | - | - |
| | | **Total** | **-** | **-** |
| | SB | Left | 667 | 34 |
| | | Through | 3 | 23 |
| | | Right | 240 | 35 |
| | | U-Turn | - | - |
| | | **Total** | **910** | **34** |
| | EB | Left | - | - |
| | | Through | 813 | 19 |
| | | Right | 106 | 23 |
| | | U-Turn | - | - |
| | | **Total** | **919** | **20** |
| | WB | Left | - | - |
| | | Through | 732 | 37 |
| | | Right | 130 | 4 |
| | | U-Turn | - | - |
| | | **Total** | **862** | **32** |
| | | **Total** | **2691** | **29** |

# Delay Table

Future (2040) PM Peak
4:30 PM - 5:30 PM

## TABLE: AVERAGE DELAY

| Intersection | Approach | Movement | Volume | Average Delay (s) |
|---|---|---|---|---|
| Reed Market Road and US 97 NB Ramp | NB | Left | 127 | 39 |
| | | Through | - | - |
| | | Right | 125 | 22 |
| | | U-Turn | - | - |
| | | **Total** | **252** | **31** |
| | SB | Left | - | - |
| | | Through | - | - |
| | | Right | - | - |
| | | U-Turn | - | - |
| | | **Total** | **-** | **-** |
| | EB | Left | - | - |
| | | Through | 1336 | 29 |
| | | Right | 144 | 40 |
| | | U-Turn | - | - |
| | | **Total** | **1480** | **30** |
| | WB | Left | - | - |
| | | Through | 737 | 10 |
| | | Right | - | - |
| | | U-Turn | - | - |
| | | **Total** | **737** | **10** |
| | | **Total** | **2469** | **24** |
| Reed Market Road and Division | NB | Left | - | - |
| | | Through | - | - |
| | | Right | 49 | 67 |
| | | U-Turn | - | - |
| | | **Total** | **49** | **67** |
| | SB | Left | - | - |
| | | Through | - | - |
| | | Right | 26 | 17 |
| | | U-Turn | - | - |
| | | **Total** | **26** | **17** |
| | EB | Left | - | - |
| | | Through | 801 | 4 |
| | | Right | 658 | 4 |
| | | U-Turn | - | - |
| | | **Total** | **1459** | **4** |
| | WB | Left | - | - |
| | | Through | 715 | 13 |
| | | Right | 378 | 2 |
| | | U-Turn | - | - |
| | | **Total** | **1093** | **9** |
| | | **Total** | **2627** | **8** |

# Delay Table

Future (2040) PM Peak
4:30 PM - 5:30 PM

## TABLE: AVERAGE DELAY

| Intersection | Approach | Movement | Volume | Average Delay (s) |
|---|---|---|---|---|
| Reed Market Road and 3rd Street | NB | Left | 351 | 143 |
| | | Through | 758 | 62 |
| | | Right | 278 | 66 |
| | | U-Turn | - | - |
| | | **Total** | **1387** | **83** |
| | SB | Left | 172 | 499 |
| | | Through | 701 | 473 |
| | | Right | 167 | 484 |
| | | U-Turn | - | - |
| | | **Total** | **1040** | **479** |
| | EB | Left | 154 | 65 |
| | | Through | 623 | 61 |
| | | Right | 71 | 60 |
| | | U-Turn | - | - |
| | | **Total** | **848** | **61** |
| | WB | Left | 273 | 148 |
| | | Through | 580 | 86 |
| | | Right | 105 | 86 |
| | | U-Turn | - | - |
| | | **Total** | **958** | **104** |
| | | **Total** | **4233** | **181** |
| 3rd Street and Brosterhous Road | NB | Left | 39 | 72 |
| | | Through | 828 | 72 |
| | | Right | 55 | 75 |
| | | U-Turn | - | - |
| | | **Total** | **922** | **72** |
| | SB | Left | 211 | 76 |
| | | Through | 819 | 32 |
| | | Right | 34 | 25 |
| | | U-Turn | - | - |
| | | **Total** | **1064** | **41** |
| | EB | Left | 67 | 296 |
| | | Through | 363 | 53 |
| | | Right | 280 | 55 |
| | | U-Turn | - | - |
| | | **Total** | **710** | **77** |
| | WB | Left | 50 | 135 |
| | | Through | 27 | 133 |
| | | Right | 485 | 124 |
| | | U-Turn | - | - |
| | | **Total** | **562** | **125** |
| | | **Total** | **3258** | **72** |

# APPENDIX E: VISSIM MODEL GEH STATISTICS TABLE FOR THE PREFERRED ALTERNATIVES

# GEH Table

Future (2040) PM Peak
4:30 PM - 5:30 PM

| Intersection Number | Intersection Name | Movement | Input Volume | VISSIM Output Volume | GEH |
|---|---|---|---|---|---|
| 1 | Reed Market Road and Brookswood Boulevard/Bond Street | NBL | 195 | 175 | 1.5 |
| | | NBT | 470 | 422 | 2.3 |
| | | NBR | 70 | 65 | 0.6 |
| | | SBL | 395 | 415 | 1.0 |
| | | SBT | 470 | 477 | 0.3 |
| | | SBR | 70 | 70 | 0.0 |
| | | EBL | 65 | 65 | 0.0 |
| | | EBT | 445 | 439 | 0.3 |
| | | EBR | 210 | 212 | 0.1 |
| | | WBL | 70 | 75 | 0.6 |
| | | WBT | 360 | 366 | 0.3 |
| | | WBR | 425 | 397 | 1.4 |
| | | Total | 3245 | 3190 | 1.0 |
| 2 | Reed Market Road and US 97 SB Ramp | SBL | 640 | 667 | 1.1 |
| | | SBT | 0 | 3 | 2.4 |
| | | SBR | 235 | 240 | 0.3 |
| | | EBT | 810 | 813 | 0.1 |
| | | EBR | 95 | 106 | 1.1 |
| | | WBT | 740 | 732 | 0.3 |
| | | WBR | 145 | 130 | 1.3 |
| | | Total | 2665 | 2714 | 0.9 |
| 3 | Reed Market Road and US 97 NB Ramp | NBL | 115 | 127 | 1.1 |
| | | NBR | 115 | 125 | 0.9 |
| | | EBT | 1305 | 1336 | 0.9 |
| | | EBR | 150 | 144 | 0.5 |
| | | WBT | 770 | 737 | 1.2 |
| | | Total | 2455 | 2497 | 0.8 |
| 4 | Reed Market Road and Division Street | NBR | 50 | 49 | 0.1 |
| | | SBR | 20 | 26 | 1.3 |
| | | EBT | 695 | 801 | 3.9 |
| | | EBR | 625 | 658 | 1.3 |
| | | WBT | 750 | 715 | 1.3 |
| | | WBR | 395 | 378 | 0.9 |
| | | Total | 2635 | 2653 | 0.4 |

# GEH Table

Future (2040) PM Peak
4:30 PM - 5:30 PM

| Intersection Number | Intersection Name | Movement | Input Volume | VISSIM Output Volume | GEH |
|---|---|---|---|---|---|
| 5 | Reed Market Road and 3rd Street | NBL | 365 | 351 | 0.7 |
| | | NBT | 780 | 758 | 0.8 |
| | | NBR | 275 | 278 | 0.2 |
| | | SBL | 205 | 172 | 2.4 |
| | | SBT | 820 | 701 | 4.3 |
| | | SBR | 195 | 167 | 2.1 |
| | | EBL | 145 | 154 | 0.7 |
| | | EBT | 610 | 623 | 0.5 |
| | | EBR | 70 | 71 | 0.1 |
| | | WBL | 260 | 273 | 0.8 |
| | | WBT | 590 | 580 | 0.4 |
| | | WBR | 110 | 105 | 0.5 |
| | | Total | 4425 | 4285 | 2.1 |
| 6 | 3rd Street and Brosterhous Road | NBL | 30 | 39 | 1.5 |
| | | NBT | 855 | 828 | 0.9 |
| | | NBR | 50 | 55 | 0.7 |
| | | SBL | 230 | 211 | 1.3 |
| | | SBT | 895 | 819 | 2.6 |
| | | SBR | 35 | 34 | 0.2 |
| | | EBL | 85 | 67 | 2.1 |
| | | EBT | 345 | 363 | 1.0 |
| | | EBR | 270 | 280 | 0.6 |
| | | WBL | 55 | 50 | 0.7 |
| | | WBT | 25 | 27 | 0.4 |
| | | WBR | 480 | 485 | 0.2 |
| | | Total | 3355 | 3297 | 1.0 |

# Enter and Exit GEH

Future (2040) PM Peak
4:30 PM - 5:30 PM

| Entry GEH (4:30-5:30 PM) | | | | | |
|---|---|---|---|---|---|
| **Entry Location** | **Count** | **Vissim Throughput** | **Diff** | **%Diff** | **GEH** |
| Reed Market Road and Brookswood Boulevard/Bond Street - N | 935 | 962 | 27 | 2.9% | 0.9 |
| Reed Market Road and Brookswood Boulevard/Bond Street - S | 735 | 662 | -73 | -9.9% | 2.8 |
| Reed Market Road and Brookswood Boulevard/Bond Street - W | 720 | 716 | -4 | -0.6% | 0.1 |
| Reed Market Road and US 97 SB Ramp - N | 875 | 910 | 35 | 4.0% | 1.2 |
| Reed Market Road and US 97 NB Ramp - S | 230 | 252 | 22 | 9.6% | 1.4 |
| Reed Market Road and 3rd Street - N | 1220 | 1040 | -180 | -14.8% | 5.6 |
| Reed Market Road and 3rd Street - E | 960 | 958 | -2 | -0.2% | 0.1 |
| 3rd Street and Brosterhous Road - S | 935 | 922 | -13 | -1.4% | 0.4 |
| 3rd Street and Brosterhous Road - E | 560 | 562 | 2 | 0.4% | 0.1 |

| Exit GEH (4:30-5:30 PM) | | | | | |
|---|---|---|---|---|---|
| **Entry Location** | **Count** | **Vissim Throughput** | **Diff** | **%Diff** | **GEH** |
| Reed Market Road and Brookswood Boulevard/Bond Street - N | 960 | 884 | -76 | -7.9% | 2.6 |
| Reed Market Road and Brookswood Boulevard/Bond Street - S | 750 | 764 | 14 | 1.9% | 0.5 |
| Reed Market Road and Brookswood Boulevard/Bond Street - W | 625 | 611 | -14 | -2.2% | 0.6 |
| Reed Market Road and US 97 SB Ramp - S | 95 | 109 | 14 | 14.7% | 1.3 |
| Reed Market Road and US 97 NB Ramp - S | 150 | 144 | -6 | -4.0% | 0.5 |
| Reed Market Road and 3rd Street - N | 1035 | 1017 | -18 | -1.7% | 0.6 |
| Reed Market Road and 3rd Street - E | 1090 | 1073 | -17 | -1.6% | 0.5 |
| 3rd Street and Brosterhous Road - S | 1220 | 1149 | -71 | -5.8% | 2.1 |
| 3rd Street and Brosterhous Road - E | 625 | 629 | 4 | 0.6% | 0.2 |

# ATTACHMENT G: VISSIM PROTOCOL CALIBRATION AND VALIDATION REPORT

# TECHNICAL MEMORANDUM

DATE: March 24, 2023

TO: Project Team

FROM: Eileen Chai, EIT; Aaron Berger, PE; Kayla Fleskes-Lane, PE; John Bosket, PE | DKS Associates

SUBJECT: US 97 at Reed Market Road Operations and Safety Study - Vissim Protocol Calibration and Validation Report

This memorandum documents the development and calibration of the existing conditions year 2022 weekday PM peak period Vissim microsimulation model for the Oregon Department of Transportation (ODOT) US 97 at Reed Market Road Operations and Safety Study project. The project Methods and Assumptions memorandum[1] documented the details of model development that were assumed. This memorandum documents additional assumptions made and parameters that were changed during calibration along with the performance measures reported by the existing year Vissim model.

## PROJECT DESCRIPTION

The ODOT US 97 at Reed Market Road Operations and Safety Study project proposes to analyze operational and safety improvements for a segment of Reed Market Road within the city of Bend. The project aims to develop operational and safety solutions prioritized based upon effectiveness, and develop planning level concepts and cost estimates for the highest prioritized solutions. Additionally, the project aims to integrate proposed projects from the City of Bend Transportation System Plan[2] (TSP) and the US 97 Bend Parkway Plan[3] sited within the study segment, propose additional projects to improve mobility and safety, tabulate existing funding sources and amounts associated with the proposed projects, and identify potential funding gaps.

The primary purpose of the project Vissim analysis is to understand and test the interactions between localized solutions along the Reed Market Road corridor. This model is intended only to

[1] US 97 at Reed Market Road Operations and Safety Study Methods and Assumptions Memorandum, September 2022, DKS Associates

[2] Bend Transportation System Plan, 2020, City of Bend

[3] US 97 Parkway Plan, August 2020, Oregon Department of Transportation

refine the preferred alternative projects and is not intended for use in developing the performance measures supporting the screening process.

## STUDY AREA AND MODEL AREA

The Vissim model area and study intersections are shown in Figure 1. The model extends from Reed Market Road/Brookswood Boulevard/Bond Street Roundabout eastward to the intersection of 4th Street. The northern terminus is the 3rd Street and Roosevelt Avenue intersection, and the southern terminus is the 3rd Street and Brosterhous Road intersection. The model includes the on-ramp and off-ramps to US 97 but does not include the US 97 mainline. The model includes three signalized intersections, a roundabout, and two other unsignalized study intersections. The model also includes driveways that influence the arrival patterns, lane utilization, and queueing at the study intersections, per the ODOT Vissim Protocol guidelines[4]. Performance measures are reported only for the study intersections.

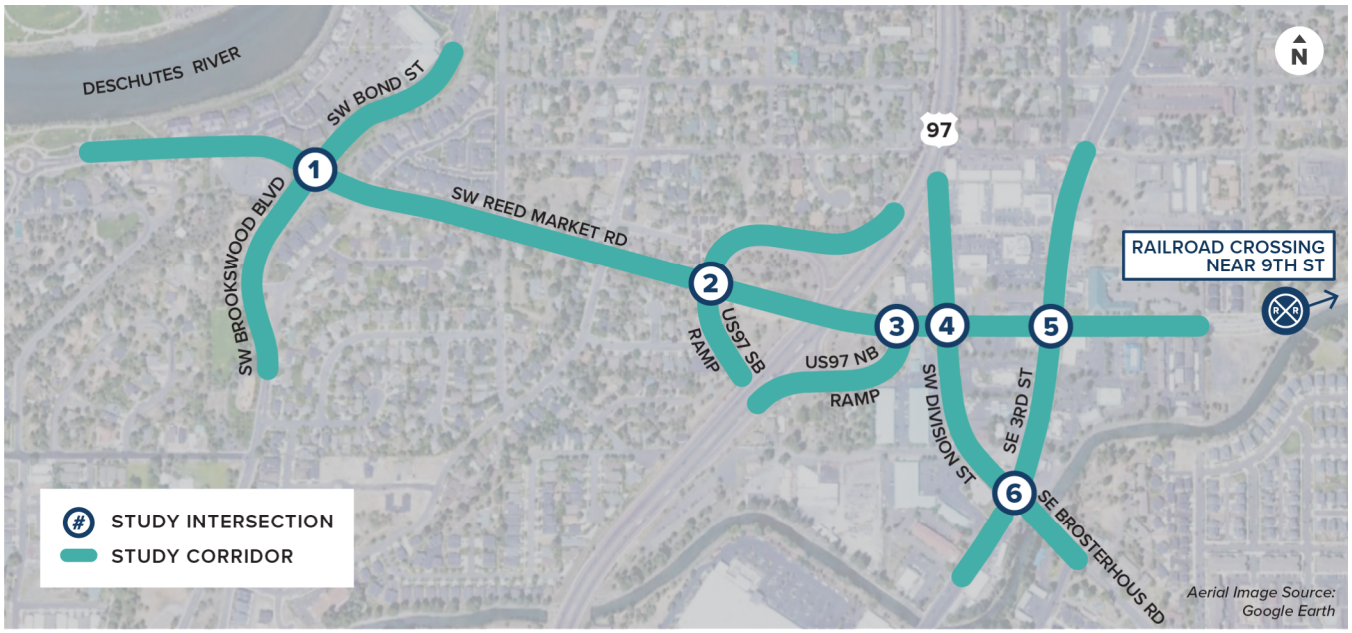


**FIGURE 1: STUDY INTERSECTIONS**

[4] Protocol for Vissim Simulation, June 2011, Oregon Department of Transportation

## DATA COLLECTION SUMMARY

DKS collected the following data to develop and calibrate the base year Vissim model:

- **Roadway Geometry Data**: This included roadway segment lengths, number of lanes, lengths of storage bays and tapers, intersection geometry, pedestrian crossing locations and widths, and transit stop locations. This data was primarily obtained from aerial imagery and Google Street View and was verified with field observations.

- **Traffic Control Data**: This included posted speeds, stop bar and stop sign locations, traffic signal locations, traffic signal timing data, and detector plans. This data was obtained from local agencies, aerial imagery and Google Street View and was verified with field observations.

- **Traffic Volume Data**: DKS collected traffic count data at all the Vissim model study intersections to serve as inputs for the existing year PM peak hour Vissim model. The traffic count data was collected on August 3, 2022, and included 5-minute volume profiles. Daily count data on both US 97 and within the City of Bend indicates that the August 3rd PM peak period would fall with the 30 highest annual hours (30 HV) for the City, making this a 30 HV data set and model. The peak hour of traffic for the three westernmost study intersections starts at 4:50 p.m. while the peak hour for the three easternmost occurs earlier, starting between 4:10 p.m. and 4:15 p.m. The system-wide peak hour was 4:30 PM to 5:30 PM. The balanced 2-hour (4:00 PM to 6:00 PM) counts are shown in Figure 2. The unbalanced count data is provided in Appendix A. Study intersection traffic count locations, collection dates, and intersection specific peak hours are shown in Table 1.

**TABLE 1: STUDY INTERSECTION COUNT LOCATION, DATE, AND INTERSECTION PEAK HOUR**

| STUDY INTERSECTION # | INTERSECTION | DATE COLLECTED | INTERSECTION SPECIFIC PEAK HOUR |
|---|---|---|---|
| 1 | Reed Market Rd & Brookswood Blvd/Bond St | Wednesday, August 3, 2022 | 4:50-5:50PM |
| 2 | Reed Market Rd & US 97 SB | Wednesday, August 3, 2022 | 4:50-5:50PM |
| 3 | Reed Market Rd & US 97 NB | Wednesday, August 3, 2022 | 4:50-5:50PM |
| 4 | Reed Market Rd & Division St | Wednesday, August 3, 2022 | 4:10-5:10PM |
| 5 | Reed Market Rd & 3rd St | Wednesday, August 3, 2022 | 4:15-5:15PM |
| 6 | 3rd St & Brosterhous Rd | Wednesday, August 3, 2022 | 4:10-5:10PM |

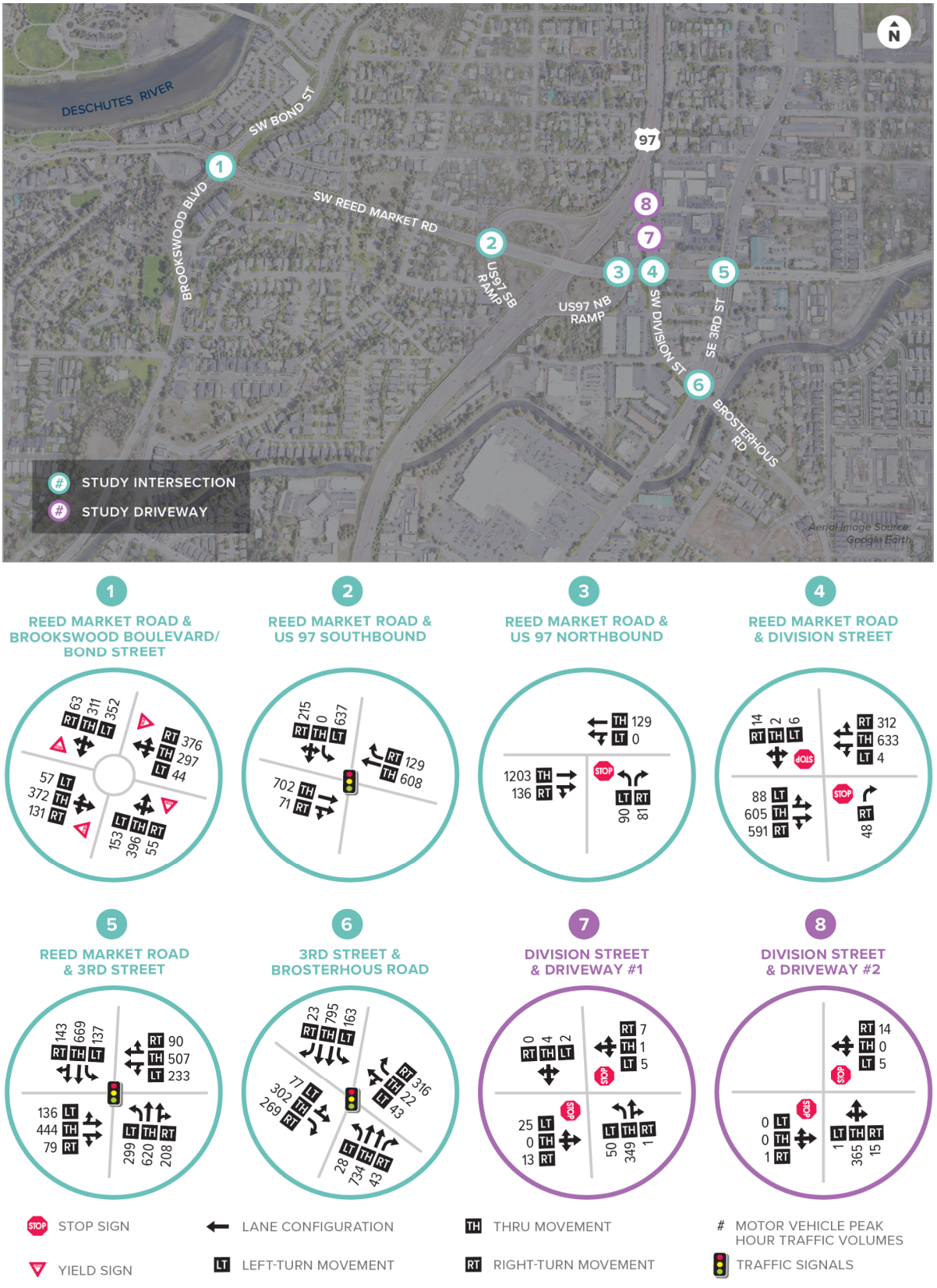


**FIGURE 2: EXISTING PM PEAK HOUR BALANCED COUNTS**

- **Transit Data:** This included bus schedules, headways, and stop locations. Local transit routes within the Vissim model study area include the South 3rd Street line (Route 1) and the Brookswood Boulevard line (Route 2). This data was obtained from the Cascades East Transit website.

- **Field Observations**: DKS conducted field observations in the study area during the weekday PM peak period[5]. Field observations were used to help verify roadway geometry and traffic control data, as well as to identify queuing issues and areas of congestion. Additional details of the field observations are documented in the Existing Condition memorandum[6].

- **Origin Destination (O-D) data development**: In addition to the turn movement count data at intersections, the Vissim model requires O-D data to route the traffic through the network (i.e., the origin location and the destination location of each vehicle). DKS developed this data based on the Bend-Redmond travel demand model using a process described in detail in the Methods and Assumptions memorandum. The result of the process was traffic demand with complete O-D routing that closely maintains the Bend-Redmond travel demand model (BRM) trip distribution patterns, while having volume for each turn movement match closely to the count data. The O-D data in the form of a matrix was then exported to Vissim for microsimulation analysis.

- **Queueing Data**: Queue lengths throughout the study area were noted during field observations. In addition, typical traffic plots from Google maps at 15-minute intervals were captured while the traffic counts and field observations were occurring and are included for reference in Appendix B.

## MODEL DEVELOPMENT SUMMARY

The Vissim model development process used two documents as guidance, including The Federal Highway Administration's (FHWA's) Traffic Analysis Toolbox Volume iii: Guidelines for Applying Traffic Microsimulation Modeling Software[7] and the ODOT Protocol for Vissim Simulation. This section describes the steps completed in the existing (or base) year 2022 PM peak model development process.

### NETWORK CODING

This step involved coding the geometry of the entire network. Network objects and attributes added in this step include the following:

[5] Field observations conducted on Wednesday, August 3, 2022.
[6] US 97 at Reed Market Road Operations and Safety Study Existing Condition Memorandum, September 2022, DKS Associates
[7] Traffic Analysis Toolbox Volume III: Guidelines for Applying Traffic Microsimulation Modeling Software, Federal Highway Administration, August 2003.

1. Physical roadway (links and connectors)
2. Intersection geometry (links and connectors)
3. Pedestrian links
4. Traffic control (speed distributions and decisions, reduced speed areas, conflict areas, priority rules, stop signs, signal heads, detectors, signal timing, and ramp metering)

Desired speed distributions were developed using the ODOT Vissim protocol methods for links without measured speed data based on posted speed.

## TRAFFIC DEMAND AND ROUTING

The first step in demand development was to balance the 2-hour turning movement count data. The count data was consistent between study intersection, requiring minimal balancing adjustments. O-D Matrix Estimation (TFlowFuzzy) was used in Visum to develop an O-D matrix based on the 2-hour balanced turning movement counts. A sub-area model from the Bend-Redmond travel demand 2019 base year model provided the initial seed trip distribution. The end result of this process is a calibrated O-D matrix that matches the balanced count data while preserving trip distribution from the Bend-Redmond model for major travel patterns.

The O-D data was assigned to a linear Visum network that aligned geometrically with the project Vissim model. The vehicle routing information from the Visum model was then exported to the Vissim model as hourly volume inputs and static vehicle routing, maintaining the O-D patterns developed from the 2019 BRM model scenario.

Pedestrian counts were used as pedestrian inputs for all intersections and crossing locations within the Vissim model. Pedestrian counts were rounded up to the nearest 10 to provide a more conservative estimate of pedestrian impacts on the model network.

## TRAFFIC VOLUME PEAKING PROFILE

The initial PM peak two-hour volume inputs in Vissim (from the demand development process described above) were modified to include a "peaking profile" of 15-minute volume flow rate increments. The peaking profiles were generated based on traffic counts. All input locations with volumes greater than 300 vehicles per hour (vph) were assigned a profile unique to a corresponding traffic count. The traffic counts for all other approaches representing driveways and side streets with volumes less than 300 vph were added together and used to develop a typical low volume approach profile for the model. Field observations and traffic counts show that none of the driveways and side streets had radically different peaking profiles that would have an impact on corridor operations. The volume profiles used for the model are included in Appendix C.

### VEHICLE COMPOSITIONS

The volume inputs included heavy vehicle percentages based on the count data. The heavy vehicle percentages were rounded to the nearest one percent from the existing counts, and the percentages were applied to the corresponding volume inputs to the model network. The heavy vehicle fleet was modified from the Vissim defaults to be consistent with the ODOT Vissim protocol.

### SIMULATION PERIOD AND SEEDING PERIOD

The system-wide peak hour for the collected traffic count data was 4:30 to 5:30 PM. The FHWA's Traffic Analysis Toolbox recommends a seeding period equal to or greater than twice the estimated travel time at free-flow conditions to traverse the entire network. The free flow travel time is approximately 3 minutes. To be conservative and allow for the congestion levels and queues to develop to peak conditions, a seeding period of 15 minutes was chosen. The Vissim simulation period included the 15-minute seeding period (initialization period) followed by the entire two-hour analysis period (4-6 PM). The volume rate for the 4:00-4:15 period was used for the seeding period flow rate. Measures of effectiveness were collected for the one-hour system peak period.

## ERROR CHECKING

The error checking portion of the model development focused on fixing coding errors before the calibration process began. Error checking is a process that includes a review of the coded data and a review of the animation. All coded data (geometry, speeds, signal timing data, stop and yield controls, transit data, and traffic volumes) was reviewed by the model developer and quality control reviewer.

A review of the animation was conducted to determine locations where conflict areas or priority rules might be missing, where signal timing may not be operating correctly, or any other locations where generally coded parameters may have been overlooked. No significant error messages, such as vehicle input not generating all vehicles or vehicles getting diffused from the network were generated.

## CALIBRATION AND VALIDATION

Upon the completion of the error checking, DKS calibrated the simulation model following the traffic volume and travel time calibration criteria in the ODOT Simulation Protocol. Additionally, the model was visually validated on queue observations. The model validation was based on 10 simulation runs.

The following calibration targets were used for the existing year Vissim model:

- A quantitative comparison between real-world data and model output results ODOT Vissim Protocol calibration criteria for traffic volume GEH and travel time target criteria.

- A qualitative comparison (visual inspection and validation) of queuing and general operations along the entire study area based on field observations and Google Traffic Maps of conditions collected during traffic counts.

To best replicate field conditions, the Vissim model calibration process implemented a variety of standard techniques where appropriate, including:

- Lane change distance on turning movement connectors to capture upstream lane positioning.
- Intersection "keep clear" zones through congested intersections.
- Increased turning speeds for turning movements with larger than typical radii.

A large portion of the study area maintained Vissim default driver parameters from the Wiedemann 74 Model[8], including urban and roundabout. Edits were made to better reflect observed driving behavior, and are described as follows:

- "Urban" - this driving behavior used the Wiedermann 74 model with default parameters, with two edits. The "Additive Part of Safety Distance" was changed from the default (2.00) to 2.60, and the "Multiplicative Part of Safety Distance" was changed from the default (3.00) to 3.60. These changes decreased that saturation flow rate and allowed the model to better replicate the field observed driver behavior, especially on 3rd Street. The "Urban" drive behavior was applied on all non-roundabout, non-US 97 motor vehicle links in the network.
- "Roundabout" – this driving behavior used the Wiedermann 74 model with default parameters. The Wiedermann 74 model driving behavior defaults represent an efficient driver population with high saturation flow rates. This driving behavior matched well with the driving behavior observed at the roundabouts, and calibrated well to the HCM roundabout capacity curves, as discussed later in this document. This driving behavior was only applied at the roundabout and roundabout approaches in the model.

In addition, lane decision distances were adjusted for non-US 97 intersections, mainly based on model error checking, ensuring that vehicles were not getting trapped trying to make an urban lane change for a turn movement.

The roundabout at Reed Market and Bond Street was calibrated separately. While a roundabout may appear to be operating correctly under existing conditions in Vissim, the actual capacity of the roundabout may be unrealistic. The existing volumes were used as a baseline and each approach was overloaded and tested individually. For each approach test, the throughput for the overloaded approach and the conflicting volume throughput were recorded and plotted against the HCM 6th Edition and HCM 2010 roundabout capacity curves. The roundabout circulating speeds, approach speeds, and conflict area size and gap parameters were adjusted iteratively until the approach throughput matched the expected HCM capacity closely. The final calibrated results are shown in Figure 3.

[8] Vissim 10.0 Car Following Driver Behavior Model

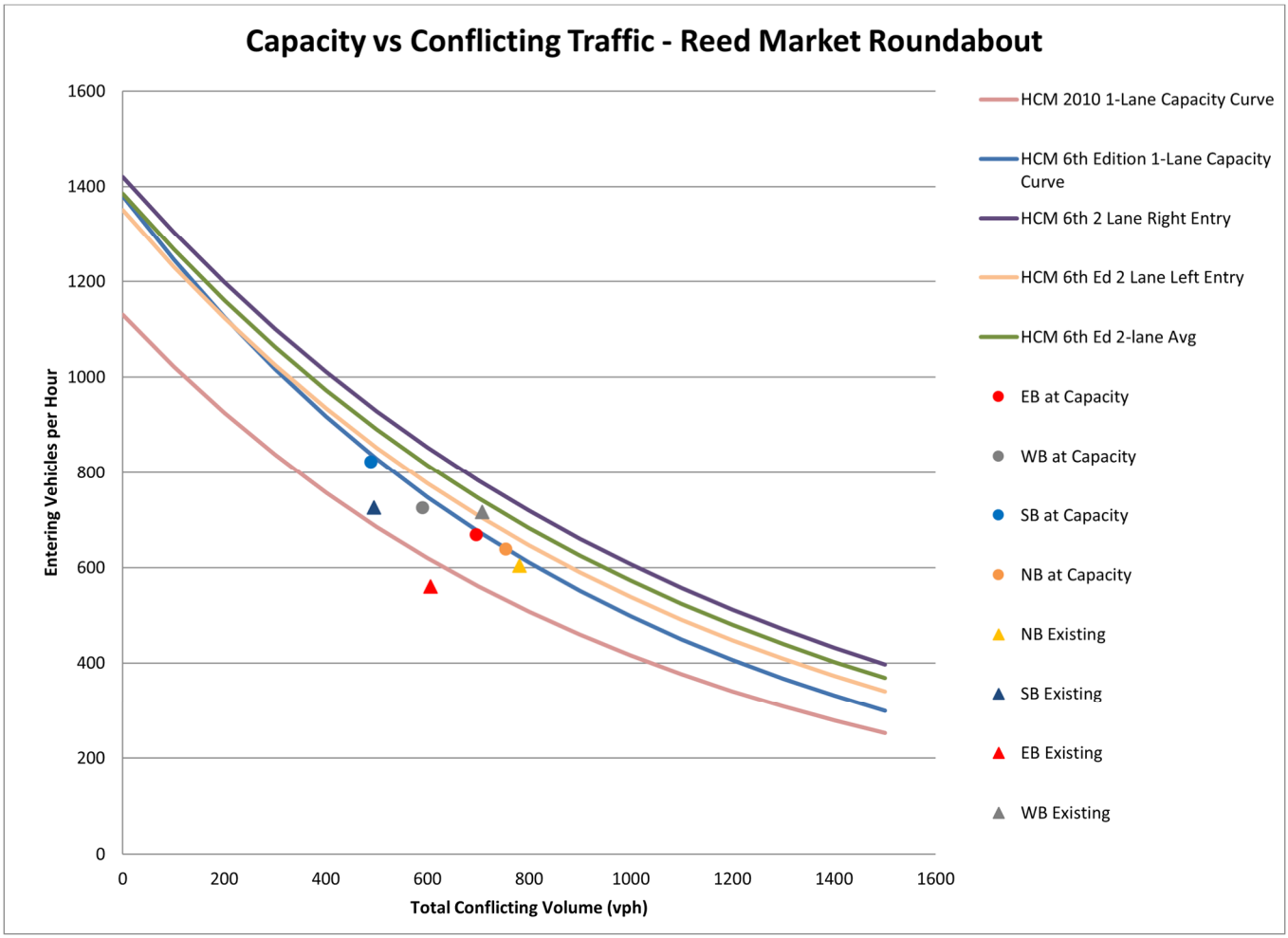


**FIGURE 3: ROUNDABOUT CALIBRATION RESULTS**

As shown in the roundabout capacity plot, at a minimum, all modeled approaches met the HCM 2010 capacity curve. Some of the lower capacity approaches were closer to the periphery of the HCM curves, where the empirical data is scarcer and less accurate. Southbound and westbound approach capacities do not perfectly reach the HCM 6th Edition capacity. However, these are low speed approaches that are arguably at or near capacity today, so these results are reasonable.

Volume profile adjustments were made to the northbound, southbound, and eastbound approaches at Reed Market Road/Brookswood Boulevard/Bond Street roundabout to better capture the peak hour demand profile. Figure 4 shows the count volume profile and adjusted model demand profile for the mentioned approaches at the roundabout.

**FIGURE 4: ROUNDABOUT VOLUME PROFILE ADJUSTMENT**

## VOLUME/DENSITY

The initial calibration target set was for traffic volumes. Per the ODOT Vissim Protocol guidelines, individual turn movements greater than 100 vehicles per hour were calibrated within an acceptable GEH Statistic[9]. The GEH statistic was calculated for all study intersections. The traffic volume calibration results are documented in Appendix D. The total throughput at all study intersections

[9] The GEH Statistic is a universal measure to compare model inputs and outputs. It is a continuous volume tolerance formula was developed to avoid the pitfalls associated with using a simple percentage comparison of a wide range of volumes.

passed the GEH statistic check. All movements with a volume greater than 100 vehicle per hour also passed the GEH statistic check.

### QUEUING

The simulation model was also used to measure delay relative to desired speed as an indicator of queue length. The figures in Appendix E show the relative delay (queues) for each 15-minute interval during the 4:00-6:00 PM analysis period, as averaged over 10 simulations. The colors shown in these figures indicate the following approximate queue states:

1. Dark Green = Free flow, no delay
2. Light Green = Slight slowing
3. Yellow = Increased slowing, but not yet stop and go
4. Orange = Furthest extent of stop and go queues
5. Red = Fluctuates between low speed flow and stopped queue
6. Dark Red = Stop and go queue during the entire 15-minute peak interval

As part of the calibration process, these maps were compared to the Google Typical Traffic maps, and were found to follow the existing summer traffic trends.

## BASE YEAR MODEL MEASURES OF EFFECTIVENESS

The following measures of effectiveness were collected from the base year model and summarized in the appendices:

- Average and 95$^{th}$ percentile motor vehicle queue lengths (Appendix F)
- Vehicle delay and throughput (Appendix G)
- Congestion plots (Appendix E)

To calculate 95$^{th}$ percentile queues, queue length data was collected from Vissim using queue counters on critical approaches and a 120-second interval to reflect queues that form while traffic flow is impeded. The 95th percentile queue was then calculated using a percentile function. The delay measurements were calculated over the system peak hour interval (4:30-5:30 PM) for each simulation run at each signalized study intersection. Delay reported for a study intersection is measured upstream to the next intersection and not through the intersection. Congestion plots were plotted based on relative speed.

## EXISTING CONDITIONS CALIBRATION SUMMARY

As presented in this memo, the existing conditions model meets the calibration targets for volume throughput that GEH for all turn volumes > 100 vph and all model entry/exit locations are less than 5.0. Model validation is further confirmed via queuing observations as documented by the Vissim Queue Delay plots (included in Appendix E) compared to the Google Traffic maps (included in Appendix B), showing consistent patterns over each 15-minute interval. Based on the information presented in this memorandum, the existing conditions model is calibrated according to the ODOT Vissim Protocol and is ready for use to support the US 97 at Reed Market Road Operations and Safety Study.

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# VISSIM MODEL CALIBRATION METHODOLOGY AND RESULTS MEMORANDUM - APPENDIX

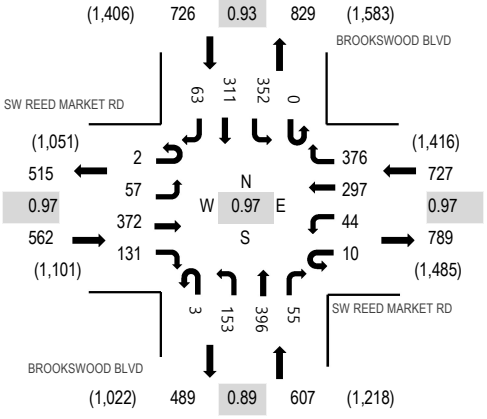
# APPENDIX A: TRAFFIC COUNTS

ALL TRAFFIC DATA SERVICES
(303) 216-2439
www.alltrafficdata.net

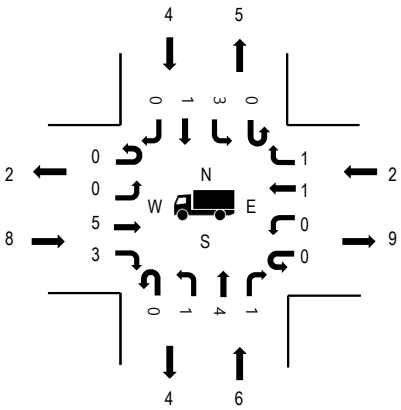
**Location:** 1 BROOKSWOOD BLVD & SW REED MARKET RD PM
**Date:** Wednesday, August 3, 2022
**Peak Hour:** 04:50 PM - 05:50 PM
**Peak 15-Minutes:** 04:55 PM - 05:10 PM

## Peak Hour

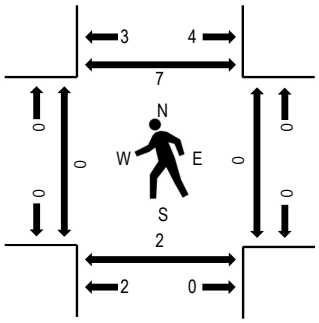
### Motorized Vehicles




### Heavy Vehicles




### Pedestrians




Note: Total study counts contained in parentheses.

| | HV% | PHF |
|---|---|---|
| EB | 1.4% | 0.97 |
| WB | 0.3% | 0.97 |
| NB | 1.0% | 0.89 |
| SB | 0.6% | 0.93 |
| All | 0.8% | 0.97 |

## Traffic Counts - Motorized Vehicles

| Interval Start Time | SW REED MARKET RD Eastbound | | | | SW REED MARKET RD Westbound | | | | BROOKSWOOD BLVD Northbound | | | | BROOKSWOOD BLVD Southbound | | | | | Rolling Hour |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | Total | |
| 4:00 PM | 0 | 3 | 25 | 16 | 1 | 4 | 21 | 37 | 0 | 17 | 31 | 7 | 0 | 30 | 30 | 6 | 228 | 2,544 |
| 4:05 PM | 0 | 2 | 30 | 13 | 0 | 7 | 27 | 31 | 0 | 13 | 21 | 8 | 0 | 25 | 26 | 6 | 209 | 2,533 |
| 4:10 PM | 0 | 6 | 24 | 18 | 1 | 10 | 25 | 16 | 0 | 18 | 26 | 4 | 1 | 20 | 32 | 4 | 205 | 2,559 |
| 4:15 PM | 0 | 2 | 27 | 15 | 2 | 10 | 16 | 26 | 0 | 17 | 25 | 4 | 0 | 28 | 26 | 4 | 202 | 2,568 |
| 4:20 PM | 0 | 3 | 30 | 9 | 1 | 4 | 21 | 30 | 0 | 12 | 34 | 3 | 0 | 28 | 31 | 4 | 210 | 2,587 |
| 4:25 PM | 1 | 4 | 27 | 17 | 1 | 7 | 26 | 38 | 0 | 16 | 17 | 4 | 0 | 31 | 18 | 4 | 211 | 2,603 |
| 4:30 PM | 0 | 7 | 27 | 14 | 1 | 3 | 26 | 32 | 1 | 9 | 23 | 4 | 1 | 34 | 24 | 3 | 209 | 2,604 |
| 4:35 PM | 1 | 4 | 25 | 16 | 0 | 4 | 22 | 20 | 0 | 21 | 35 | 4 | 0 | 21 | 26 | 3 | 202 | 2,609 |
| 4:40 PM | 0 | 5 | 30 | 11 | 0 | 3 | 25 | 29 | 1 | 18 | 40 | 2 | 0 | 34 | 19 | 3 | 220 | 2,620 |
| 4:45 PM | 0 | 5 | 35 | 12 | 0 | 3 | 26 | 26 | 1 | 17 | 34 | 4 | 0 | 24 | 26 | 1 | 214 | 2,617 |
| 4:50 PM | 1 | 6 | 28 | 9 | 1 | 6 | 24 | 21 | 1 | 11 | 41 | 5 | 0 | 30 | 21 | 4 | 209 | 2,622 |
| 4:55 PM | 0 | 5 | 30 | 8 | 0 | 0 | 22 | 38 | 2 | 13 | 36 | 1 | 0 | 36 | 33 | 1 | 225 | 2,614 |
| 5:00 PM | 0 | 4 | 28 | 15 | 1 | 4 | 23 | 36 | 0 | 14 | 28 | 5 | 0 | 30 | 24 | 5 | 217 | 2,597 |
| 5:05 PM | 0 | 3 | 37 | 15 | 1 | 4 | 28 | 30 | 0 | 15 | 40 | 6 | 0 | 24 | 28 | 4 | 235 | |
| 5:10 PM | 0 | 6 | 16 | 13 | 2 | 4 | 20 | 33 | 0 | 18 | 36 | 5 | 0 | 36 | 23 | 2 | 214 | |
| 5:15 PM | 0 | 3 | 37 | 11 | 0 | 3 | 27 | 29 | 0 | 10 | 30 | 5 | 0 | 34 | 27 | 5 | 221 | |
| 5:20 PM | 1 | 6 | 31 | 10 | 2 | 2 | 27 | 36 | 0 | 5 | 38 | 3 | 0 | 32 | 24 | 9 | 226 | |
| 5:25 PM | 0 | 5 | 35 | 8 | 0 | 3 | 17 | 36 | 0 | 13 | 26 | 5 | 0 | 26 | 32 | 6 | 212 | |
| 5:30 PM | 0 | 8 | 28 | 11 | 0 | 4 | 24 | 31 | 0 | 9 | 29 | 5 | 0 | 28 | 30 | 7 | 214 | |
| 5:35 PM | 0 | 4 | 40 | 8 | 0 | 3 | 38 | 24 | 0 | 10 | 29 | 5 | 0 | 25 | 19 | 8 | 213 | |
| 5:40 PM | 0 | 3 | 30 | 14 | 2 | 5 | 20 | 34 | 0 | 20 | 29 | 5 | 0 | 27 | 22 | 6 | 217 | |
| 5:45 PM | 0 | 4 | 32 | 9 | 1 | 6 | 27 | 28 | 0 | 15 | 34 | 5 | 0 | 24 | 28 | 6 | 219 | |
| 5:50 PM | 0 | 2 | 21 | 10 | 0 | 4 | 21 | 29 | 1 | 19 | 38 | 3 | 0 | 20 | 25 | 8 | 201 | |
| 5:55 PM | 0 | 8 | 18 | 16 | 0 | 2 | 25 | 26 | 0 | 19 | 37 | 3 | 0 | 25 | 18 | 11 | 208 | |
| Count Total | 4 | 108 | 691 | 298 | 17 | 105 | 578 | 716 | 7 | 349 | 757 | 105 | 2 | 672 | 612 | 120 | 5,141 | |
| Peak Hour | 2 | 57 | 372 | 131 | 10 | 44 | 297 | 376 | 3 | 153 | 396 | 55 | 0 | 352 | 311 | 63 | 2,622 | |

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

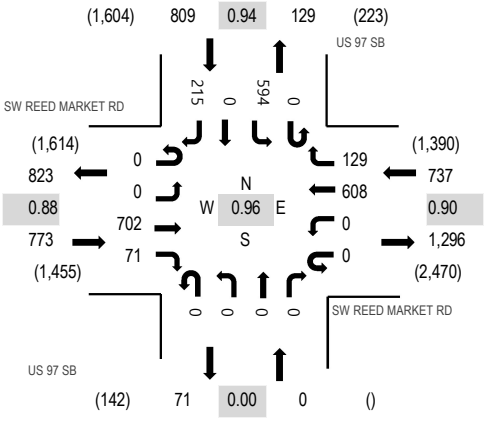
| Interval Start Time | Heavy Vehicles | | | | | Interval Start Time | Bicycles on Roadway | | | | | Interval Start Time | Pedestrians/Bicycles on Crosswalk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | EB | NB | WB | SB | Total | | EB | NB | WB | SB | Total | | EB | NB | WB | SB | Total |
| 4:00 PM | 1 | 1 | 1 | 2 | 5 | 4:00 PM | 0 | 0 | 1 | 0 | 1 | 4:00 PM | 0 | 0 | 0 | 0 | 0 |
| 4:05 PM | 0 | 0 | 1 | 3 | 4 | 4:05 PM | 0 | 0 | 0 | 1 | 1 | 4:05 PM | 0 | 0 | 0 | 1 | 1 |
| 4:10 PM | 1 | 1 | 0 | 0 | 2 | 4:10 PM | 0 | 0 | 0 | 0 | 0 | 4:10 PM | 0 | 0 | 0 | 0 | 0 |
| 4:15 PM | 0 | 0 | 0 | 0 | 0 | 4:15 PM | 0 | 0 | 0 | 0 | 0 | 4:15 PM | 0 | 0 | 0 | 1 | 1 |
| 4:20 PM | 2 | 0 | 0 | 2 | 4 | 4:20 PM | 0 | 0 | 1 | 2 | 3 | 4:20 PM | 0 | 0 | 0 | 0 | 0 |
| 4:25 PM | 1 | 0 | 0 | 0 | 1 | 4:25 PM | 0 | 0 | 0 | 0 | 0 | 4:25 PM | 0 | 0 | 0 | 0 | 0 |
| 4:30 PM | 1 | 0 | 0 | 1 | 2 | 4:30 PM | 0 | 0 | 0 | 0 | 0 | 4:30 PM | 0 | 0 | 0 | 0 | 0 |
| 4:35 PM | 1 | 1 | 2 | 0 | 4 | 4:35 PM | 0 | 0 | 0 | 0 | 0 | 4:35 PM | 0 | 0 | 0 | 3 | 3 |
| 4:40 PM | 0 | 1 | 1 | 0 | 2 | 4:40 PM | 0 | 0 | 0 | 0 | 0 | 4:40 PM | 0 | 0 | 0 | 0 | 0 |
| 4:45 PM | 0 | 0 | 0 | 1 | 1 | 4:45 PM | 1 | 2 | 0 | 0 | 3 | 4:45 PM | 0 | 0 | 0 | 0 | 0 |
| 4:50 PM | 1 | 0 | 0 | 0 | 1 | 4:50 PM | 1 | 0 | 0 | 0 | 1 | 4:50 PM | 0 | 0 | 0 | 2 | 2 |
| 4:55 PM | 1 | 0 | 0 | 0 | 1 | 4:55 PM | 0 | 1 | 1 | 0 | 2 | 4:55 PM | 0 | 0 | 0 | 0 | 0 |
| 5:00 PM | 2 | 1 | 0 | 1 | 4 | 5:00 PM | 0 | 0 | 0 | 0 | 0 | 5:00 PM | 0 | 0 | 0 | 1 | 1 |
| 5:05 PM | 0 | 0 | 1 | 0 | 1 | 5:05 PM | 0 | 0 | 0 | 0 | 0 | 5:05 PM | 0 | 0 | 0 | 1 | 1 |
| 5:10 PM | 1 | 0 | 0 | 0 | 1 | 5:10 PM | 0 | 0 | 0 | 1 | 1 | 5:10 PM | 0 | 2 | 0 | 0 | 2 |
| 5:15 PM | 3 | 1 | 0 | 0 | 4 | 5:15 PM | 0 | 0 | 0 | 0 | 0 | 5:15 PM | 0 | 0 | 0 | 2 | 2 |
| 5:20 PM | 0 | 1 | 0 | 0 | 1 | 5:20 PM | 0 | 0 | 0 | 0 | 0 | 5:20 PM | 0 | 0 | 0 | 0 | 0 |
| 5:25 PM | 0 | 0 | 0 | 1 | 1 | 5:25 PM | 1 | 0 | 1 | 1 | 3 | 5:25 PM | 0 | 0 | 0 | 2 | 2 |
| 5:30 PM | 0 | 1 | 0 | 1 | 2 | 5:30 PM | 0 | 0 | 2 | 1 | 3 | 5:30 PM | 0 | 0 | 0 | 1 | 1 |
| 5:35 PM | 0 | 0 | 0 | 1 | 1 | 5:35 PM | 0 | 0 | 0 | 1 | 1 | 5:35 PM | 0 | 0 | 0 | 1 | 1 |
| 5:40 PM | 0 | 0 | 1 | 0 | 1 | 5:40 PM | 1 | 0 | 0 | 0 | 1 | 5:40 PM | 0 | 0 | 0 | 0 | 0 |
| 5:45 PM | 0 | 2 | 0 | 0 | 2 | 5:45 PM | 0 | 0 | 0 | 0 | 0 | 5:45 PM | 0 | 0 | 0 | 0 | 0 |
| 5:50 PM | 0 | 0 | 0 | 0 | 0 | 5:50 PM | 0 | 0 | 0 | 0 | 0 | 5:50 PM | 0 | 0 | 0 | 3 | 3 |
| 5:55 PM | 1 | 0 | 0 | 1 | 2 | 5:55 PM | 0 | 0 | 0 | 2 | 2 | 5:55 PM | 0 | 0 | 0 | 2 | 2 |
| Count Total | 16 | 10 | 7 | 14 | 47 | Count Total | 4 | 3 | 6 | 9 | 22 | Count Total | 0 | 2 | 0 | 20 | 22 |
| Peak Hour | 8 | 6 | 2 | 4 | 20 | Peak Hour | 3 | 1 | 4 | 4 | 12 | Peak Hour | 0 | 2 | 0 | 10 | 12 |

ALL TRAFFIC DATA SERVICES
(303) 216-2439
www.alltrafficdata.net

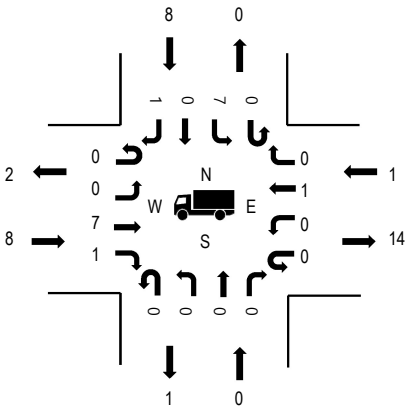
**Location:** 2 US 97 SB & SW REED MARKET RD PM
**Date:** Wednesday, August 3, 2022
**Peak Hour:** 04:50 PM - 05:50 PM
**Peak 15-Minutes:** 05:00 PM - 05:15 PM

## Peak Hour

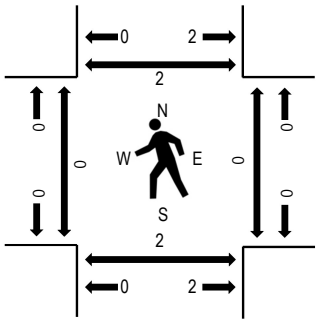
### Motorized Vehicles




### Heavy Vehicles




### Pedestrians




Note: Total study counts contained in parentheses.

| | HV% | PHF |
|---|---|---|
| EB | 1.0% | 0.88 |
| WB | 0.1% | 0.90 |
| NB | 0.0% | 0.00 |
| SB | 1.0% | 0.94 |
| All | 0.7% | 0.96 |

## Traffic Counts - Motorized Vehicles

| Interval Start Time | SW REED MARKET RD Eastbound | | | | SW REED MARKET RD Westbound | | | | US 97 SB Northbound | | | | US 97 SB Southbound | | | | | Rolling Hour |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | Total | |
| 4:00 PM | 0 | 0 | 53 | 2 | 0 | 0 | 41 | 11 | 0 | 0 | 0 | 0 | 0 | 58 | 0 | 17 | 182 | 2,171 |
| 4:05 PM | 0 | 0 | 65 | 7 | 0 | 0 | 52 | 7 | 0 | 0 | 0 | 0 | 0 | 39 | 0 | 13 | 183 | 2,212 |
| 4:10 PM | 0 | 0 | 56 | 7 | 0 | 0 | 33 | 4 | 0 | 0 | 0 | 0 | 0 | 63 | 0 | 18 | 181 | 2,212 |
| 4:15 PM | 0 | 0 | 48 | 4 | 0 | 0 | 43 | 6 | 0 | 0 | 0 | 0 | 0 | 51 | 0 | 21 | 173 | 2,232 |
| 4:20 PM | 0 | 0 | 69 | 8 | 0 | 0 | 57 | 9 | 0 | 0 | 0 | 0 | 0 | 41 | 0 | 14 | 198 | 2,252 |
| 4:25 PM | 0 | 0 | 50 | 8 | 0 | 0 | 50 | 7 | 0 | 0 | 0 | 0 | 0 | 48 | 0 | 30 | 193 | 2,257 |
| 4:30 PM | 0 | 0 | 52 | 1 | 0 | 0 | 61 | 3 | 0 | 0 | 0 | 0 | 0 | 51 | 0 | 17 | 185 | 2,249 |
| 4:35 PM | 0 | 0 | 46 | 9 | 0 | 0 | 45 | 9 | 0 | 0 | 0 | 0 | 0 | 44 | 1 | 24 | 178 | 2,260 |
| 4:40 PM | 0 | 0 | 49 | 5 | 0 | 0 | 40 | 6 | 0 | 0 | 0 | 0 | 0 | 47 | 0 | 23 | 170 | 2,290 |
| 4:45 PM | 0 | 0 | 46 | 10 | 0 | 0 | 32 | 8 | 0 | 0 | 0 | 0 | 0 | 47 | 0 | 21 | 164 | 2,303 |
| 4:50 PM | 0 | 0 | 56 | 6 | 0 | 0 | 48 | 12 | 0 | 0 | 0 | 0 | 0 | 46 | 0 | 12 | 180 | 2,319 |
| 4:55 PM | 0 | 0 | 54 | 6 | 0 | 0 | 43 | 11 | 0 | 0 | 0 | 0 | 0 | 48 | 0 | 22 | 184 | 2,315 |
| 5:00 PM | 0 | 0 | 61 | 9 | 0 | 0 | 53 | 12 | 0 | 0 | 0 | 0 | 0 | 73 | 0 | 15 | 223 | 2,278 |
| 5:05 PM | 0 | 0 | 55 | 3 | 0 | 0 | 45 | 14 | 0 | 0 | 0 | 0 | 0 | 47 | 0 | 19 | 183 | |
| 5:10 PM | 0 | 0 | 59 | 5 | 0 | 0 | 48 | 12 | 0 | 0 | 0 | 0 | 0 | 50 | 0 | 27 | 201 | |
| 5:15 PM | 0 | 0 | 49 | 7 | 0 | 0 | 50 | 9 | 0 | 0 | 0 | 0 | 0 | 63 | 0 | 15 | 193 | |
| 5:20 PM | 0 | 0 | 57 | 9 | 0 | 0 | 56 | 7 | 0 | 0 | 0 | 0 | 0 | 54 | 0 | 20 | 203 | |
| 5:25 PM | 0 | 0 | 63 | 10 | 0 | 0 | 39 | 6 | 0 | 0 | 0 | 0 | 0 | 49 | 0 | 18 | 185 | |
| 5:30 PM | 0 | 0 | 72 | 1 | 0 | 0 | 49 | 13 | 0 | 0 | 0 | 0 | 0 | 39 | 0 | 22 | 196 | |
| 5:35 PM | 0 | 0 | 72 | 2 | 0 | 0 | 67 | 12 | 0 | 0 | 0 | 0 | 0 | 43 | 0 | 12 | 208 | |
| 5:40 PM | 0 | 0 | 48 | 6 | 0 | 0 | 56 | 10 | 0 | 0 | 0 | 0 | 0 | 46 | 0 | 17 | 183 | |
| 5:45 PM | 0 | 0 | 56 | 7 | 0 | 0 | 54 | 11 | 0 | 0 | 0 | 0 | 0 | 36 | 0 | 16 | 180 | |
| 5:50 PM | 0 | 0 | 39 | 7 | 0 | 0 | 54 | 14 | 0 | 0 | 0 | 0 | 0 | 40 | 0 | 22 | 176 | |
| 5:55 PM | 0 | 0 | 39 | 2 | 0 | 0 | 51 | 10 | 0 | 0 | 0 | 0 | 0 | 33 | 0 | 12 | 147 | |
| Count Total | 0 | 0 | 1,314 | 141 | 0 | 0 | 1,167 | 223 | 0 | 0 | 0 | 0 | 0 | 1,156 | 1 | 447 | 4,449 | |
| Peak Hour | 0 | 0 | 702 | 71 | 0 | 0 | 608 | 129 | 0 | 0 | 0 | 0 | 0 | 594 | 0 | 215 | 2,319 | |

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

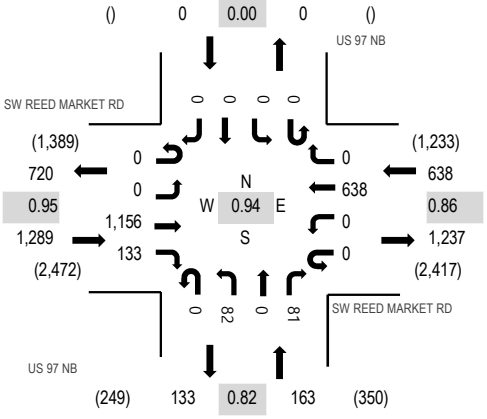
| Interval Start Time | Heavy Vehicles | | | | | Interval Start Time | Bicycles on Roadway | | | | | Interval Start Time | Pedestrians/Bicycles on Crosswalk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | EB | NB | WB | SB | Total | | EB | NB | WB | SB | Total | | EB | NB | WB | SB | Total |
| 4:00 PM | 1 | 0 | 1 | 0 | 2 | 4:00 PM | 0 | 0 | 0 | 0 | 0 | 4:00 PM | 0 | 0 | 0 | 1 | 1 |
| 4:05 PM | 3 | 0 | 1 | 2 | 6 | 4:05 PM | 1 | 0 | 0 | 0 | 1 | 4:05 PM | 0 | 0 | 0 | 0 | 0 |
| 4:10 PM | 0 | 0 | 0 | 1 | 1 | 4:10 PM | 1 | 0 | 0 | 0 | 1 | 4:10 PM | 0 | 0 | 0 | 1 | 1 |
| 4:15 PM | 0 | 0 | 0 | 1 | 1 | 4:15 PM | 0 | 0 | 0 | 0 | 0 | 4:15 PM | 0 | 0 | 0 | 0 | 0 |
| 4:20 PM | 0 | 0 | 1 | 0 | 1 | 4:20 PM | 1 | 0 | 0 | 0 | 1 | 4:20 PM | 0 | 0 | 0 | 0 | 0 |
| 4:25 PM | 0 | 0 | 0 | 2 | 2 | 4:25 PM | 0 | 0 | 0 | 0 | 0 | 4:25 PM | 0 | 0 | 0 | 0 | 0 |
| 4:30 PM | 2 | 0 | 2 | 0 | 4 | 4:30 PM | 0 | 0 | 1 | 0 | 1 | 4:30 PM | 0 | 0 | 0 | 0 | 0 |
| 4:35 PM | 0 | 0 | 0 | 0 | 0 | 4:35 PM | 0 | 0 | 0 | 0 | 0 | 4:35 PM | 0 | 0 | 0 | 0 | 0 |
| 4:40 PM | 1 | 0 | 0 | 1 | 2 | 4:40 PM | 1 | 0 | 0 | 0 | 1 | 4:40 PM | 0 | 0 | 0 | 0 | 0 |
| 4:45 PM | 0 | 0 | 0 | 1 | 1 | 4:45 PM | 0 | 0 | 0 | 0 | 0 | 4:45 PM | 0 | 0 | 0 | 2 | 2 |
| 4:50 PM | 1 | 0 | 0 | 1 | 2 | 4:50 PM | 0 | 0 | 0 | 0 | 0 | 4:50 PM | 0 | 1 | 0 | 0 | 1 |
| 4:55 PM | 1 | 0 | 0 | 0 | 1 | 4:55 PM | 0 | 0 | 1 | 0 | 1 | 4:55 PM | 0 | 1 | 0 | 0 | 1 |
| 5:00 PM | 1 | 0 | 0 | 1 | 2 | 5:00 PM | 0 | 0 | 0 | 0 | 0 | 5:00 PM | 0 | 0 | 0 | 1 | 1 |
| 5:05 PM | 0 | 0 | 0 | 1 | 1 | 5:05 PM | 0 | 0 | 0 | 0 | 0 | 5:05 PM | 0 | 0 | 0 | 0 | 0 |
| 5:10 PM | 1 | 0 | 0 | 1 | 2 | 5:10 PM | 0 | 0 | 0 | 0 | 0 | 5:10 PM | 0 | 0 | 0 | 1 | 1 |
| 5:15 PM | 3 | 0 | 0 | 0 | 3 | 5:15 PM | 1 | 0 | 0 | 0 | 1 | 5:15 PM | 0 | 0 | 0 | 0 | 0 |
| 5:20 PM | 0 | 0 | 0 | 1 | 1 | 5:20 PM | 0 | 0 | 0 | 0 | 0 | 5:20 PM | 0 | 0 | 0 | 0 | 0 |
| 5:25 PM | 0 | 0 | 0 | 1 | 1 | 5:25 PM | 0 | 0 | 1 | 1 | 2 | 5:25 PM | 0 | 0 | 0 | 2 | 2 |
| 5:30 PM | 0 | 0 | 0 | 0 | 0 | 5:30 PM | 1 | 0 | 0 | 0 | 1 | 5:30 PM | 0 | 0 | 0 | 1 | 1 |
| 5:35 PM | 1 | 0 | 0 | 0 | 1 | 5:35 PM | 0 | 0 | 1 | 0 | 1 | 5:35 PM | 0 | 0 | 0 | 0 | 0 |
| 5:40 PM | 0 | 0 | 1 | 1 | 2 | 5:40 PM | 0 | 0 | 0 | 0 | 0 | 5:40 PM | 0 | 0 | 0 | 0 | 0 |
| 5:45 PM | 0 | 0 | 0 | 1 | 1 | 5:45 PM | 0 | 0 | 0 | 0 | 0 | 5:45 PM | 0 | 0 | 0 | 0 | 0 |
| 5:50 PM | 0 | 0 | 0 | 1 | 1 | 5:50 PM | 0 | 0 | 2 | 0 | 2 | 5:50 PM | 0 | 0 | 0 | 0 | 0 |
| 5:55 PM | 1 | 0 | 0 | 1 | 2 | 5:55 PM | 0 | 0 | 0 | 0 | 0 | 5:55 PM | 0 | 3 | 0 | 0 | 3 |
| Count Total | 16 | 0 | 6 | 18 | 40 | Count Total | 6 | 0 | 6 | 1 | 13 | Count Total | 0 | 5 | 0 | 9 | 14 |
| Peak Hour | 8 | 0 | 1 | 8 | 17 | Peak Hour | 2 | 0 | 3 | 1 | 6 | Peak Hour | 0 | 2 | 0 | 5 | 7 |

ALL TRAFFIC DATA SERVICES
(303) 216-2439
www.alltrafficdata.net

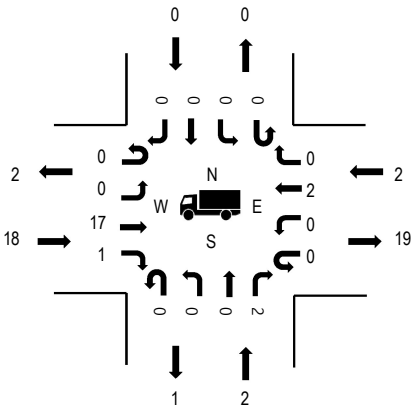
**Location:** 3 US 97 NB & SW REED MARKET RD PM
**Date:** Wednesday, August 3, 2022
**Peak Hour:** 04:50 PM - 05:50 PM
**Peak 15-Minutes:** 05:00 PM - 05:15 PM

## Peak Hour

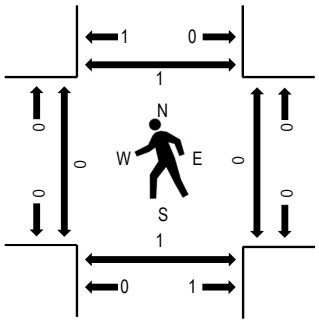
### Motorized Vehicles




### Heavy Vehicles




### Pedestrians




Note: Total study counts contained in parentheses.

| | HV% | PHF |
|---|---|---|
| EB | 1.4% | 0.95 |
| WB | 0.3% | 0.86 |
| NB | 1.2% | 0.82 |
| SB | 0.0% | 0.00 |
| All | 1.1% | 0.94 |

## Traffic Counts - Motorized Vehicles

| Interval Start Time | SW REED MARKET RD Eastbound | | | | SW REED MARKET RD Westbound | | | | US 97 NB Northbound | | | | US 97 NB Southbound | | | | | Rolling Hour |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | Total | |
| 4:00 PM | 0 | 0 | 100 | 8 | 0 | 0 | 52 | 0 | 0 | 2 | 0 | 5 | 0 | 0 | 0 | 0 | 167 | 1,993 |
| 4:05 PM | 0 | 0 | 87 | 9 | 0 | 0 | 46 | 0 | 0 | 6 | 0 | 8 | 0 | 0 | 0 | 0 | 156 | 2,025 |
| 4:10 PM | 0 | 0 | 117 | 10 | 0 | 0 | 44 | 0 | 0 | 3 | 0 | 5 | 0 | 0 | 0 | 0 | 179 | 2,052 |
| 4:15 PM | 0 | 0 | 92 | 13 | 0 | 0 | 46 | 0 | 0 | 5 | 0 | 13 | 0 | 0 | 0 | 0 | 169 | 2,047 |
| 4:20 PM | 0 | 0 | 101 | 7 | 0 | 0 | 47 | 0 | 0 | 9 | 0 | 9 | 0 | 0 | 0 | 0 | 173 | 2,058 |
| 4:25 PM | 0 | 0 | 86 | 14 | 0 | 0 | 53 | 0 | 0 | 10 | 0 | 13 | 0 | 0 | 0 | 0 | 176 | 2,047 |
| 4:30 PM | 0 | 0 | 92 | 7 | 0 | 0 | 49 | 0 | 0 | 7 | 0 | 13 | 0 | 0 | 0 | 0 | 168 | 2,041 |
| 4:35 PM | 0 | 0 | 83 | 12 | 0 | 0 | 58 | 0 | 0 | 8 | 0 | 13 | 0 | 0 | 0 | 0 | 174 | 2,054 |
| 4:40 PM | 0 | 0 | 92 | 6 | 0 | 0 | 51 | 0 | 0 | 4 | 0 | 12 | 0 | 0 | 0 | 0 | 165 | 2,084 |
| 4:45 PM | 0 | 0 | 82 | 9 | 0 | 0 | 39 | 0 | 0 | 6 | 0 | 11 | 0 | 0 | 0 | 0 | 147 | 2,081 |
| 4:50 PM | 0 | 0 | 95 | 9 | 0 | 0 | 50 | 0 | 0 | 3 | 0 | 8 | 0 | 0 | 0 | 0 | 165 | 2,090 |
| 4:55 PM | 0 | 0 | 99 | 7 | 0 | 0 | 33 | 0 | 0 | 9 | 0 | 6 | 0 | 0 | 0 | 0 | 154 | 2,068 |
| 5:00 PM | 0 | 0 | 119 | 9 | 0 | 0 | 59 | 0 | 0 | 4 | 0 | 8 | 0 | 0 | 0 | 0 | 199 | 2,062 |
| 5:05 PM | 0 | 0 | 96 | 8 | 0 | 0 | 59 | 0 | 0 | 8 | 0 | 12 | 0 | 0 | 0 | 0 | 183 | |
| 5:10 PM | 0 | 0 | 96 | 11 | 0 | 0 | 48 | 0 | 0 | 9 | 0 | 10 | 0 | 0 | 0 | 0 | 174 | |
| 5:15 PM | 0 | 0 | 104 | 9 | 0 | 0 | 57 | 0 | 0 | 5 | 0 | 5 | 0 | 0 | 0 | 0 | 180 | |
| 5:20 PM | 0 | 0 | 93 | 11 | 0 | 0 | 43 | 0 | 0 | 9 | 0 | 6 | 0 | 0 | 0 | 0 | 162 | |
| 5:25 PM | 0 | 0 | 93 | 23 | 0 | 0 | 39 | 0 | 0 | 10 | 0 | 5 | 0 | 0 | 0 | 0 | 170 | |
| 5:30 PM | 0 | 0 | 94 | 10 | 0 | 0 | 65 | 0 | 0 | 2 | 0 | 10 | 0 | 0 | 0 | 0 | 181 | |
| 5:35 PM | 0 | 0 | 110 | 13 | 0 | 0 | 72 | 0 | 0 | 6 | 0 | 3 | 0 | 0 | 0 | 0 | 204 | |
| 5:40 PM | 0 | 0 | 80 | 14 | 0 | 0 | 57 | 0 | 0 | 7 | 0 | 4 | 0 | 0 | 0 | 0 | 162 | |
| 5:45 PM | 0 | 0 | 77 | 9 | 0 | 0 | 56 | 0 | 0 | 10 | 0 | 4 | 0 | 0 | 0 | 0 | 156 | |
| 5:50 PM | 0 | 0 | 66 | 10 | 0 | 0 | 58 | 0 | 0 | 4 | 0 | 5 | 0 | 0 | 0 | 0 | 143 | |
| 5:55 PM | 0 | 0 | 69 | 11 | 0 | 0 | 52 | 0 | 0 | 10 | 0 | 6 | 0 | 0 | 0 | 0 | 148 | |
| Count Total | 0 | 0 | 2,223 | 249 | 0 | 0 | 1,233 | 0 | 0 | 156 | 0 | 194 | 0 | 0 | 0 | 0 | 4,055 | |
| Peak Hour | 0 | 0 | 1,156 | 133 | 0 | 0 | 638 | 0 | 0 | 82 | 0 | 81 | 0 | 0 | 0 | 0 | 2,090 | |

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

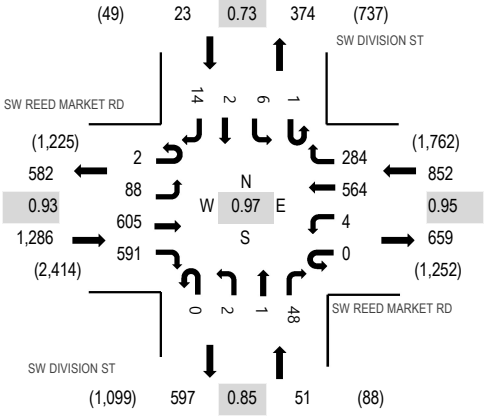
| Interval Start Time | Heavy Vehicles | | | | | Interval Start Time | Bicycles on Roadway | | | | | Interval Start Time | Pedestrians/Bicycles on Crosswalk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | EB | NB | WB | SB | Total | | EB | NB | WB | SB | Total | | EB | NB | WB | SB | Total |
| 4:00 PM | 3 | 0 | 0 | 0 | 3 | 4:00 PM | 0 | 0 | 0 | 0 | 0 | 4:00 PM | 0 | 1 | 0 | 3 | 4 |
| 4:05 PM | 5 | 0 | 2 | 0 | 7 | 4:05 PM | 1 | 0 | 0 | 0 | 1 | 4:05 PM | 0 | 0 | 0 | 0 | 0 |
| 4:10 PM | 1 | 0 | 0 | 0 | 1 | 4:10 PM | 1 | 0 | 0 | 0 | 1 | 4:10 PM | 0 | 0 | 0 | 0 | 0 |
| 4:15 PM | 1 | 1 | 0 | 0 | 2 | 4:15 PM | 0 | 0 | 0 | 0 | 0 | 4:15 PM | 0 | 2 | 0 | 0 | 2 |
| 4:20 PM | 1 | 0 | 1 | 0 | 2 | 4:20 PM | 0 | 0 | 1 | 0 | 1 | 4:20 PM | 0 | 0 | 0 | 0 | 0 |
| 4:25 PM | 1 | 0 | 0 | 0 | 1 | 4:25 PM | 0 | 0 | 0 | 0 | 0 | 4:25 PM | 0 | 0 | 0 | 1 | 1 |
| 4:30 PM | 2 | 1 | 2 | 0 | 5 | 4:30 PM | 0 | 0 | 0 | 0 | 0 | 4:30 PM | 0 | 0 | 0 | 0 | 0 |
| 4:35 PM | 1 | 0 | 0 | 0 | 1 | 4:35 PM | 0 | 0 | 0 | 0 | 0 | 4:35 PM | 0 | 0 | 0 | 0 | 0 |
| 4:40 PM | 3 | 0 | 0 | 0 | 3 | 4:40 PM | 1 | 0 | 0 | 0 | 1 | 4:40 PM | 0 | 0 | 0 | 1 | 1 |
| 4:45 PM | 2 | 0 | 0 | 0 | 2 | 4:45 PM | 0 | 0 | 0 | 0 | 0 | 4:45 PM | 0 | 1 | 0 | 0 | 1 |
| 4:50 PM | 1 | 0 | 0 | 0 | 1 | 4:50 PM | 0 | 0 | 0 | 0 | 0 | 4:50 PM | 0 | 0 | 0 | 2 | 2 |
| 4:55 PM | 1 | 1 | 0 | 0 | 2 | 4:55 PM | 0 | 0 | 1 | 0 | 1 | 4:55 PM | 0 | 0 | 0 | 0 | 0 |
| 5:00 PM | 0 | 1 | 0 | 0 | 1 | 5:00 PM | 0 | 0 | 0 | 0 | 0 | 5:00 PM | 0 | 0 | 0 | 0 | 0 |
| 5:05 PM | 2 | 0 | 0 | 0 | 2 | 5:05 PM | 0 | 0 | 0 | 0 | 0 | 5:05 PM | 0 | 1 | 0 | 0 | 1 |
| 5:10 PM | 2 | 0 | 0 | 0 | 2 | 5:10 PM | 1 | 0 | 0 | 0 | 1 | 5:10 PM | 0 | 1 | 0 | 0 | 1 |
| 5:15 PM | 3 | 0 | 0 | 0 | 3 | 5:15 PM | 1 | 0 | 0 | 0 | 1 | 5:15 PM | 0 | 0 | 0 | 0 | 0 |
| 5:20 PM | 2 | 0 | 1 | 0 | 3 | 5:20 PM | 0 | 0 | 1 | 0 | 1 | 5:20 PM | 0 | 0 | 0 | 0 | 0 |
| 5:25 PM | 1 | 0 | 0 | 0 | 1 | 5:25 PM | 0 | 0 | 0 | 0 | 0 | 5:25 PM | 0 | 2 | 0 | 0 | 2 |
| 5:30 PM | 1 | 0 | 0 | 0 | 1 | 5:30 PM | 2 | 0 | 0 | 0 | 2 | 5:30 PM | 0 | 0 | 0 | 1 | 1 |
| 5:35 PM | 1 | 0 | 1 | 0 | 2 | 5:35 PM | 0 | 0 | 0 | 0 | 0 | 5:35 PM | 0 | 0 | 0 | 0 | 0 |
| 5:40 PM | 3 | 0 | 0 | 0 | 3 | 5:40 PM | 0 | 0 | 0 | 0 | 0 | 5:40 PM | 0 | 0 | 0 | 0 | 0 |
| 5:45 PM | 1 | 0 | 0 | 0 | 1 | 5:45 PM | 0 | 0 | 0 | 0 | 0 | 5:45 PM | 0 | 0 | 0 | 0 | 0 |
| 5:50 PM | 1 | 1 | 1 | 0 | 3 | 5:50 PM | 0 | 0 | 0 | 0 | 0 | 5:50 PM | 0 | 0 | 0 | 3 | 3 |
| 5:55 PM | 3 | 0 | 0 | 0 | 3 | 5:55 PM | 0 | 0 | 0 | 0 | 0 | 5:55 PM | 0 | 0 | 0 | 0 | 0 |
| Count Total | 42 | 5 | 8 | 0 | 55 | Count Total | 7 | 0 | 3 | 0 | 10 | Count Total | 0 | 8 | 0 | 11 | 19 |
| Peak Hour | 18 | 2 | 2 | 0 | 22 | Peak Hour | 4 | 0 | 2 | 0 | 6 | Peak Hour | 0 | 4 | 0 | 3 | 7 |

ALL TRAFFIC DATA SERVICES
(303) 216-2439
www.alltrafficdata.net

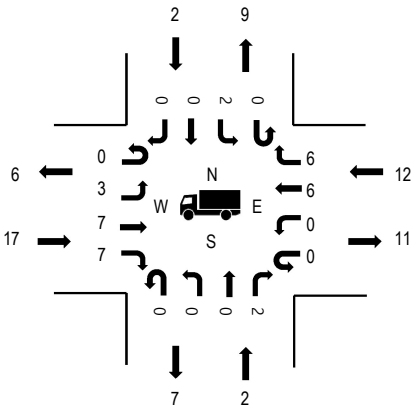
**Location:** 4 SW DIVISION ST & SW REED MARKET RD PM
**Date:** Wednesday, August 3, 2022
**Peak Hour:** 04:10 PM - 05:10 PM
**Peak 15-Minutes:** 04:10 PM - 04:25 PM

## Peak Hour

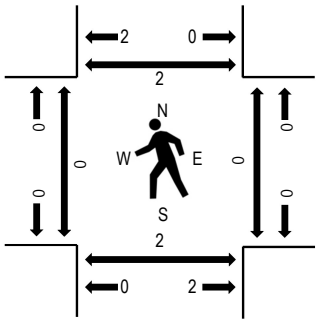
### Motorized Vehicles




### Heavy Vehicles




### Pedestrians




Note: Total study counts contained in parentheses.

| | HV% | PHF |
|---|---|---|
| EB | 1.3% | 0.93 |
| WB | 1.4% | 0.95 |
| NB | 3.9% | 0.85 |
| SB | 8.7% | 0.73 |
| All | 1.5% | 0.97 |

## Traffic Counts - Motorized Vehicles

| Interval Start Time | SW REED MARKET RD Eastbound | | | | SW REED MARKET RD Westbound | | | | SW DIVISION ST Northbound | | | | SW DIVISION ST Southbound | | | | | Rolling Hour |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | Total | |
| 4:00 PM | 0 | 3 | 36 | 44 | 0 | 0 | 50 | 19 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 155 | 2,155 |
| 4:05 PM | 1 | 6 | 53 | 42 | 0 | 0 | 50 | 26 | 0 | 0 | 0 | 3 | 0 | 0 | 1 | 2 | 184 | 2,195 |
| 4:10 PM | 0 | 4 | 55 | 59 | 0 | 0 | 44 | 26 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 1 | 194 | 2,212 |
| 4:15 PM | 0 | 4 | 58 | 61 | 0 | 0 | 44 | 25 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 1 | 195 | 2,207 |
| 4:20 PM | 0 | 6 | 50 | 47 | 0 | 0 | 49 | 26 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 1 | 183 | 2,198 |
| 4:25 PM | 0 | 5 | 55 | 45 | 0 | 1 | 53 | 22 | 0 | 0 | 0 | 6 | 0 | 0 | 1 | 0 | 188 | 2,197 |
| 4:30 PM | 0 | 4 | 56 | 45 | 0 | 1 | 50 | 24 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 1 | 184 | 2,181 |
| 4:35 PM | 0 | 10 | 41 | 37 | 0 | 1 | 53 | 24 | 0 | 1 | 1 | 4 | 0 | 2 | 0 | 3 | 177 | 2,171 |
| 4:40 PM | 1 | 7 | 52 | 47 | 0 | 0 | 46 | 22 | 0 | 0 | 0 | 3 | 0 | 1 | 0 | 2 | 181 | 2,210 |
| 4:45 PM | 1 | 5 | 46 | 43 | 0 | 0 | 40 | 27 | 0 | 1 | 0 | 5 | 0 | 1 | 0 | 1 | 170 | 2,193 |
| 4:50 PM | 0 | 8 | 42 | 53 | 0 | 0 | 48 | 28 | 0 | 0 | 0 | 5 | 1 | 0 | 1 | 1 | 187 | 2,194 |
| 4:55 PM | 0 | 8 | 45 | 54 | 0 | 0 | 29 | 16 | 0 | 0 | 0 | 3 | 0 | 2 | 0 | 0 | 157 | 2,170 |
| 5:00 PM | 0 | 7 | 50 | 54 | 0 | 0 | 57 | 23 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 1 | 195 | 2,158 |
| 5:05 PM | 0 | 20 | 55 | 46 | 0 | 1 | 51 | 21 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 2 | 201 | |
| 5:10 PM | 0 | 11 | 49 | 48 | 0 | 0 | 44 | 31 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 2 | 189 | |
| 5:15 PM | 0 | 8 | 51 | 41 | 0 | 0 | 50 | 29 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 4 | 186 | |
| 5:20 PM | 0 | 3 | 51 | 55 | 0 | 0 | 44 | 25 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 1 | 182 | |
| 5:25 PM | 1 | 9 | 45 | 48 | 0 | 0 | 38 | 26 | 0 | 0 | 0 | 3 | 0 | 2 | 0 | 0 | 172 | |
| 5:30 PM | 0 | 7 | 48 | 36 | 0 | 0 | 58 | 19 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 2 | 174 | |
| 5:35 PM | 1 | 8 | 54 | 58 | 0 | 0 | 68 | 22 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 2 | 216 | |
| 5:40 PM | 0 | 5 | 42 | 37 | 0 | 0 | 53 | 21 | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 3 | 164 | |
| 5:45 PM | 1 | 2 | 47 | 38 | 0 | 0 | 53 | 23 | 0 | 0 | 0 | 3 | 0 | 2 | 0 | 2 | 171 | |
| 5:50 PM | 0 | 3 | 37 | 29 | 0 | 0 | 59 | 31 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 1 | 163 | |
| 5:55 PM | 0 | 7 | 38 | 25 | 0 | 0 | 52 | 19 | 0 | 0 | 0 | 2 | 0 | 2 | 0 | 0 | 145 | |
| Count Total | 6 | 160 | 1,156 | 1,092 | 0 | 4 | 1,183 | 575 | 0 | 3 | 1 | 84 | 1 | 12 | 3 | 33 | 4,313 | |
| Peak Hour | 2 | 88 | 605 | 591 | 0 | 4 | 564 | 284 | 0 | 2 | 1 | 48 | 1 | 6 | 2 | 14 | 2,212 | |

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

| Interval Start Time | Heavy Vehicles | | | | | Interval Start Time | Bicycles on Roadway | | | | | Interval Start Time | Pedestrians/Bicycles on Crosswalk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | EB | NB | WB | SB | Total | | EB | NB | WB | SB | Total | | EB | NB | WB | SB | Total |
| 4:00 PM | 1 | 0 | 1 | 0 | 2 | 4:00 PM | 0 | 0 | 0 | 0 | 0 | 4:00 PM | 0 | 0 | 0 | 3 | 3 |
| 4:05 PM | 5 | 0 | 2 | 0 | 7 | 4:05 PM | 0 | 0 | 0 | 0 | 0 | 4:05 PM | 0 | 0 | 0 | 0 | 0 |
| 4:10 PM | 1 | 0 | 1 | 0 | 2 | 4:10 PM | 2 | 0 | 0 | 0 | 2 | 4:10 PM | 0 | 0 | 0 | 0 | 0 |
| 4:15 PM | 2 | 1 | 1 | 0 | 4 | 4:15 PM | 0 | 0 | 0 | 0 | 0 | 4:15 PM | 0 | 1 | 0 | 0 | 1 |
| 4:20 PM | 1 | 0 | 1 | 0 | 2 | 4:20 PM | 1 | 0 | 0 | 0 | 1 | 4:20 PM | 0 | 0 | 0 | 0 | 0 |
| 4:25 PM | 2 | 0 | 0 | 0 | 2 | 4:25 PM | 0 | 0 | 1 | 0 | 1 | 4:25 PM | 0 | 0 | 0 | 0 | 0 |
| 4:30 PM | 2 | 0 | 4 | 0 | 6 | 4:30 PM | 0 | 0 | 0 | 0 | 0 | 4:30 PM | 1 | 0 | 0 | 0 | 1 |
| 4:35 PM | 0 | 0 | 1 | 1 | 2 | 4:35 PM | 0 | 0 | 1 | 0 | 1 | 4:35 PM | 0 | 0 | 0 | 0 | 0 |
| 4:40 PM | 2 | 0 | 0 | 1 | 3 | 4:40 PM | 0 | 0 | 0 | 0 | 0 | 4:40 PM | 0 | 0 | 0 | 1 | 1 |
| 4:45 PM | 1 | 1 | 1 | 0 | 3 | 4:45 PM | 0 | 0 | 0 | 0 | 0 | 4:45 PM | 0 | 0 | 0 | 0 | 0 |
| 4:50 PM | 1 | 0 | 1 | 0 | 2 | 4:50 PM | 0 | 0 | 0 | 0 | 0 | 4:50 PM | 0 | 1 | 0 | 1 | 2 |
| 4:55 PM | 2 | 0 | 0 | 0 | 2 | 4:55 PM | 0 | 0 | 0 | 1 | 1 | 4:55 PM | 0 | 0 | 0 | 0 | 0 |
| 5:00 PM | 1 | 0 | 2 | 0 | 3 | 5:00 PM | 0 | 0 | 0 | 0 | 0 | 5:00 PM | 0 | 0 | 0 | 0 | 0 |
| 5:05 PM | 2 | 0 | 0 | 0 | 2 | 5:05 PM | 0 | 0 | 0 | 0 | 0 | 5:05 PM | 0 | 0 | 0 | 0 | 0 |
| 5:10 PM | 3 | 0 | 1 | 0 | 4 | 5:10 PM | 1 | 1 | 0 | 0 | 2 | 5:10 PM | 0 | 0 | 0 | 0 | 0 |
| 5:15 PM | 4 | 0 | 0 | 0 | 4 | 5:15 PM | 1 | 0 | 0 | 0 | 1 | 5:15 PM | 0 | 1 | 0 | 0 | 1 |
| 5:20 PM | 2 | 0 | 3 | 0 | 5 | 5:20 PM | 0 | 0 | 0 | 0 | 0 | 5:20 PM | 0 | 0 | 0 | 0 | 0 |
| 5:25 PM | 1 | 0 | 0 | 0 | 1 | 5:25 PM | 0 | 0 | 0 | 0 | 0 | 5:25 PM | 0 | 0 | 0 | 0 | 0 |
| 5:30 PM | 0 | 0 | 0 | 0 | 0 | 5:30 PM | 2 | 0 | 2 | 0 | 4 | 5:30 PM | 0 | 2 | 0 | 0 | 2 |
| 5:35 PM | 1 | 0 | 1 | 0 | 2 | 5:35 PM | 0 | 0 | 0 | 0 | 0 | 5:35 PM | 0 | 0 | 0 | 2 | 2 |
| 5:40 PM | 3 | 0 | 0 | 0 | 3 | 5:40 PM | 0 | 0 | 0 | 0 | 0 | 5:40 PM | 0 | 0 | 0 | 0 | 0 |
| 5:45 PM | 1 | 0 | 1 | 0 | 2 | 5:45 PM | 0 | 0 | 0 | 0 | 0 | 5:45 PM | 0 | 0 | 0 | 3 | 3 |
| 5:50 PM | 2 | 0 | 2 | 0 | 4 | 5:50 PM | 0 | 0 | 2 | 0 | 2 | 5:50 PM | 0 | 0 | 0 | 1 | 1 |
| 5:55 PM | 2 | 0 | 0 | 0 | 2 | 5:55 PM | 0 | 0 | 0 | 0 | 0 | 5:55 PM | 0 | 0 | 0 | 1 | 1 |
| Count Total | 42 | 2 | 23 | 2 | 69 | Count Total | 7 | 1 | 6 | 1 | 15 | Count Total | 1 | 5 | 0 | 12 | 18 |
| Peak Hour | 17 | 2 | 12 | 2 | 33 | Peak Hour | 3 | 0 | 2 | 1 | 6 | Peak Hour | 1 | 2 | 0 | 2 | 5 |

ALL TRAFFIC DATA SERVICES
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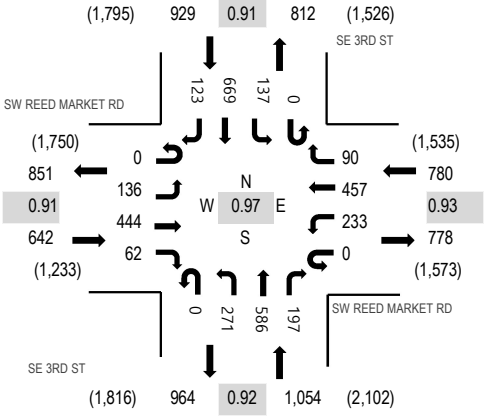
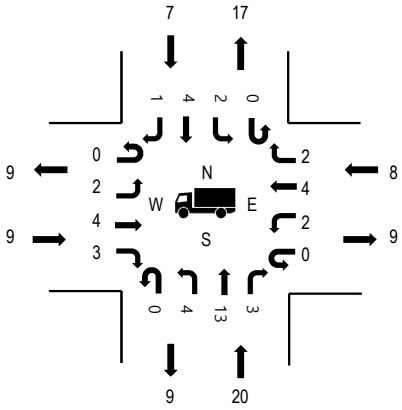
**Location:** 5 SE 3RD ST & SW REED MARKET RD PM
**Date:** Wednesday, August 3, 2022
**Peak Hour:** 04:15 PM - 05:15 PM
**Peak 15-Minutes:** 04:40 PM - 04:55 PM

## Peak Hour

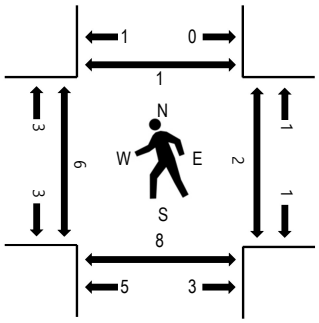
### Motorized Vehicles




### Heavy Vehicles




### Pedestrians




Note: Total study counts contained in parentheses.

| | HV% | PHF |
|---|---|---|
| EB | 1.4% | 0.91 |
| WB | 1.0% | 0.93 |
| NB | 1.9% | 0.92 |
| SB | 0.8% | 0.91 |
| All | 1.3% | 0.97 |

## Traffic Counts - Motorized Vehicles

| Interval Start Time | SW REED MARKET RD Eastbound | | | | SW REED MARKET RD Westbound | | | | SE 3RD ST Northbound | | | | SE 3RD ST Southbound | | | | | Rolling Hour |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | Total | |
| 4:00 PM | 0 | 5 | 26 | 3 | 0 | 21 | 30 | 8 | 0 | 27 | 54 | 28 | 0 | 7 | 68 | 11 | 288 | 3,376 |
| 4:05 PM | 0 | 4 | 47 | 5 | 0 | 18 | 42 | 7 | 0 | 25 | 51 | 15 | 0 | 12 | 43 | 10 | 279 | 3,363 |
| 4:10 PM | 0 | 6 | 53 | 3 | 0 | 11 | 38 | 7 | 0 | 21 | 49 | 21 | 0 | 4 | 51 | 8 | 272 | 3,389 |
| 4:15 PM | 0 | 7 | 47 | 5 | 0 | 18 | 38 | 8 | 0 | 23 | 48 | 16 | 0 | 12 | 51 | 7 | 280 | 3,405 |
| 4:20 PM | 0 | 15 | 34 | 8 | 0 | 21 | 38 | 6 | 0 | 26 | 44 | 17 | 0 | 10 | 54 | 10 | 283 | 3,405 |
| 4:25 PM | 0 | 14 | 37 | 7 | 0 | 21 | 40 | 7 | 0 | 26 | 46 | 22 | 0 | 7 | 51 | 8 | 286 | 3,394 |
| 4:30 PM | 0 | 15 | 37 | 3 | 0 | 23 | 37 | 10 | 0 | 20 | 53 | 12 | 0 | 11 | 54 | 15 | 290 | 3,403 |
| 4:35 PM | 0 | 7 | 33 | 7 | 0 | 19 | 48 | 4 | 0 | 23 | 43 | 12 | 0 | 11 | 59 | 7 | 273 | 3,374 |
| 4:40 PM | 0 | 15 | 38 | 6 | 0 | 18 | 48 | 5 | 0 | 24 | 53 | 19 | 0 | 13 | 50 | 4 | 293 | 3,392 |
| 4:45 PM | 0 | 20 | 26 | 4 | 0 | 21 | 41 | 8 | 0 | 18 | 49 | 18 | 0 | 13 | 62 | 9 | 289 | 3,370 |
| 4:50 PM | 0 | 10 | 29 | 6 | 0 | 22 | 38 | 11 | 0 | 26 | 52 | 19 | 0 | 14 | 62 | 11 | 300 | 3,343 |
| 4:55 PM | 0 | 6 | 36 | 6 | 0 | 6 | 14 | 13 | 0 | 16 | 41 | 14 | 0 | 14 | 64 | 13 | 243 | 3,313 |
| 5:00 PM | 0 | 7 | 38 | 5 | 0 | 14 | 37 | 4 | 0 | 24 | 55 | 14 | 0 | 12 | 52 | 13 | 275 | 3,289 |
| 5:05 PM | 0 | 8 | 50 | 1 | 0 | 28 | 35 | 7 | 0 | 24 | 56 | 18 | 0 | 11 | 55 | 12 | 305 | |
| 5:10 PM | 0 | 12 | 39 | 4 | 0 | 22 | 43 | 7 | 0 | 21 | 46 | 16 | 0 | 9 | 55 | 14 | 288 | |
| 5:15 PM | 0 | 13 | 31 | 4 | 0 | 19 | 48 | 3 | 0 | 24 | 53 | 14 | 0 | 12 | 48 | 11 | 280 | |
| 5:20 PM | 0 | 10 | 37 | 4 | 0 | 11 | 38 | 4 | 0 | 26 | 47 | 15 | 0 | 13 | 61 | 6 | 272 | |
| 5:25 PM | 0 | 5 | 44 | 4 | 0 | 25 | 30 | 7 | 0 | 25 | 47 | 23 | 0 | 14 | 63 | 8 | 295 | |
| 5:30 PM | 0 | 14 | 27 | 3 | 0 | 15 | 40 | 9 | 0 | 24 | 37 | 14 | 0 | 8 | 53 | 17 | 261 | |
| 5:35 PM | 0 | 11 | 41 | 6 | 0 | 12 | 52 | 6 | 0 | 23 | 34 | 25 | 0 | 12 | 59 | 10 | 291 | |
| 5:40 PM | 0 | 4 | 49 | 3 | 0 | 12 | 48 | 8 | 0 | 17 | 46 | 16 | 0 | 7 | 51 | 10 | 271 | |
| 5:45 PM | 0 | 11 | 29 | 3 | 0 | 14 | 40 | 11 | 0 | 24 | 45 | 16 | 0 | 12 | 47 | 10 | 262 | |
| 5:50 PM | 0 | 5 | 38 | 6 | 0 | 10 | 43 | 7 | 0 | 25 | 42 | 26 | 0 | 12 | 36 | 20 | 270 | |
| 5:55 PM | 0 | 5 | 28 | 4 | 0 | 15 | 43 | 3 | 0 | 20 | 36 | 13 | 0 | 6 | 41 | 5 | 219 | |
| Count Total | 0 | 229 | 894 | 110 | 0 | 416 | 949 | 170 | 0 | 552 | 1,127 | 423 | 0 | 256 | 1,290 | 249 | 6,665 | |
| Peak Hour | 0 | 136 | 444 | 62 | 0 | 233 | 457 | 90 | 0 | 271 | 586 | 197 | 0 | 137 | 669 | 123 | 3,405 | |

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

| Interval Start Time | Heavy Vehicles | | | | | Interval Start Time | Bicycles on Roadway | | | | | Interval Start Time | Pedestrians/Bicycles on Crosswalk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | EB | NB | WB | SB | Total | | EB | NB | WB | SB | Total | | EB | NB | WB | SB | Total |
| 4:00 PM | 2 | 1 | 1 | 1 | 5 | 4:00 PM | 0 | 0 | 0 | 0 | 0 | 4:00 PM | 1 | 0 | 0 | 0 | 1 |
| 4:05 PM | 2 | 2 | 1 | 1 | 6 | 4:05 PM | 0 | 1 | 0 | 1 | 2 | 4:05 PM | 0 | 0 | 0 | 0 | 0 |
| 4:10 PM | 3 | 1 | 3 | 0 | 7 | 4:10 PM | 1 | 1 | 0 | 0 | 2 | 4:10 PM | 1 | 0 | 2 | 1 | 4 |
| 4:15 PM | 1 | 2 | 0 | 0 | 3 | 4:15 PM | 0 | 0 | 0 | 0 | 0 | 4:15 PM | 1 | 1 | 0 | 0 | 2 |
| 4:20 PM | 1 | 1 | 1 | 1 | 4 | 4:20 PM | 0 | 1 | 0 | 1 | 2 | 4:20 PM | 0 | 3 | 3 | 1 | 7 |
| 4:25 PM | 2 | 1 | 1 | 0 | 4 | 4:25 PM | 1 | 0 | 1 | 0 | 2 | 4:25 PM | 2 | 1 | 1 | 0 | 4 |
| 4:30 PM | 0 | 3 | 2 | 3 | 8 | 4:30 PM | 0 | 0 | 0 | 0 | 0 | 4:30 PM | 1 | 1 | 0 | 0 | 2 |
| 4:35 PM | 0 | 2 | 3 | 0 | 5 | 4:35 PM | 0 | 0 | 0 | 0 | 0 | 4:35 PM | 0 | 0 | 2 | 0 | 2 |
| 4:40 PM | 1 | 1 | 0 | 1 | 3 | 4:40 PM | 0 | 2 | 0 | 0 | 2 | 4:40 PM | 3 | 1 | 0 | 0 | 4 |
| 4:45 PM | 2 | 2 | 0 | 0 | 4 | 4:45 PM | 0 | 2 | 0 | 0 | 2 | 4:45 PM | 0 | 0 | 1 | 1 | 2 |
| 4:50 PM | 1 | 3 | 0 | 1 | 5 | 4:50 PM | 0 | 0 | 1 | 0 | 1 | 4:50 PM | 0 | 0 | 0 | 0 | 0 |
| 4:55 PM | 0 | 1 | 0 | 0 | 1 | 4:55 PM | 0 | 0 | 0 | 0 | 0 | 4:55 PM | 0 | 1 | 0 | 0 | 1 |
| 5:00 PM | 0 | 1 | 1 | 0 | 2 | 5:00 PM | 0 | 1 | 0 | 0 | 1 | 5:00 PM | 0 | 1 | 0 | 0 | 1 |
| 5:05 PM | 0 | 1 | 0 | 1 | 2 | 5:05 PM | 0 | 2 | 0 | 0 | 2 | 5:05 PM | 0 | 1 | 0 | 0 | 1 |
| 5:10 PM | 1 | 2 | 0 | 0 | 3 | 5:10 PM | 2 | 1 | 0 | 0 | 3 | 5:10 PM | 1 | 1 | 0 | 0 | 2 |
| 5:15 PM | 0 | 0 | 0 | 1 | 1 | 5:15 PM | 0 | 0 | 0 | 1 | 1 | 5:15 PM | 0 | 1 | 1 | 0 | 2 |
| 5:20 PM | 3 | 1 | 2 | 0 | 6 | 5:20 PM | 1 | 0 | 0 | 0 | 1 | 5:20 PM | 0 | 0 | 0 | 0 | 0 |
| 5:25 PM | 0 | 1 | 0 | 1 | 2 | 5:25 PM | 0 | 0 | 0 | 0 | 0 | 5:25 PM | 0 | 0 | 0 | 0 | 0 |
| 5:30 PM | 0 | 1 | 0 | 1 | 2 | 5:30 PM | 0 | 1 | 0 | 0 | 1 | 5:30 PM | 2 | 2 | 0 | 0 | 4 |
| 5:35 PM | 1 | 0 | 1 | 3 | 5 | 5:35 PM | 1 | 0 | 0 | 0 | 1 | 5:35 PM | 0 | 0 | 0 | 0 | 0 |
| 5:40 PM | 1 | 1 | 1 | 2 | 5 | 5:40 PM | 0 | 0 | 0 | 2 | 2 | 5:40 PM | 0 | 0 | 0 | 1 | 1 |
| 5:45 PM | 0 | 1 | 0 | 0 | 1 | 5:45 PM | 0 | 0 | 0 | 0 | 0 | 5:45 PM | 2 | 0 | 0 | 0 | 2 |
| 5:50 PM | 1 | 0 | 1 | 1 | 3 | 5:50 PM | 0 | 1 | 0 | 1 | 2 | 5:50 PM | 1 | 1 | 1 | 2 | 5 |
| 5:55 PM | 1 | 0 | 0 | 0 | 1 | 5:55 PM | 0 | 0 | 0 | 0 | 0 | 5:55 PM | 0 | 0 | 0 | 0 | 0 |
| Count Total | 23 | 29 | 18 | 18 | 88 | Count Total | 6 | 13 | 2 | 6 | 27 | Count Total | 15 | 15 | 11 | 6 | 47 |
| Peak Hour | 9 | 20 | 8 | 7 | 44 | Peak Hour | 3 | 9 | 2 | 1 | 15 | Peak Hour | 8 | 11 | 7 | 2 | 28 |

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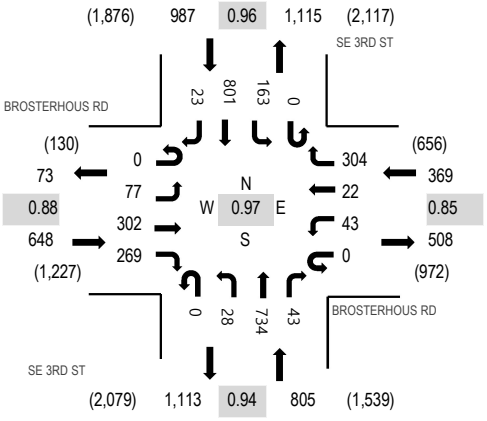
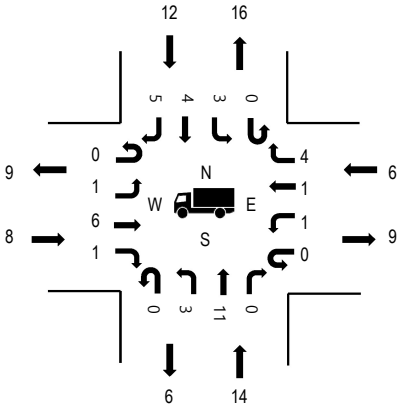
**Location:** 6 SE 3RD ST & BROSTERHOUS RD PM
**Date:** Wednesday, August 3, 2022
**Peak Hour:** 04:10 PM - 05:10 PM
**Peak 15-Minutes:** 04:40 PM - 04:55 PM

## Peak Hour

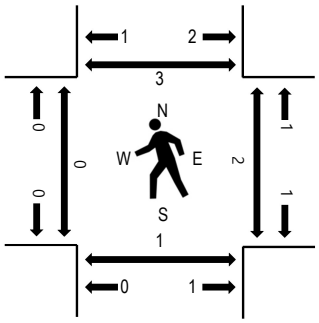
### Motorized Vehicles




### Heavy Vehicles




### Pedestrians




Note: Total study counts contained in parentheses.

| | HV% | PHF |
|---|---|---|
| EB | 1.2% | 0.88 |
| WB | 1.6% | 0.85 |
| NB | 1.7% | 0.94 |
| SB | 1.2% | 0.96 |
| All | 1.4% | 0.97 |

## Traffic Counts - Motorized Vehicles

| Interval Start Time | BROSTERHOUS RD Eastbound | | | | BROSTERHOUS RD Westbound | | | | SE 3RD ST Northbound | | | | SE 3RD ST Southbound | | | | | Rolling Hour |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | Total | |
| 4:00 PM | 0 | 7 | 22 | 18 | 0 | 3 | 3 | 23 | 0 | 2 | 61 | 7 | 0 | 7 | 86 | 0 | 239 | 2,765 |
| 4:05 PM | 0 | 23 | 21 | 29 | 0 | 4 | 0 | 16 | 0 | 4 | 48 | 2 | 0 | 15 | 55 | 2 | 219 | 2,785 |
| 4:10 PM | 0 | 4 | 21 | 35 | 0 | 2 | 1 | 26 | 0 | 2 | 66 | 2 | 0 | 12 | 56 | 4 | 231 | 2,809 |
| 4:15 PM | 0 | 9 | 21 | 23 | 0 | 3 | 1 | 24 | 0 | 4 | 59 | 4 | 0 | 12 | 59 | 4 | 223 | 2,784 |
| 4:20 PM | 0 | 6 | 28 | 23 | 0 | 2 | 1 | 26 | 0 | 2 | 71 | 4 | 0 | 18 | 68 | 2 | 251 | 2,777 |
| 4:25 PM | 0 | 10 | 21 | 17 | 0 | 2 | 2 | 20 | 0 | 3 | 64 | 4 | 0 | 8 | 72 | 1 | 224 | 2,740 |
| 4:30 PM | 0 | 5 | 28 | 24 | 0 | 5 | 3 | 23 | 0 | 2 | 55 | 4 | 0 | 14 | 64 | 2 | 229 | 2,744 |
| 4:35 PM | 0 | 3 | 20 | 15 | 0 | 1 | 2 | 24 | 0 | 1 | 61 | 2 | 0 | 17 | 83 | 0 | 229 | 2,723 |
| 4:40 PM | 0 | 5 | 18 | 16 | 0 | 3 | 1 | 31 | 0 | 0 | 70 | 7 | 0 | 14 | 57 | 1 | 223 | 2,706 |
| 4:45 PM | 0 | 6 | 25 | 20 | 0 | 8 | 5 | 34 | 0 | 4 | 56 | 2 | 0 | 14 | 66 | 3 | 243 | 2,687 |
| 4:50 PM | 0 | 3 | 34 | 23 | 0 | 1 | 1 | 18 | 0 | 2 | 70 | 2 | 0 | 10 | 90 | 4 | 258 | 2,653 |
| 4:55 PM | 0 | 6 | 27 | 21 | 0 | 5 | 2 | 18 | 0 | 6 | 42 | 3 | 0 | 16 | 49 | 1 | 196 | 2,561 |
| 5:00 PM | 0 | 11 | 35 | 28 | 0 | 5 | 2 | 24 | 0 | 0 | 65 | 4 | 0 | 17 | 68 | 0 | 259 | 2,533 |
| 5:05 PM | 0 | 9 | 24 | 24 | 0 | 6 | 1 | 36 | 0 | 2 | 55 | 5 | 0 | 11 | 69 | 1 | 243 | |
| 5:10 PM | 0 | 3 | 23 | 17 | 0 | 0 | 1 | 17 | 0 | 0 | 56 | 3 | 0 | 15 | 70 | 1 | 206 | |
| 5:15 PM | 0 | 6 | 30 | 15 | 0 | 3 | 0 | 26 | 0 | 3 | 57 | 2 | 0 | 7 | 64 | 3 | 216 | |
| 5:20 PM | 0 | 5 | 28 | 16 | 0 | 1 | 1 | 25 | 0 | 2 | 62 | 0 | 0 | 18 | 55 | 1 | 214 | |
| 5:25 PM | 0 | 3 | 23 | 26 | 0 | 2 | 0 | 21 | 0 | 2 | 61 | 7 | 0 | 12 | 68 | 3 | 228 | |
| 5:30 PM | 0 | 6 | 21 | 20 | 0 | 1 | 1 | 22 | 0 | 7 | 47 | 3 | 0 | 15 | 64 | 1 | 208 | |
| 5:35 PM | 0 | 6 | 29 | 22 | 0 | 1 | 1 | 16 | 0 | 0 | 57 | 3 | 0 | 16 | 58 | 3 | 212 | |
| 5:40 PM | 0 | 6 | 17 | 17 | 0 | 2 | 2 | 20 | 0 | 2 | 62 | 1 | 0 | 17 | 57 | 1 | 204 | |
| 5:45 PM | 0 | 7 | 27 | 13 | 0 | 3 | 1 | 31 | 0 | 3 | 59 | 5 | 0 | 7 | 52 | 1 | 209 | |
| 5:50 PM | 0 | 9 | 17 | 15 | 0 | 3 | 0 | 21 | 0 | 2 | 46 | 3 | 0 | 11 | 38 | 1 | 166 | |
| 5:55 PM | 0 | 2 | 15 | 15 | 0 | 2 | 1 | 13 | 0 | 1 | 52 | 2 | 0 | 13 | 51 | 1 | 168 | |
| Count Total | 0 | 160 | 575 | 492 | 0 | 68 | 33 | 555 | 0 | 56 | 1,402 | 81 | 0 | 316 | 1,519 | 41 | 5,298 | |
| Peak Hour | 0 | 77 | 302 | 269 | 0 | 43 | 22 | 304 | 0 | 28 | 734 | 43 | 0 | 163 | 801 | 23 | 2,809 | |

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

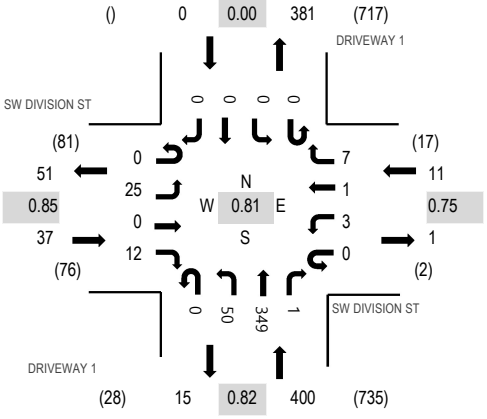
| Interval Start Time | Heavy Vehicles | | | | | Interval Start Time | Bicycles on Roadway | | | | | Interval Start Time | Pedestrians/Bicycles on Crosswalk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | EB | NB | WB | SB | Total | | EB | NB | WB | SB | Total | | EB | NB | WB | SB | Total |
| 4:00 PM | 1 | 2 | 0 | 0 | 3 | 4:00 PM | 0 | 0 | 0 | 0 | 0 | 4:00 PM | 1 | 0 | 0 | 1 | 2 |
| 4:05 PM | 1 | 2 | 0 | 2 | 5 | 4:05 PM | 0 | 0 | 0 | 0 | 0 | 4:05 PM | 1 | 1 | 0 | 1 | 3 |
| 4:10 PM | 0 | 2 | 1 | 1 | 4 | 4:10 PM | 1 | 0 | 0 | 0 | 1 | 4:10 PM | 0 | 0 | 0 | 0 | 0 |
| 4:15 PM | 0 | 1 | 0 | 2 | 3 | 4:15 PM | 0 | 0 | 0 | 0 | 0 | 4:15 PM | 0 | 0 | 0 | 0 | 0 |
| 4:20 PM | 0 | 1 | 0 | 1 | 2 | 4:20 PM | 0 | 0 | 0 | 0 | 0 | 4:20 PM | 0 | 0 | 0 | 1 | 1 |
| 4:25 PM | 1 | 1 | 1 | 0 | 3 | 4:25 PM | 0 | 0 | 1 | 0 | 1 | 4:25 PM | 0 | 0 | 0 | 0 | 0 |
| 4:30 PM | 1 | 2 | 1 | 1 | 5 | 4:30 PM | 0 | 0 | 0 | 0 | 0 | 4:30 PM | 1 | 0 | 0 | 0 | 1 |
| 4:35 PM | 1 | 2 | 1 | 3 | 7 | 4:35 PM | 0 | 0 | 0 | 0 | 0 | 4:35 PM | 0 | 0 | 0 | 0 | 0 |
| 4:40 PM | 1 | 1 | 1 | 1 | 4 | 4:40 PM | 0 | 0 | 0 | 0 | 0 | 4:40 PM | 1 | 1 | 0 | 0 | 2 |
| 4:45 PM | 0 | 1 | 0 | 1 | 2 | 4:45 PM | 0 | 0 | 0 | 2 | 2 | 4:45 PM | 1 | 0 | 0 | 0 | 1 |
| 4:50 PM | 1 | 1 | 0 | 0 | 2 | 4:50 PM | 0 | 0 | 1 | 0 | 1 | 4:50 PM | 0 | 0 | 1 | 1 | 2 |
| 4:55 PM | 1 | 1 | 0 | 1 | 3 | 4:55 PM | 0 | 0 | 0 | 0 | 0 | 4:55 PM | 0 | 0 | 1 | 1 | 2 |
| 5:00 PM | 1 | 1 | 1 | 0 | 3 | 5:00 PM | 0 | 0 | 0 | 0 | 0 | 5:00 PM | 0 | 0 | 0 | 0 | 0 |
| 5:05 PM | 1 | 0 | 0 | 1 | 2 | 5:05 PM | 0 | 0 | 1 | 1 | 2 | 5:05 PM | 0 | 1 | 0 | 1 | 2 |
| 5:10 PM | 0 | 1 | 0 | 0 | 1 | 5:10 PM | 1 | 0 | 0 | 0 | 1 | 5:10 PM | 0 | 1 | 1 | 2 | 4 |
| 5:15 PM | 0 | 0 | 0 | 0 | 0 | 5:15 PM | 0 | 0 | 0 | 1 | 1 | 5:15 PM | 1 | 0 | 1 | 2 | 4 |
| 5:20 PM | 0 | 0 | 0 | 0 | 0 | 5:20 PM | 0 | 0 | 0 | 0 | 0 | 5:20 PM | 0 | 0 | 0 | 0 | 0 |
| 5:25 PM | 0 | 1 | 0 | 2 | 3 | 5:25 PM | 0 | 0 | 0 | 1 | 1 | 5:25 PM | 0 | 0 | 0 | 1 | 1 |
| 5:30 PM | 0 | 1 | 0 | 1 | 2 | 5:30 PM | 0 | 0 | 0 | 0 | 0 | 5:30 PM | 1 | 1 | 0 | 0 | 2 |
| 5:35 PM | 1 | 0 | 0 | 4 | 5 | 5:35 PM | 0 | 0 | 0 | 0 | 0 | 5:35 PM | 0 | 0 | 0 | 0 | 0 |
| 5:40 PM | 1 | 0 | 0 | 3 | 4 | 5:40 PM | 0 | 0 | 0 | 0 | 0 | 5:40 PM | 0 | 0 | 2 | 0 | 2 |
| 5:45 PM | 0 | 1 | 1 | 0 | 2 | 5:45 PM | 0 | 0 | 0 | 0 | 0 | 5:45 PM | 1 | 0 | 0 | 0 | 1 |
| 5:50 PM | 0 | 0 | 0 | 1 | 1 | 5:50 PM | 0 | 0 | 0 | 1 | 1 | 5:50 PM | 0 | 0 | 0 | 0 | 0 |
| 5:55 PM | 0 | 0 | 0 | 0 | 0 | 5:55 PM | 0 | 0 | 0 | 0 | 0 | 5:55 PM | 0 | 0 | 1 | 0 | 1 |
| Count Total | 12 | 22 | 7 | 25 | 66 | Count Total | 2 | 0 | 3 | 6 | 11 | Count Total | 8 | 5 | 7 | 11 | 31 |
| Peak Hour | 8 | 14 | 6 | 12 | 40 | Peak Hour | 1 | 0 | 3 | 3 | 7 | Peak Hour | 3 | 2 | 2 | 4 | 11 |

ALL TRAFFIC DATA SERVICES
(303) 216-2439
www.alltrafficdata.net

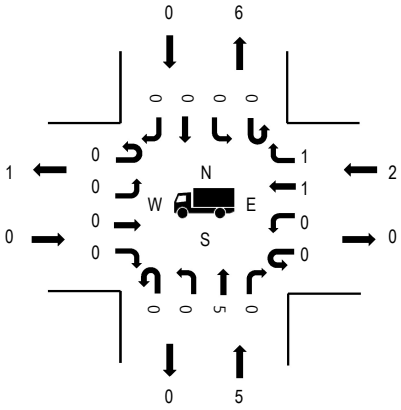
**Location:** 7 DRIVEWAY 1 & SW DIVISION ST PM
**Date:** Wednesday, August 3, 2022
**Peak Hour:** 04:35 PM - 05:35 PM
**Peak 15-Minutes:** 05:05 PM - 05:20 PM

## Peak Hour

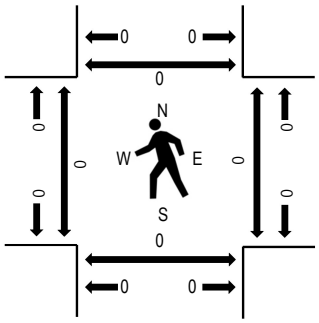
### Motorized Vehicles




### Heavy Vehicles




### Pedestrians




Note: Total study counts contained in parentheses.

| | HV% | PHF |
|---|---|---|
| EB | 0.0% | 0.85 |
| WB | 18.2% | 0.75 |
| NB | 1.3% | 0.82 |
| SB | 0.0% | 0.00 |
| All | 1.6% | 0.81 |

## Traffic Counts - Motorized Vehicles

| Interval Start Time | SW DIVISION ST Eastbound | | | | SW DIVISION ST Westbound | | | | DRIVEWAY 1 Northbound | | | | DRIVEWAY 1 Southbound | | | | | Rolling Hour |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | Total | |
| 4:00 PM | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 22 | 0 | 0 | 0 | 0 | 0 | 27 | 405 |
| 4:05 PM | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 2 | 28 | 0 | 0 | 0 | 0 | 0 | 32 | 410 |
| 4:10 PM | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 28 | 0 | 0 | 0 | 0 | 0 | 31 | 422 |
| 4:15 PM | 0 | 5 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 30 | 0 | 0 | 0 | 0 | 0 | 38 | 441 |
| 4:20 PM | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 3 | 29 | 0 | 0 | 0 | 0 | 0 | 34 | 447 |
| 4:25 PM | 0 | 2 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 2 | 24 | 0 | 0 | 0 | 0 | 0 | 30 | 445 |
| 4:30 PM | 0 | 2 | 1 | 2 | 0 | 0 | 0 | 1 | 0 | 1 | 23 | 0 | 0 | 0 | 0 | 0 | 30 | 447 |
| 4:35 PM | 0 | 2 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 4 | 30 | 0 | 0 | 0 | 0 | 0 | 39 | 448 |
| 4:40 PM | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 3 | 27 | 0 | 0 | 0 | 0 | 0 | 33 | 436 |
| 4:45 PM | 0 | 5 | 0 | 2 | 0 | 0 | 0 | 2 | 0 | 2 | 28 | 1 | 0 | 0 | 0 | 0 | 40 | 432 |
| 4:50 PM | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 5 | 31 | 0 | 0 | 0 | 0 | 0 | 38 | 425 |
| 4:55 PM | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 5 | 25 | 0 | 0 | 0 | 0 | 0 | 33 | 423 |
| 5:00 PM | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 6 | 22 | 0 | 0 | 0 | 0 | 0 | 32 | 423 |
| 5:05 PM | 0 | 3 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 9 | 31 | 0 | 0 | 0 | 0 | 0 | 44 | |
| 5:10 PM | 0 | 4 | 0 | 1 | 0 | 0 | 0 | 2 | 0 | 6 | 37 | 0 | 0 | 0 | 0 | 0 | 50 | |
| 5:15 PM | 0 | 1 | 0 | 3 | 0 | 1 | 0 | 0 | 0 | 2 | 37 | 0 | 0 | 0 | 0 | 0 | 44 | |
| 5:20 PM | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 30 | 0 | 0 | 0 | 0 | 0 | 32 | |
| 5:25 PM | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 28 | 0 | 0 | 0 | 0 | 0 | 32 | |
| 5:30 PM | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 6 | 23 | 0 | 0 | 0 | 0 | 0 | 31 | |
| 5:35 PM | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 4 | 21 | 0 | 0 | 0 | 0 | 0 | 27 | |
| 5:40 PM | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 5 | 22 | 0 | 0 | 0 | 0 | 0 | 29 | |
| 5:45 PM | 0 | 4 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 26 | 0 | 0 | 0 | 0 | 0 | 33 | |
| 5:50 PM | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 31 | 0 | 0 | 0 | 0 | 0 | 36 | |
| 5:55 PM | 0 | 3 | 0 | 1 | 0 | 0 | 0 | 2 | 0 | 5 | 22 | 0 | 0 | 0 | 0 | 0 | 33 | |
| Count Total | 0 | 50 | 1 | 25 | 0 | 3 | 2 | 12 | 0 | 79 | 655 | 1 | 0 | 0 | 0 | 0 | 828 | |
| Peak Hour | 0 | 25 | 0 | 12 | 0 | 3 | 1 | 7 | 0 | 50 | 349 | 1 | 0 | 0 | 0 | 0 | 448 | |

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

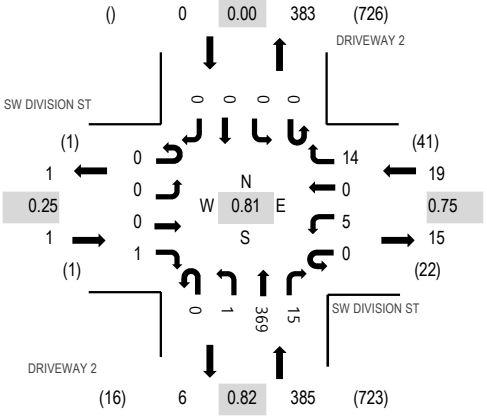
| Interval Start Time | Heavy Vehicles | | | | | Interval Start Time | Bicycles on Roadway | | | | | Interval Start Time | Pedestrians/Bicycles on Crosswalk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | EB | NB | WB | SB | Total | | EB | NB | WB | SB | Total | | EB | NB | WB | SB | Total |
| 4:00 PM | 0 | 0 | 0 | 0 | 0 | 4:00 PM | 0 | 0 | 0 | 0 | 0 | 4:00 PM | 0 | 0 | 0 | 0 | 0 |
| 4:05 PM | 0 | 1 | 0 | 0 | 1 | 4:05 PM | 0 | 0 | 0 | 0 | 0 | 4:05 PM | 0 | 0 | 0 | 0 | 0 |
| 4:10 PM | 0 | 1 | 0 | 0 | 1 | 4:10 PM | 0 | 0 | 0 | 0 | 0 | 4:10 PM | 0 | 0 | 0 | 0 | 0 |
| 4:15 PM | 0 | 0 | 1 | 0 | 1 | 4:15 PM | 0 | 0 | 0 | 0 | 0 | 4:15 PM | 0 | 0 | 0 | 0 | 0 |
| 4:20 PM | 0 | 0 | 0 | 0 | 0 | 4:20 PM | 0 | 0 | 0 | 0 | 0 | 4:20 PM | 0 | 0 | 0 | 0 | 0 |
| 4:25 PM | 0 | 0 | 0 | 0 | 0 | 4:25 PM | 0 | 0 | 0 | 0 | 0 | 4:25 PM | 0 | 0 | 0 | 0 | 0 |
| 4:30 PM | 0 | 0 | 0 | 0 | 0 | 4:30 PM | 0 | 0 | 0 | 0 | 0 | 4:30 PM | 0 | 0 | 0 | 0 | 0 |
| 4:35 PM | 0 | 1 | 0 | 0 | 1 | 4:35 PM | 0 | 0 | 0 | 0 | 0 | 4:35 PM | 0 | 0 | 0 | 0 | 0 |
| 4:40 PM | 0 | 0 | 0 | 0 | 0 | 4:40 PM | 0 | 0 | 0 | 0 | 0 | 4:40 PM | 0 | 0 | 0 | 0 | 0 |
| 4:45 PM | 0 | 1 | 1 | 0 | 2 | 4:45 PM | 0 | 0 | 0 | 0 | 0 | 4:45 PM | 0 | 0 | 0 | 0 | 0 |
| 4:50 PM | 0 | 0 | 0 | 0 | 0 | 4:50 PM | 0 | 0 | 0 | 0 | 0 | 4:50 PM | 0 | 0 | 0 | 0 | 0 |
| 4:55 PM | 0 | 0 | 0 | 0 | 0 | 4:55 PM | 0 | 0 | 0 | 0 | 0 | 4:55 PM | 0 | 0 | 1 | 0 | 1 |
| 5:00 PM | 0 | 1 | 0 | 0 | 1 | 5:00 PM | 0 | 0 | 0 | 0 | 0 | 5:00 PM | 0 | 0 | 0 | 0 | 0 |
| 5:05 PM | 0 | 1 | 0 | 0 | 1 | 5:05 PM | 0 | 0 | 0 | 0 | 0 | 5:05 PM | 0 | 0 | 0 | 0 | 0 |
| 5:10 PM | 0 | 0 | 0 | 0 | 0 | 5:10 PM | 0 | 0 | 0 | 0 | 0 | 5:10 PM | 0 | 0 | 0 | 0 | 0 |
| 5:15 PM | 0 | 0 | 0 | 0 | 0 | 5:15 PM | 0 | 0 | 0 | 0 | 0 | 5:15 PM | 0 | 0 | 0 | 0 | 0 |
| 5:20 PM | 0 | 1 | 0 | 0 | 1 | 5:20 PM | 0 | 0 | 0 | 0 | 0 | 5:20 PM | 0 | 0 | 0 | 0 | 0 |
| 5:25 PM | 0 | 0 | 0 | 0 | 0 | 5:25 PM | 0 | 0 | 0 | 0 | 0 | 5:25 PM | 0 | 0 | 0 | 0 | 0 |
| 5:30 PM | 0 | 0 | 1 | 0 | 1 | 5:30 PM | 0 | 0 | 0 | 0 | 0 | 5:30 PM | 0 | 0 | 0 | 0 | 0 |
| 5:35 PM | 0 | 0 | 0 | 0 | 0 | 5:35 PM | 1 | 0 | 0 | 0 | 1 | 5:35 PM | 0 | 0 | 4 | 0 | 4 |
| 5:40 PM | 0 | 0 | 0 | 0 | 0 | 5:40 PM | 0 | 0 | 0 | 0 | 0 | 5:40 PM | 0 | 0 | 0 | 0 | 0 |
| 5:45 PM | 0 | 0 | 0 | 0 | 0 | 5:45 PM | 0 | 0 | 0 | 0 | 0 | 5:45 PM | 0 | 0 | 1 | 0 | 1 |
| 5:50 PM | 0 | 0 | 0 | 0 | 0 | 5:50 PM | 0 | 0 | 0 | 0 | 0 | 5:50 PM | 0 | 0 | 0 | 0 | 0 |
| 5:55 PM | 0 | 0 | 1 | 0 | 1 | 5:55 PM | 0 | 0 | 0 | 0 | 0 | 5:55 PM | 0 | 0 | 0 | 0 | 0 |
| Count Total | 0 | 7 | 4 | 0 | 11 | Count Total | 1 | 0 | 0 | 0 | 1 | Count Total | 0 | 0 | 6 | 0 | 6 |
| Peak Hour | 0 | 5 | 2 | 0 | 7 | Peak Hour | 0 | 0 | 0 | 0 | 0 | Peak Hour | 0 | 0 | 1 | 0 | 1 |

ALL TRAFFIC DATA SERVICES
(303) 216-2439
www.alltrafficdata.net

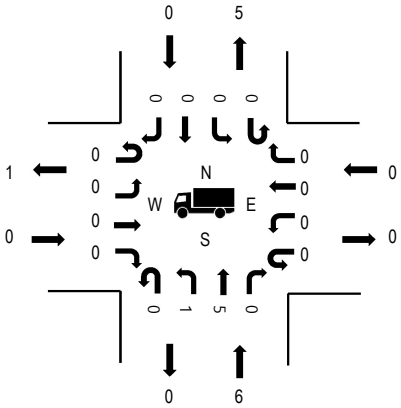
**Location:** 8 DRIVEWAY 2 & SW DIVISION ST PM
**Date:** Wednesday, August 3, 2022
**Peak Hour:** 04:15 PM - 05:15 PM
**Peak 15-Minutes:** 05:00 PM - 05:15 PM

## Peak Hour

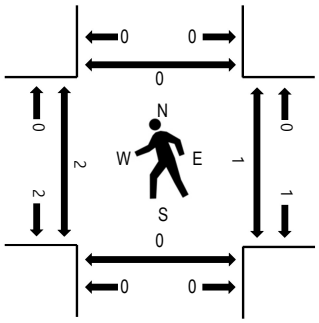
### Motorized Vehicles




### Heavy Vehicles



### Pedestrians



Note: Total study counts contained in parentheses.

| | HV% | PHF |
|---|---|---|
| EB | 0.0% | 0.25 |
| WB | 0.0% | 0.75 |
| NB | 1.6% | 0.82 |
| SB | 0.0% | 0.00 |
| All | 1.5% | 0.81 |

## Traffic Counts - Motorized Vehicles

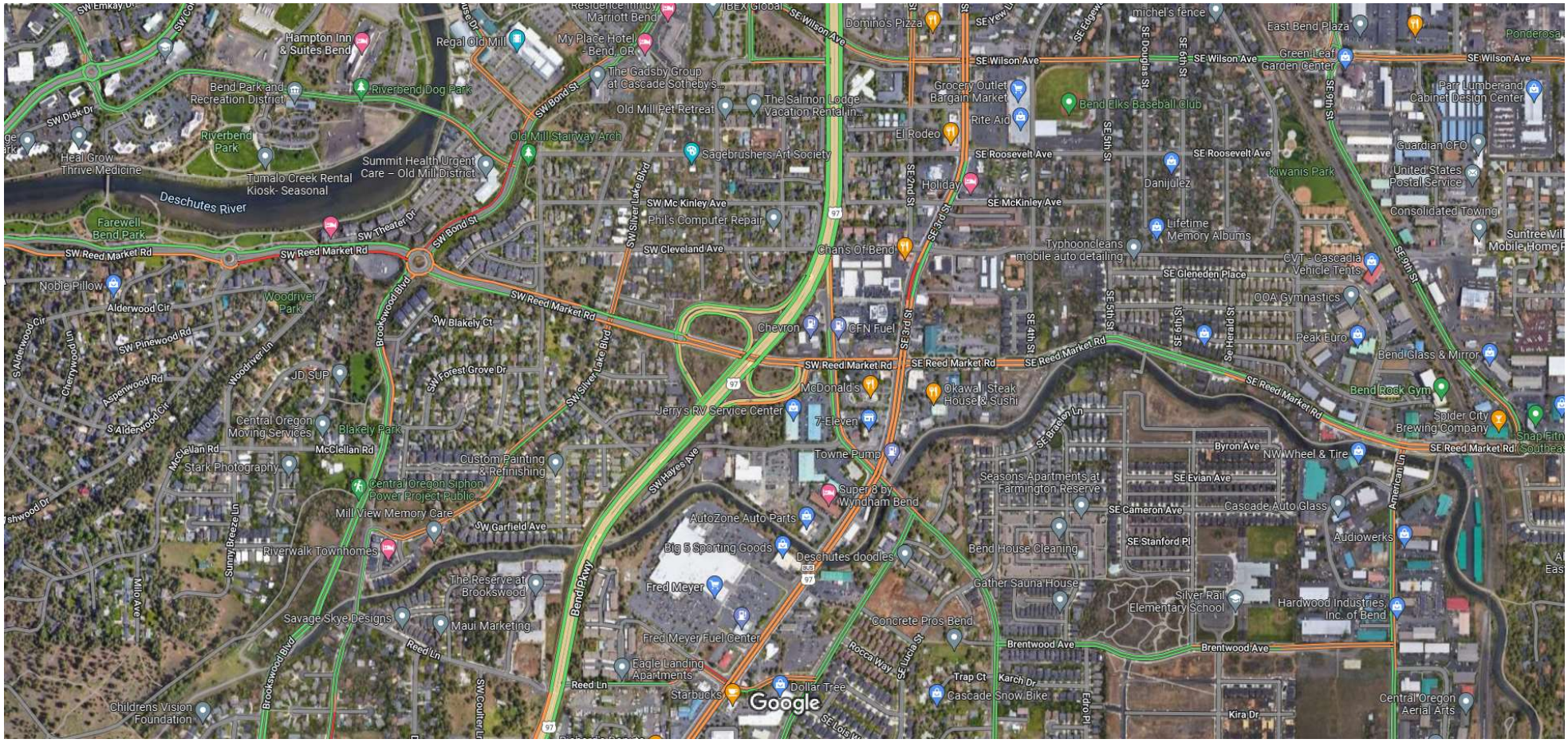
| Interval Start Time | SW DIVISION ST Eastbound | | | | SW DIVISION ST Westbound | | | | DRIVEWAY 2 Northbound | | | | DRIVEWAY 2 Southbound | | | | | Rolling Hour |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | U-Turn | Left | Thru | Right | Total | |
| 4:00 PM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 34 | 0 | 0 | 0 | 0 | 0 | 37 | 373 |
| 4:05 PM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 23 | 1 | 0 | 0 | 0 | 0 | 25 | 375 |
| 4:10 PM | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 29 | 1 | 0 | 0 | 0 | 0 | 31 | 390 |
| 4:15 PM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 31 | 0 | 0 | 0 | 0 | 0 | 32 | 405 |
| 4:20 PM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 29 | 2 | 0 | 0 | 0 | 0 | 31 | 404 |
| 4:25 PM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 28 | 1 | 0 | 0 | 0 | 0 | 29 | 404 |
| 4:30 PM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 28 | 2 | 0 | 0 | 0 | 0 | 30 | 402 |
| 4:35 PM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 30 | 2 | 0 | 0 | 0 | 0 | 34 | 404 |
| 4:40 PM | 0 | 0 | 0 | 1 | 0 | 3 | 0 | 1 | 0 | 0 | 35 | 0 | 0 | 0 | 0 | 0 | 40 | 394 |
| 4:45 PM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 28 | 0 | 0 | 0 | 0 | 0 | 29 | 382 |
| 4:50 PM | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 29 | 0 | 0 | 0 | 0 | 0 | 31 | 378 |
| 4:55 PM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 22 | 1 | 0 | 0 | 0 | 0 | 24 | 381 |
| 5:00 PM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 31 | 4 | 0 | 0 | 0 | 0 | 39 | 392 |
| 5:05 PM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 36 | 1 | 0 | 0 | 0 | 0 | 40 | |
| 5:10 PM | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 42 | 2 | 0 | 0 | 0 | 0 | 46 | |
| 5:15 PM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 31 | 0 | 0 | 0 | 0 | 0 | 31 | |
| 5:20 PM | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 29 | 0 | 0 | 0 | 0 | 0 | 31 | |
| 5:25 PM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 26 | 0 | 0 | 0 | 0 | 0 | 27 | |
| 5:30 PM | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 2 | 0 | 0 | 26 | 1 | 0 | 0 | 0 | 0 | 32 | |
| 5:35 PM | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 0 | 0 | 20 | 1 | 0 | 0 | 0 | 0 | 24 | |
| 5:40 PM | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 26 | 0 | 0 | 0 | 0 | 0 | 28 | |
| 5:45 PM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 24 | 1 | 0 | 0 | 0 | 0 | 25 | |
| 5:50 PM | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 2 | 0 | 0 | 29 | 1 | 0 | 0 | 0 | 0 | 34 | |
| 5:55 PM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 34 | 1 | 0 | 0 | 0 | 0 | 35 | |
| Count Total | 0 | 0 | 0 | 1 | 0 | 15 | 0 | 26 | 0 | 1 | 700 | 22 | 0 | 0 | 0 | 0 | 765 | |
| Peak Hour | 0 | 0 | 0 | 1 | 0 | 5 | 0 | 14 | 0 | 1 | 369 | 15 | 0 | 0 | 0 | 0 | 405 | |

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

| Interval Start Time | Heavy Vehicles | | | | | Interval Start Time | Bicycles on Roadway | | | | | Interval Start Time | Pedestrians/Bicycles on Crosswalk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | EB | NB | WB | SB | Total | | EB | NB | WB | SB | Total | | EB | NB | WB | SB | Total |
| 4:00 PM | 0 | 1 | 0 | 0 | 1 | 4:00 PM | 0 | 0 | 0 | 0 | 0 | 4:00 PM | 0 | 0 | 0 | 0 | 0 |
| 4:05 PM | 0 | 0 | 0 | 0 | 0 | 4:05 PM | 0 | 0 | 0 | 0 | 0 | 4:05 PM | 0 | 0 | 0 | 0 | 0 |
| 4:10 PM | 0 | 1 | 0 | 0 | 1 | 4:10 PM | 0 | 0 | 0 | 0 | 0 | 4:10 PM | 0 | 0 | 0 | 0 | 0 |
| 4:15 PM | 0 | 1 | 0 | 0 | 1 | 4:15 PM | 0 | 0 | 0 | 0 | 0 | 4:15 PM | 0 | 0 | 0 | 0 | 0 |
| 4:20 PM | 0 | 0 | 0 | 0 | 0 | 4:20 PM | 0 | 0 | 0 | 0 | 0 | 4:20 PM | 0 | 0 | 0 | 0 | 0 |
| 4:25 PM | 0 | 0 | 0 | 0 | 0 | 4:25 PM | 0 | 0 | 1 | 0 | 1 | 4:25 PM | 0 | 0 | 0 | 0 | 0 |
| 4:30 PM | 0 | 1 | 0 | 0 | 1 | 4:30 PM | 0 | 0 | 0 | 0 | 0 | 4:30 PM | 0 | 0 | 0 | 0 | 0 |
| 4:35 PM | 0 | 0 | 0 | 0 | 0 | 4:35 PM | 0 | 0 | 0 | 0 | 0 | 4:35 PM | 0 | 0 | 0 | 0 | 0 |
| 4:40 PM | 0 | 1 | 0 | 0 | 1 | 4:40 PM | 0 | 0 | 0 | 0 | 0 | 4:40 PM | 0 | 0 | 0 | 0 | 0 |
| 4:45 PM | 0 | 1 | 0 | 0 | 1 | 4:45 PM | 0 | 0 | 0 | 0 | 0 | 4:45 PM | 0 | 0 | 0 | 0 | 0 |
| 4:50 PM | 0 | 0 | 0 | 0 | 0 | 4:50 PM | 0 | 0 | 0 | 0 | 0 | 4:50 PM | 0 | 0 | 0 | 0 | 0 |
| 4:55 PM | 0 | 1 | 0 | 0 | 1 | 4:55 PM | 0 | 0 | 0 | 0 | 0 | 4:55 PM | 0 | 0 | 1 | 0 | 1 |
| 5:00 PM | 0 | 0 | 0 | 0 | 0 | 5:00 PM | 0 | 0 | 0 | 0 | 0 | 5:00 PM | 0 | 0 | 0 | 0 | 0 |
| 5:05 PM | 0 | 1 | 0 | 0 | 1 | 5:05 PM | 0 | 0 | 0 | 0 | 0 | 5:05 PM | 0 | 0 | 0 | 0 | 0 |
| 5:10 PM | 0 | 0 | 0 | 0 | 0 | 5:10 PM | 0 | 0 | 0 | 0 | 0 | 5:10 PM | 2 | 0 | 0 | 0 | 2 |
| 5:15 PM | 0 | 0 | 0 | 0 | 0 | 5:15 PM | 0 | 0 | 0 | 0 | 0 | 5:15 PM | 0 | 0 | 0 | 0 | 0 |
| 5:20 PM | 0 | 0 | 0 | 0 | 0 | 5:20 PM | 0 | 0 | 0 | 0 | 0 | 5:20 PM | 0 | 0 | 0 | 0 | 0 |
| 5:25 PM | 0 | 0 | 0 | 0 | 0 | 5:25 PM | 0 | 0 | 0 | 0 | 0 | 5:25 PM | 0 | 0 | 0 | 0 | 0 |
| 5:30 PM | 0 | 0 | 0 | 0 | 0 | 5:30 PM | 0 | 0 | 0 | 0 | 0 | 5:30 PM | 0 | 0 | 0 | 0 | 0 |
| 5:35 PM | 0 | 1 | 0 | 0 | 1 | 5:35 PM | 0 | 0 | 0 | 0 | 0 | 5:35 PM | 0 | 0 | 0 | 0 | 0 |
| 5:40 PM | 0 | 0 | 0 | 0 | 0 | 5:40 PM | 0 | 0 | 0 | 0 | 0 | 5:40 PM | 0 | 0 | 0 | 0 | 0 |
| 5:45 PM | 0 | 1 | 0 | 0 | 1 | 5:45 PM | 0 | 0 | 0 | 0 | 0 | 5:45 PM | 0 | 0 | 0 | 0 | 0 |
| 5:50 PM | 0 | 0 | 0 | 0 | 0 | 5:50 PM | 0 | 0 | 0 | 0 | 0 | 5:50 PM | 0 | 0 | 0 | 0 | 0 |
| 5:55 PM | 0 | 1 | 0 | 0 | 1 | 5:55 PM | 0 | 0 | 0 | 0 | 0 | 5:55 PM | 0 | 0 | 0 | 0 | 0 |
| Count Total | 0 | 11 | 0 | 0 | 11 | Count Total | 0 | 0 | 1 | 0 | 1 | Count Total | 2 | 0 | 1 | 0 | 3 |
| Peak Hour | 0 | 6 | 0 | 0 | 6 | Peak Hour | 0 | 0 | 1 | 0 | 1 | Peak Hour | 2 | 0 | 1 | 0 | 3 |

# APPENDIX B: GOOGLE TYPICAL TRAFFIC MAPS

Google Maps Typical Wednesday Traffic at 4:00 PM




Imagery ©2022 CNES / Airbus, Maxar Technologies, State of Oregon, Map data ©2022 500 ft

Typical traffic

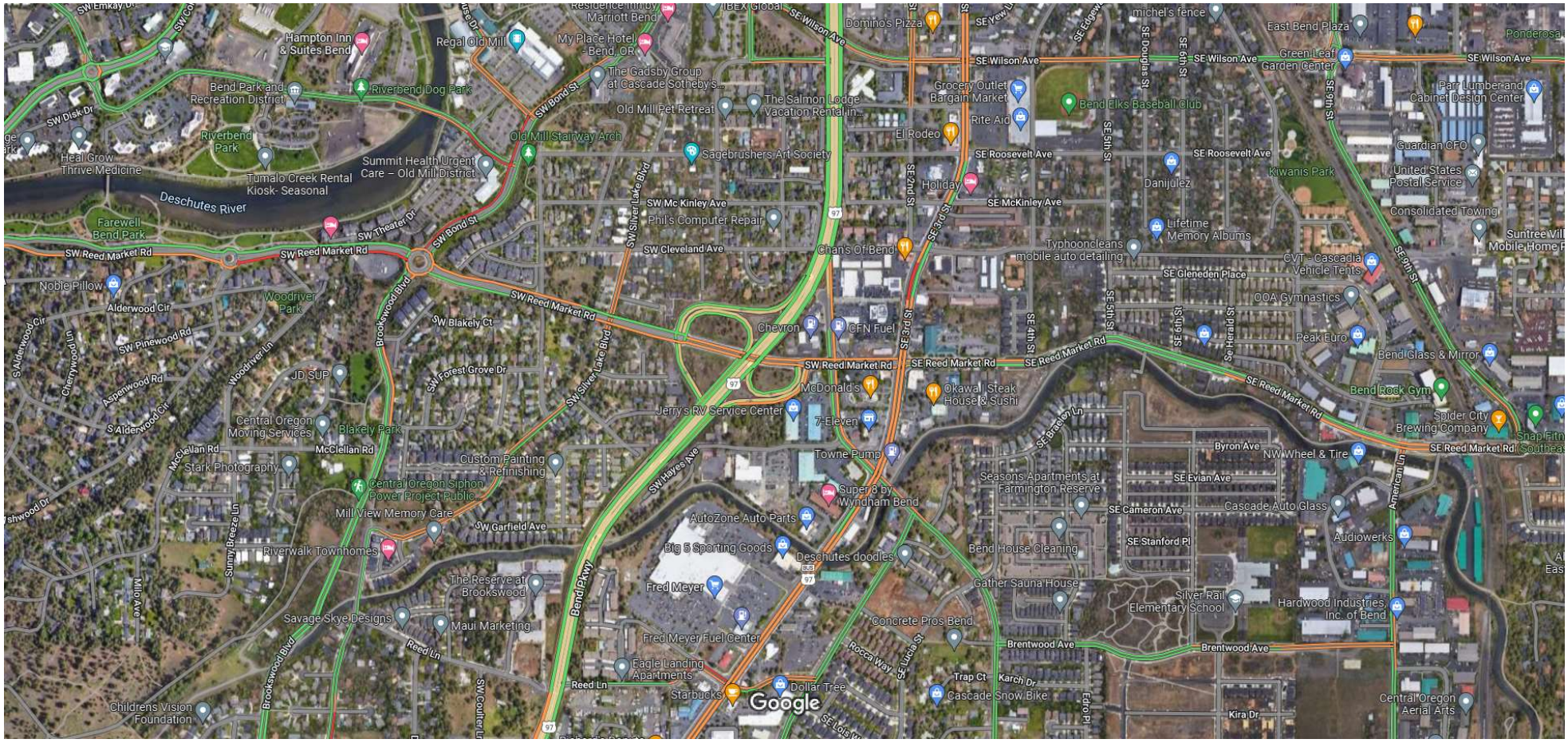
*Fast* *Slow*

S M T W T F S

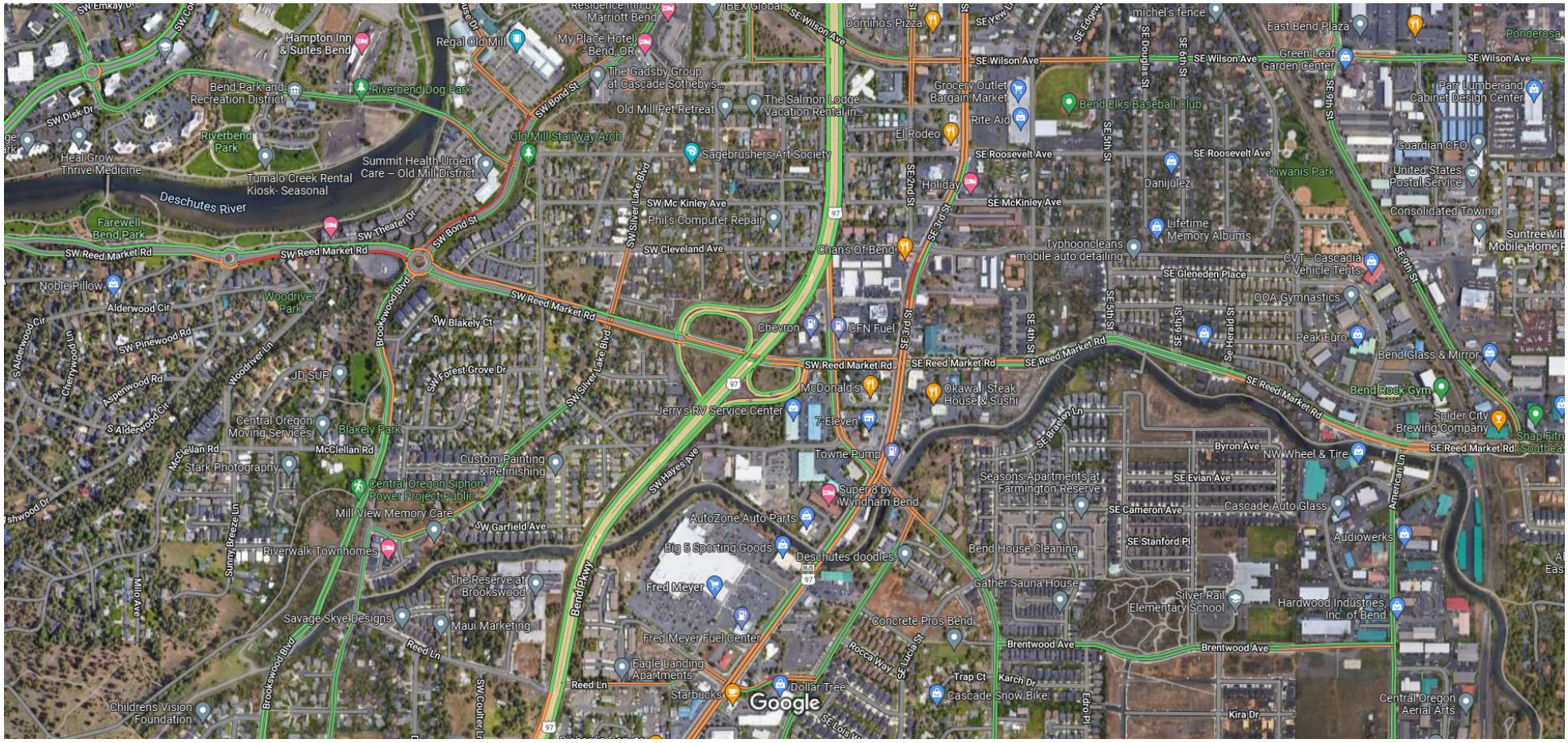
Wednesday, 4:00 PM

8:00 AM 12:00 PM 4:00 PM 8:00 PM

Google Maps Typical Wednesday Traffic at 4:15 PM



Google Maps Typical Wednesday Traffic at 4:30 PM




Imagery ©2022 CNES / Airbus, Maxar Technologies, State of Oregon, Map data ©2022 500 ft

Typical traffic

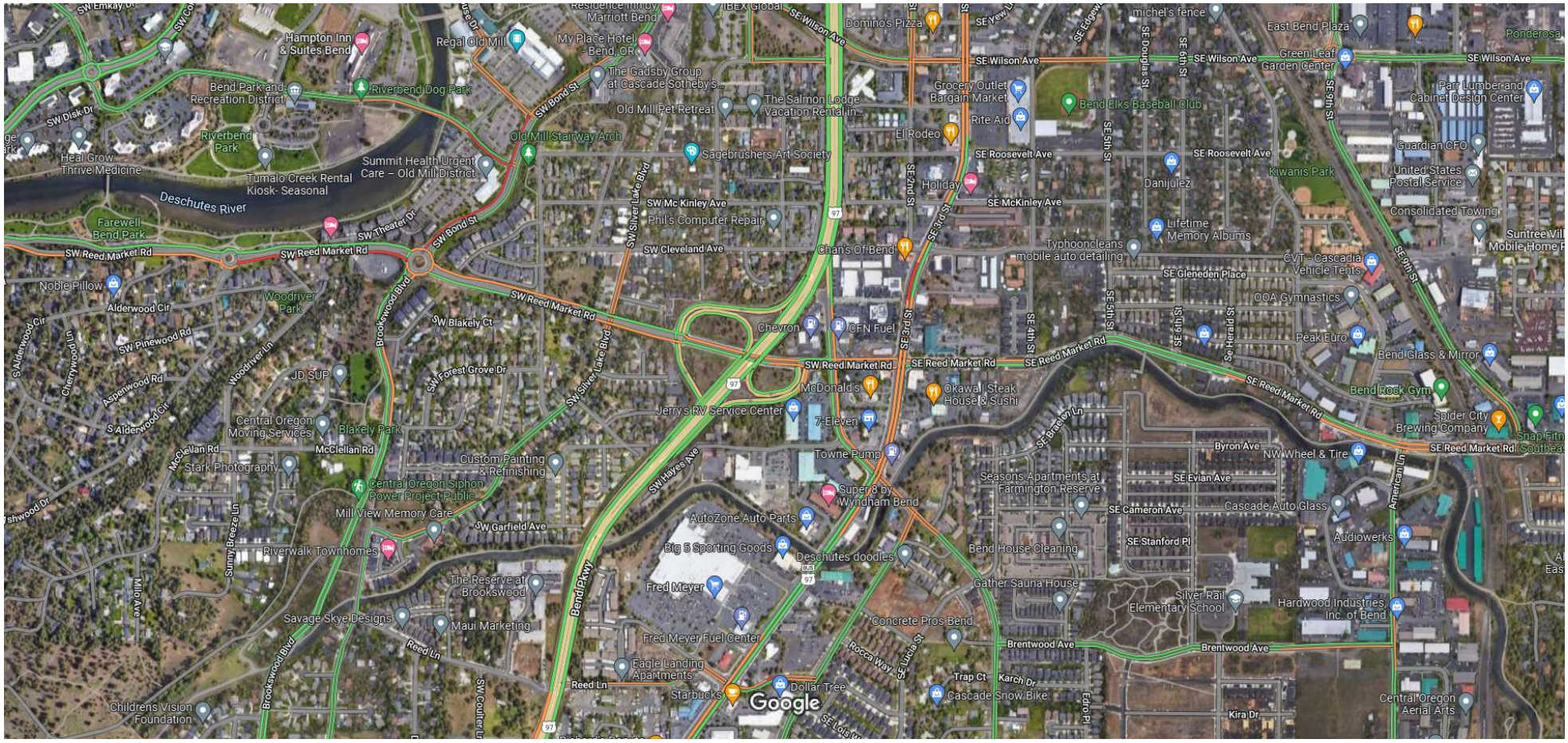
*Fast* *Slow*

S M T W T F S

Wednesday, 4:30 PM

8:00 AM 12:00 PM 4:00 PM 8:00 PM

Google Maps Typical Wednesday Traffic at 4:45 PM




Imagery ©2022 CNES / Airbus, Maxar Technologies, State of Oregon, Map data ©2022 500 ft

Typical traffic

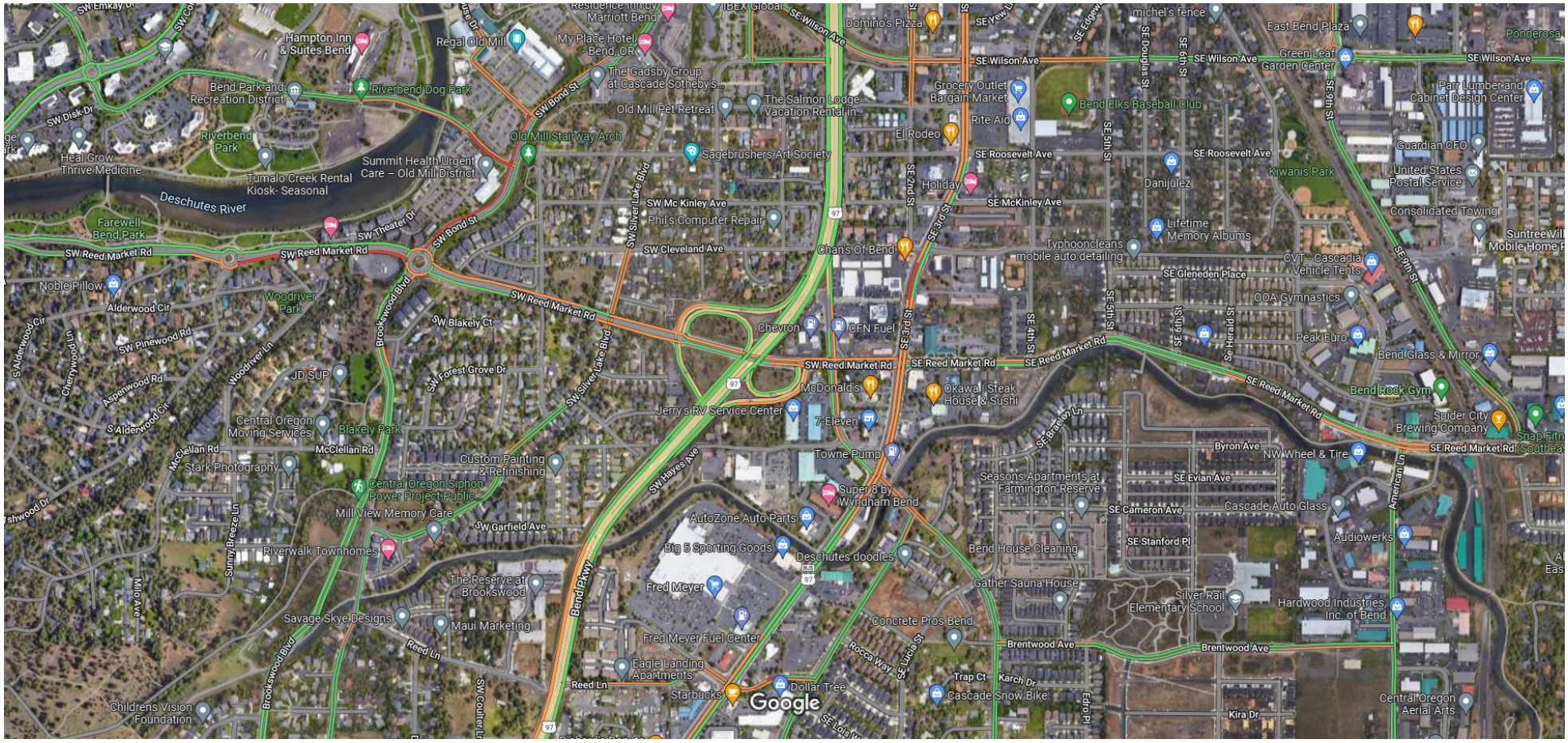
*Fast* *Slow*

S M T W T F S

Wednesday, 4:45 PM

8:00 AM 12:00 PM 4:00 PM 8:00 PM

Google Maps Typical Wednesday Traffic at 5:00 PM




Imagery ©2022 CNES / Airbus, Maxar Technologies, State of Oregon, Map data ©2022 500 ft

Typical traffic

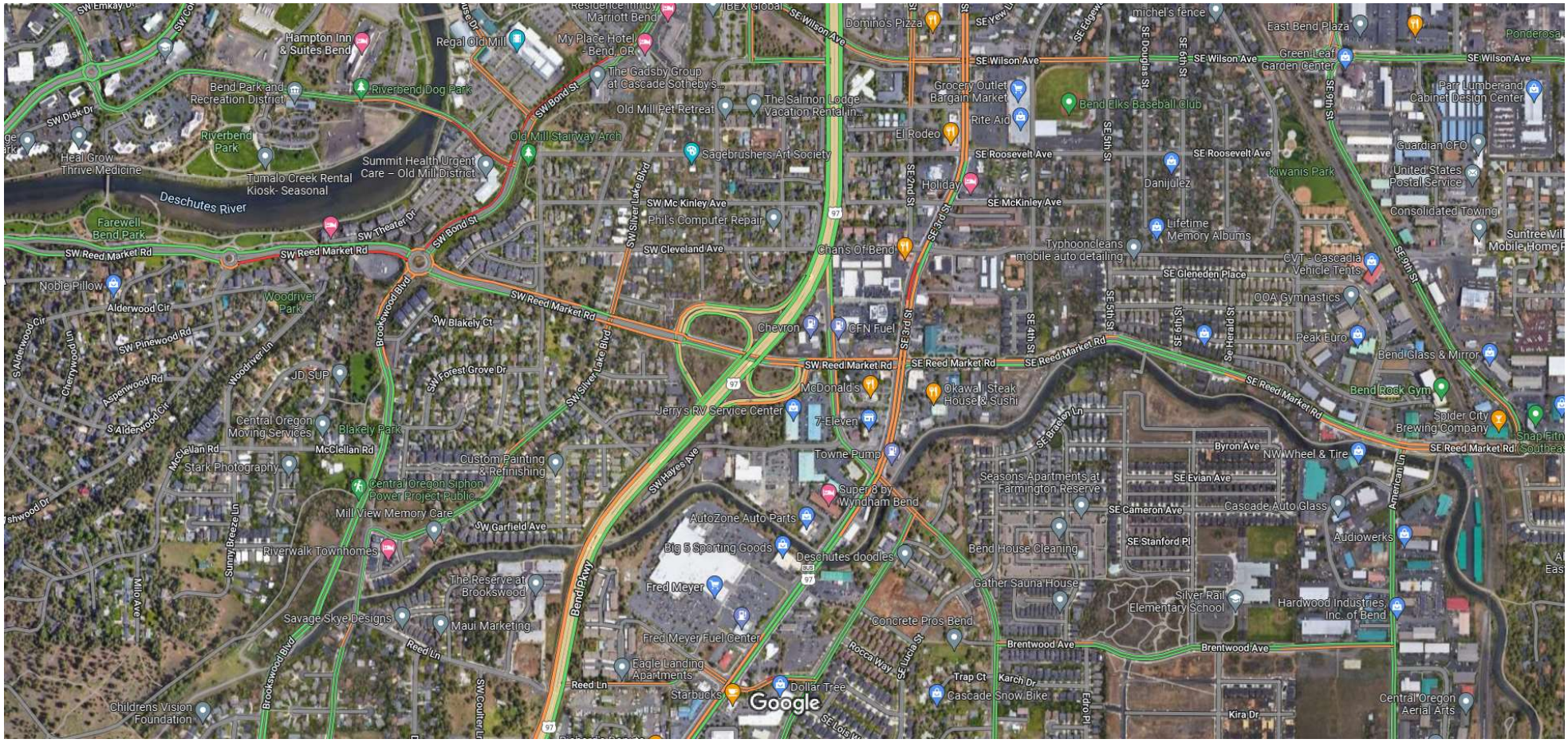
*Fast* *Slow*

S M T W T F S

Wednesday, 5:00 PM

8:00 AM 12:00 PM 4:00 PM 8:00 PM

Google Maps Typical Wednesday Traffic at 5:15 PM




Imagery ©2022 CNES / Airbus, Maxar Technologies, State of Oregon, Map data ©2022 500 ft

Typical traffic

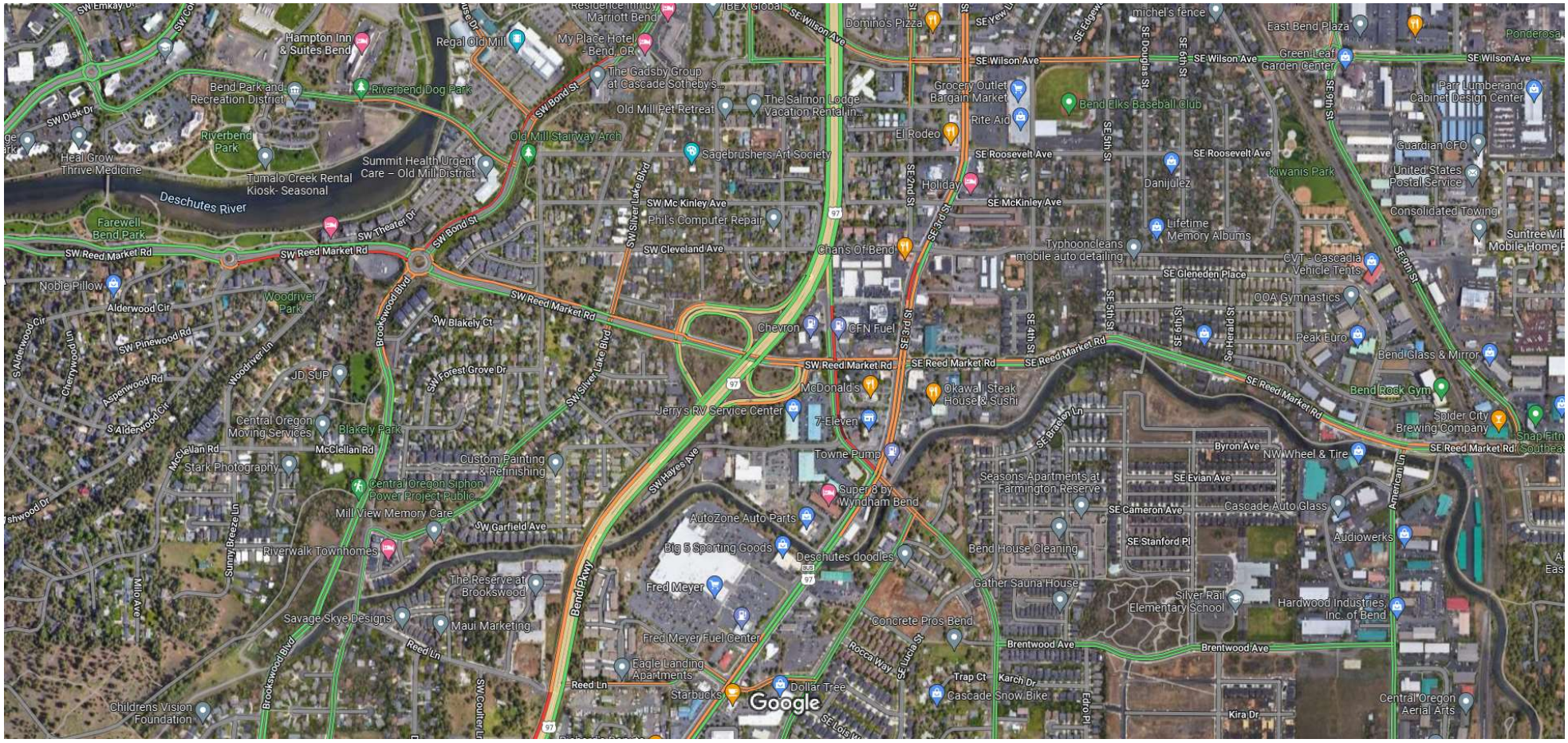
*Fast* *Slow*

S M T W T F S

Wednesday, 5:15 PM

8:00 AM 12:00 PM 4:00 PM 8:00 PM

Google Maps Typical Wednesday Traffic at 5:30 PM




Imagery ©2022 CNES / Airbus, Maxar Technologies, State of Oregon, Map data ©2022 500 ft

Typical traffic

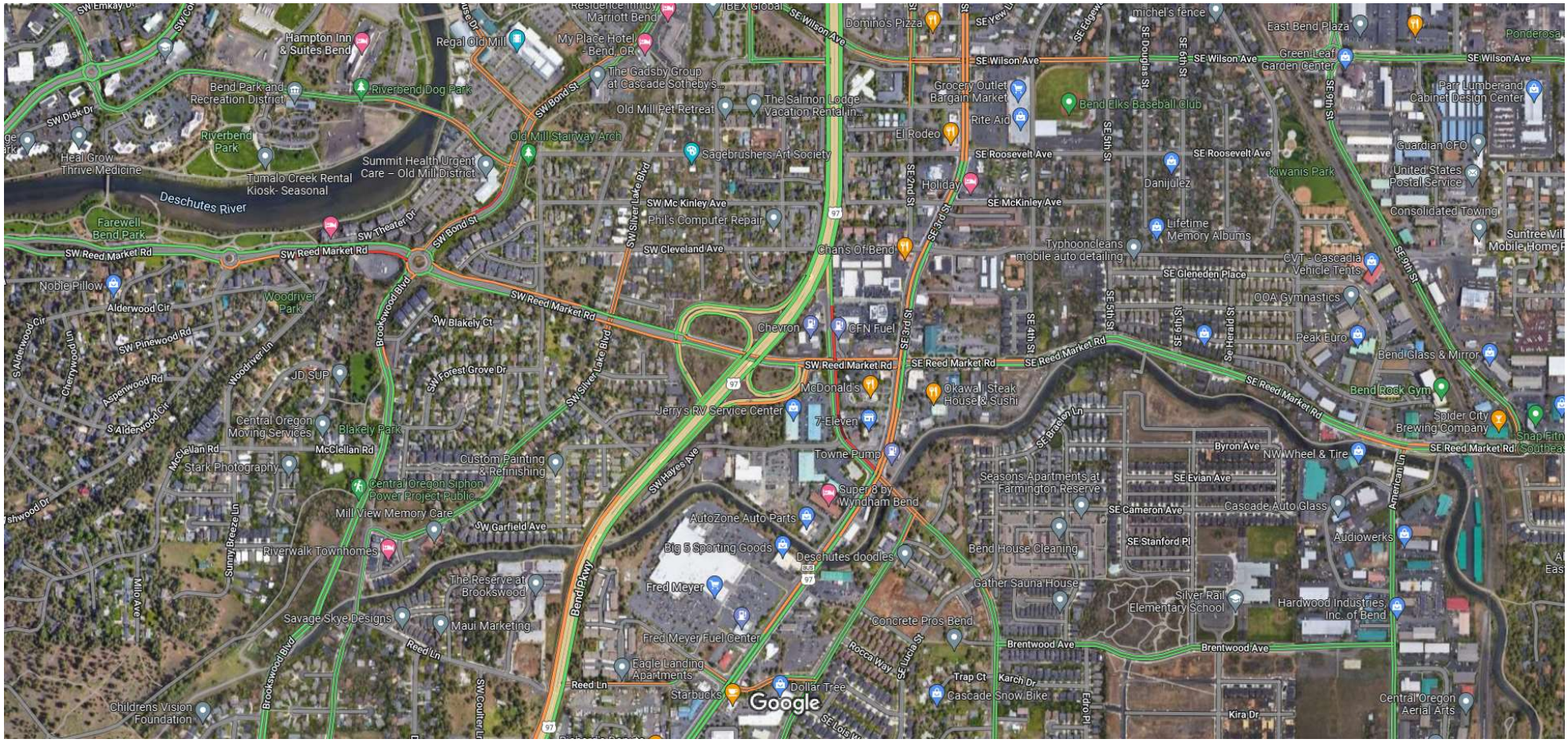
*Fast* *Slow*

S M T W T F S

Wednesday, 5:30 PM

8:00 AM 12:00 PM 4:00 PM 8:00 PM

Google Maps Typical Wednesday Traffic at 5:45 PM




Imagery ©2022 CNES / Airbus, Maxar Technologies, State of Oregon, Map data ©2022 500 ft

Typical traffic

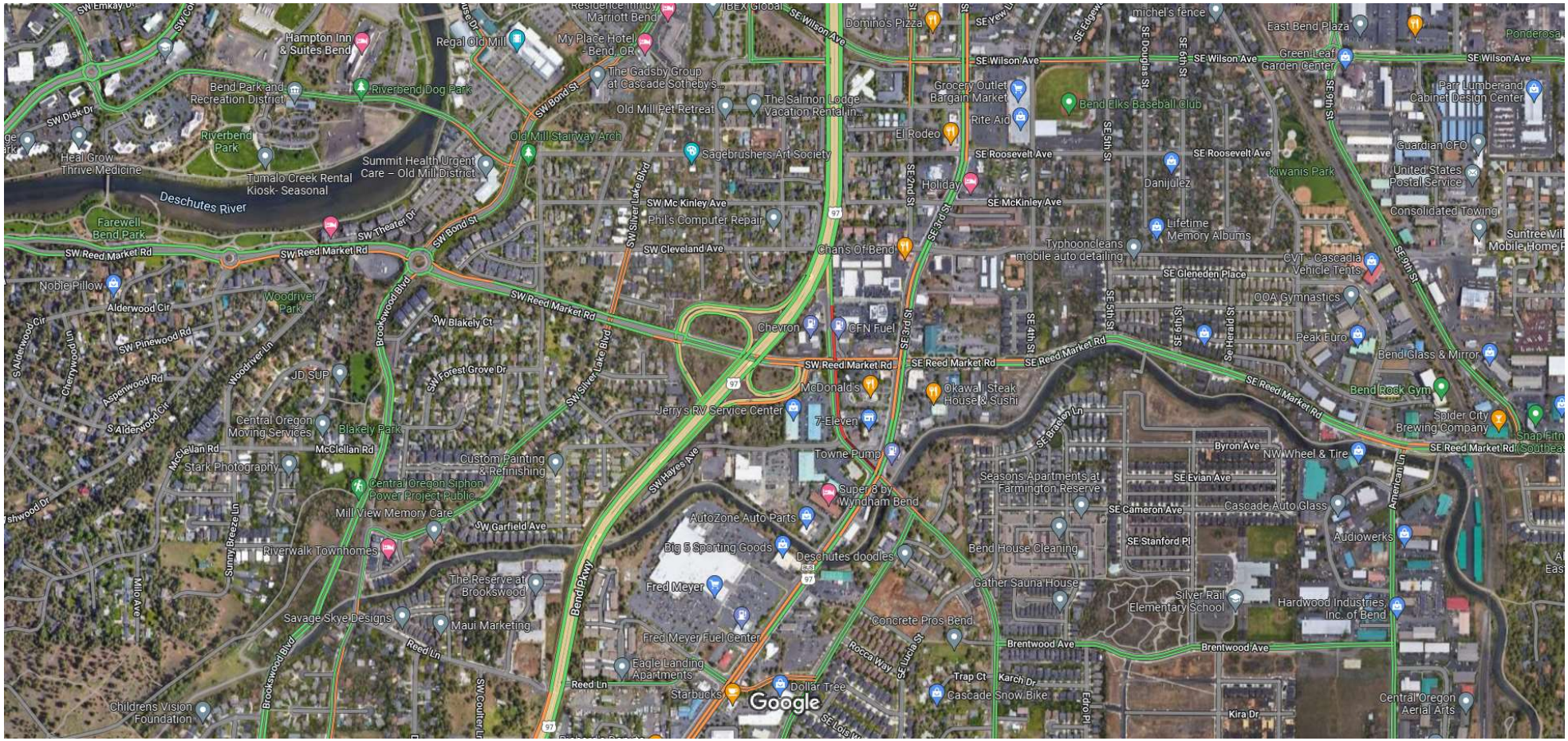
*Fast* *Slow*

S M T W T F S

Wednesday, 5:45 PM

8:00 AM 12:00 PM 4:00 PM 8:00 PM

Google Maps Typical Wednesday Traffic at 6:00 PM




Imagery ©2022 CNES / Airbus, Maxar Technologies, State of Oregon, Map data ©2022 500 ft

Typical traffic

*Fast* *Slow*

S M T W T F S

Wednesday, 6:00 PM

8:00 AM 12:00 PM 4:00 PM 8:00 PM

# APPENDIX C: VISSIM VOLUME PROFILES

| Intersection Name | 3:45 PM | 4:00 PM | 4:15 PM | 4:30 PM | 4:45 PM | 5:00 PM | 5:15 PM | 5:30 PM | 5:45 PM | Average |
|---|---|---|---|---|---|---|---|---|---|---|
| Reed Market Rd/Brookswood EB | 87% | 93% | 101% | 109% | 109% | 109% | 101% | 93% | 85% | 100% |
| Chamberlain SB | 95% | 95% | 99% | 113% | 112% | 112% | 96% | 80% | 91% | 100% |
| Reed Market Rd/Brookswood SB | 85% | 91% | 101% | 110% | 110% | 110% | 101% | 91% | 86% | 100% |
| Reed Market Rd/3rd St WB | 95% | 95% | 103% | 110% | 91% | 103% | 96% | 105% | 97% | 100% |
| Reed Market Rd/3rd St SB | 95% | 95% | 94% | 100% | 117% | 104% | 105% | 101% | 84% | 100% |
| US 97/NB Ramp NB | 66% | 66% | 135% | 130% | 98% | 117% | 91% | 73% | 89% | 100% |
| Reed Market Rd/Brookswood NB | 87% | 89% | 100% | 112% | 112% | 112% | 100% | 90% | 85% | 100% |
| 3rd/Brosterhous WB | 95% | 95% | 99% | 113% | 112% | 112% | 96% | 80% | 91% | 100% |
| US 97/SB Ramp SB | 104% | 104% | 102% | 103% | 98% | 115% | 109% | 89% | 79% | 100% |
| 3rd/Brosterhous NB | 101% | 101% | 112% | 105% | 97% | 99% | 102% | 95% | 90% | 100% |
| Silverlake SB | 139% | 139% | 93% | 93% | 81% | 116% | 139% | 58% | 81% | 100% |
| Silverlake NB | 59% | 59% | 109% | 126% | 118% | 118% | 76% | 126% | 67% | 100% |
| Driveway WB | 69% | 69% | 41% | 124% | 110% | 152% | 55% | 166% | 83% | 100% |
| Hayes EB | 95% | 95% | 99% | 113% | 112% | 112% | 96% | 80% | 91% | 100% |

Adjusted model demand volume.

# APPENDIX D: VISSIM MODEL GEH STATISTICS

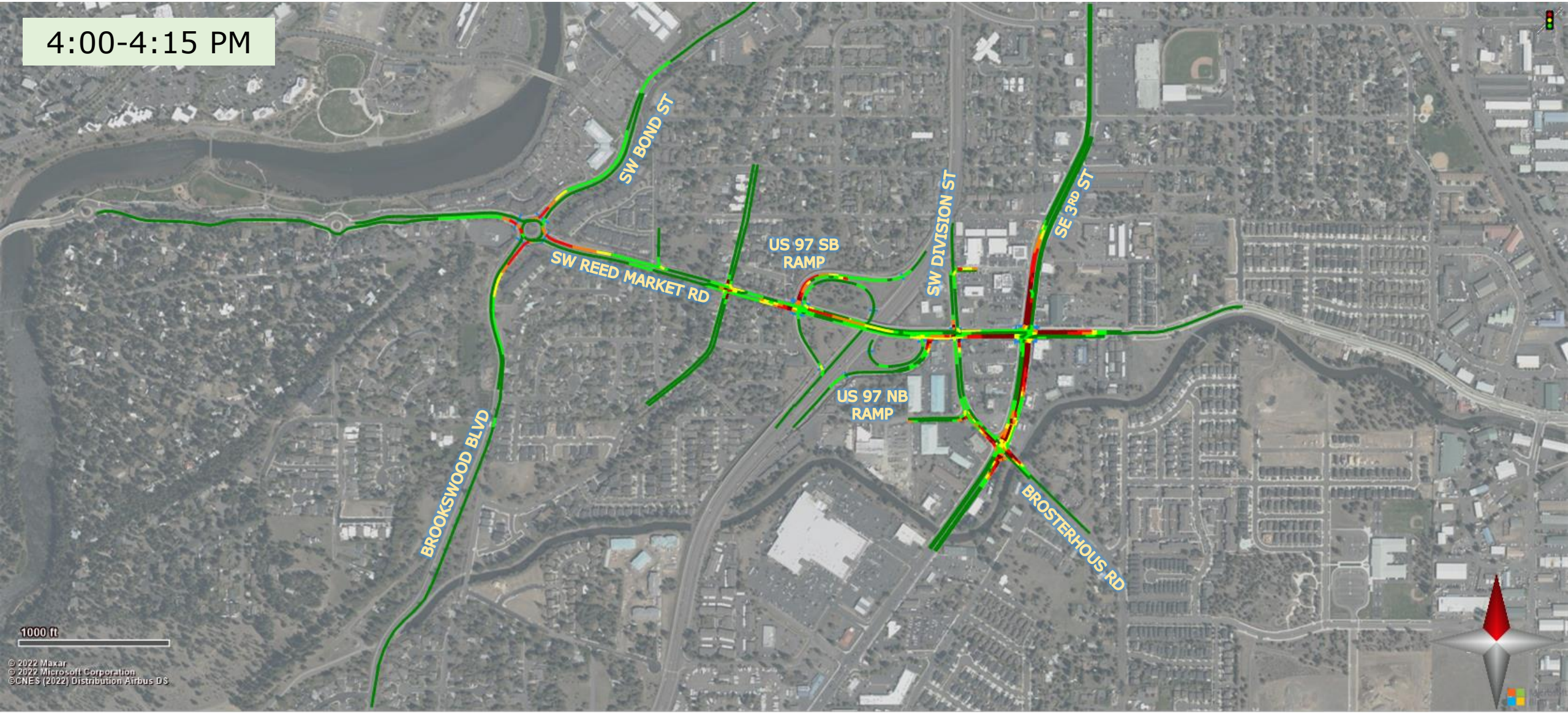
| Intersection Number | Intersection Name | Movement | Input Volume | VISSIM Output Volume | GEH |
|---|---|---|---|---|---|
| 1 | Reed Market and Brookswood/Bond | NBL | 153 | 127 | 2.2 |
| | | NBT | 396 | 400 | 0.2 |
| | | NBR | 55 | 40 | 2.2 |
| | | NBU | 0 | 0 | |
| | | SBL | 352 | 380 | 1.5 |
| | | SBT | 311 | 322 | 0.6 |
| | | SBR | 63 | 67 | 0.5 |
| | | SBU | 0 | 0 | |
| | | EBL | 57 | 54 | 0.4 |
| | | EBT | 372 | 402 | 1.5 |
| | | EBR | 131 | 146 | 1.3 |
| | | EBU | 0 | 0 | |
| | | WBL | 44 | 38 | 0.9 |
| | | WBT | 297 | 302 | 0.3 |
| | | WBR | 376 | 347 | 1.5 |
| | | WBU | 0 | 0 | |
| | | Total | 2607 | 2625 | 0.4 |
| 2 | Reed Market and SB Ramps | SBL | 637 | 673 | 1.4 |
| | | SBT | 0 | 0 | |
| | | SBR | 215 | 198 | 1.2 |
| | | EBT | 702 | 758 | 2.1 |
| | | EBR | 71 | 64 | 0.9 |
| | | WBT | 608 | 622 | 0.6 |
| | | WBR | 129 | 123 | 0.5 |
| | | Total | 2362 | 2438 | 1.6 |
| 3 | Reed Market and NB Ramps | NBL | 90 | 103 | 1.3 |
| | | NBR | 81 | 86 | 0.5 |
| | | EBT | 1203 | 1308 | 3.0 |
| | | EBR | 136 | 137 | 0.1 |
| | | WBT | 647 | 656 | 0.4 |
| | | Total | 2157 | 2290 | 2.8 |
| 4 | Reed Market and Division | NBR | 48 | 56 | 1.1 |
| | | SBL | 6 | 6 | 0.0 |
| | | SBT | 2 | 1 | 0.8 |
| | | SBR | 14 | 12 | 0.6 |
| | | EBL | 88 | 91 | 0.3 |
| | | EBT | 605 | 665 | 2.4 |
| | | EBR | 591 | 639 | 1.9 |
| | | WBL | 4 | 3 | 0.5 |
| | | WBT | 633 | 644 | 0.4 |
| | | WBR | 312 | 330 | 1.0 |
| | | Total | 2303 | 2447 | 3.0 |

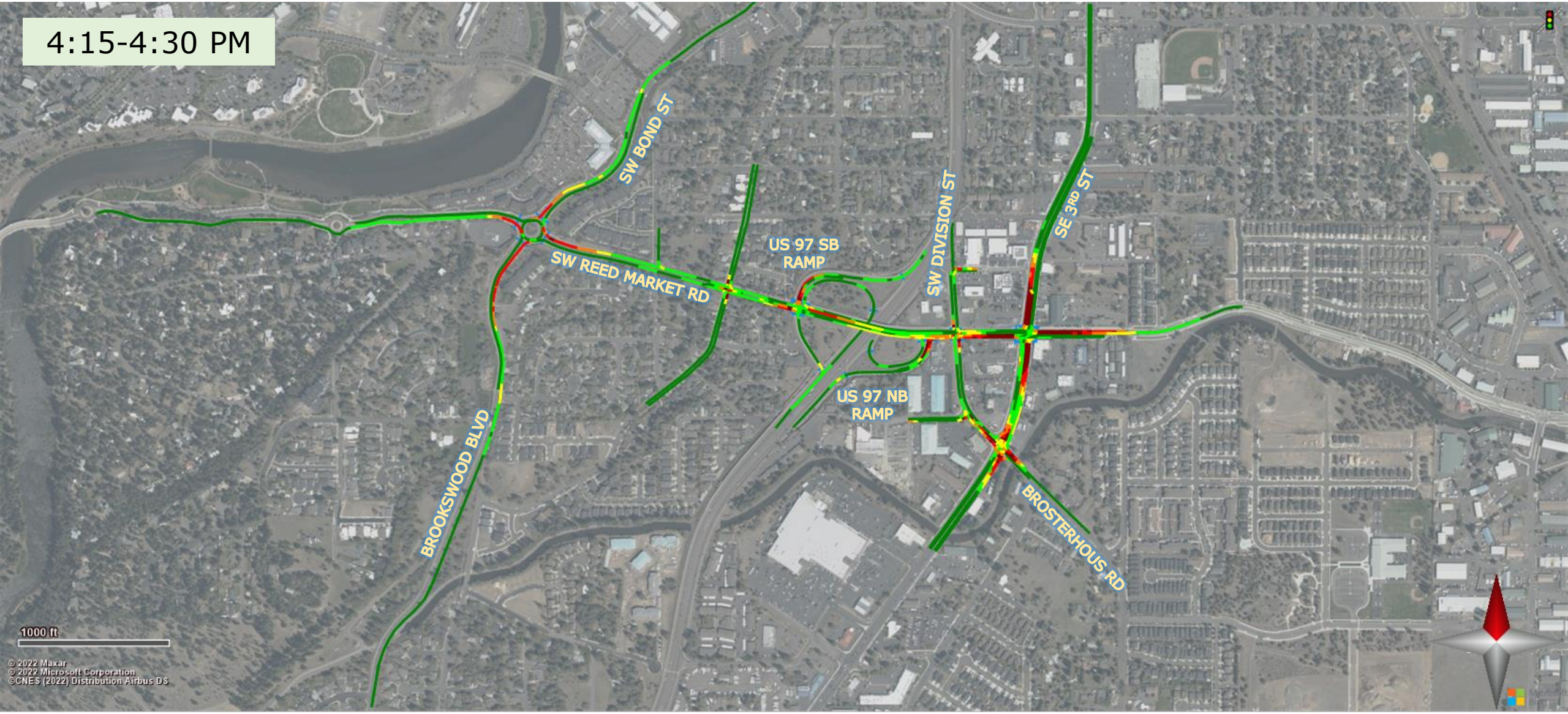
| | | | | | |
|---|---|---|---|---|---|
| 5 | Reed Market and 3rd St | NBL | 299 | 324 | 1.4 |
| | | NBT | 620 | 617 | 0.1 |
| | | NBR | 208 | 215 | 0.5 |
| | | SBL | 137 | 137 | 0.0 |
| | | SBT | 669 | 665 | 0.2 |
| | | SBR | 143 | 131 | 1.0 |
| | | EBL | 136 | 153 | 1.4 |
| | | EBT | 444 | 497 | 2.4 |
| | | EBR | 79 | 92 | 1.4 |
| | | WBL | 233 | 239 | 0.4 |
| | | WBT | 507 | 515 | 0.4 |
| | | WBR | 90 | 78 | 1.3 |
| | | Total | 3565 | 3663 | 1.6 |
| 6 | 3rd St and Brosterhous | NBL | 28 | 36 | 1.4 |
| | | NBT | 734 | 730 | 0.1 |
| | | NBR | 43 | 54 | 1.6 |
| | | SBL | 163 | 173 | 0.8 |
| | | SBT | 795 | 808 | 0.5 |
| | | SBR | 23 | 21 | 0.4 |
| | | EBL | 77 | 84 | 0.8 |
| | | EBT | 302 | 319 | 1.0 |
| | | EBR | 269 | 267 | 0.1 |
| | | WBL | 43 | 48 | 0.7 |
| | | WBT | 22 | 25 | 0.6 |
| | | WBR | 316 | 339 | 1.3 |
| | | Total | 2815 | 2904 | 1.7 |

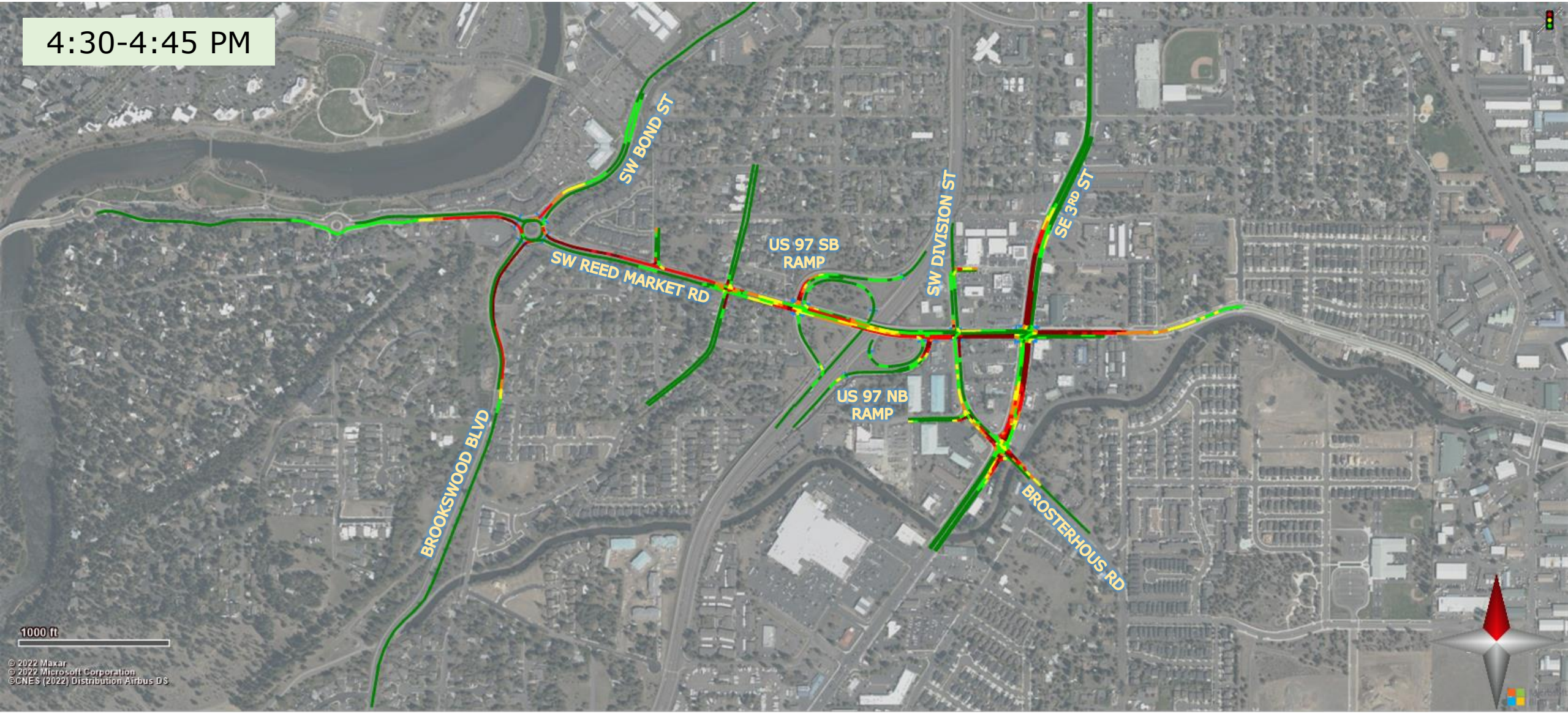
| Entry GEH (4:30-5:30 PM) | | | | | |
|---|---|---|---|---|---|
| **Entry Location** | **Count** | **Vissim Throughput** | **Diff** | **%Diff** | **GEH** |
| Reed Market and Brookswood - N | 726 | 769 | 43 | 0.059 | 1.6 |
| Reed Market and Brookswood - S | 604 | 567 | -37 | -0.061 | 1.6 |
| Reed Market and Brookswood - W | 560 | 602 | 42 | 0.075 | 1.7 |
| Reed Market and SB Ramps - N | 852 | 871 | 19 | 0.022 | 0.6 |
| Reed Market and NB Ramps - S | 171 | 189 | 18 | 0.105 | 1.3 |
| Reed Market and 3rd St - N | 949 | 933 | -16 | -0.017 | 0.5 |
| Reed Market and 3rd St - E | 830 | 832 | 2 | 0.002 | 0.1 |
| 3rd St and Brosterhous - S | 805 | 820 | 15 | 0.019 | 0.5 |
| 3rd St and Brosterhous - E | 381 | 412 | 31 | 0.081 | 1.5 |

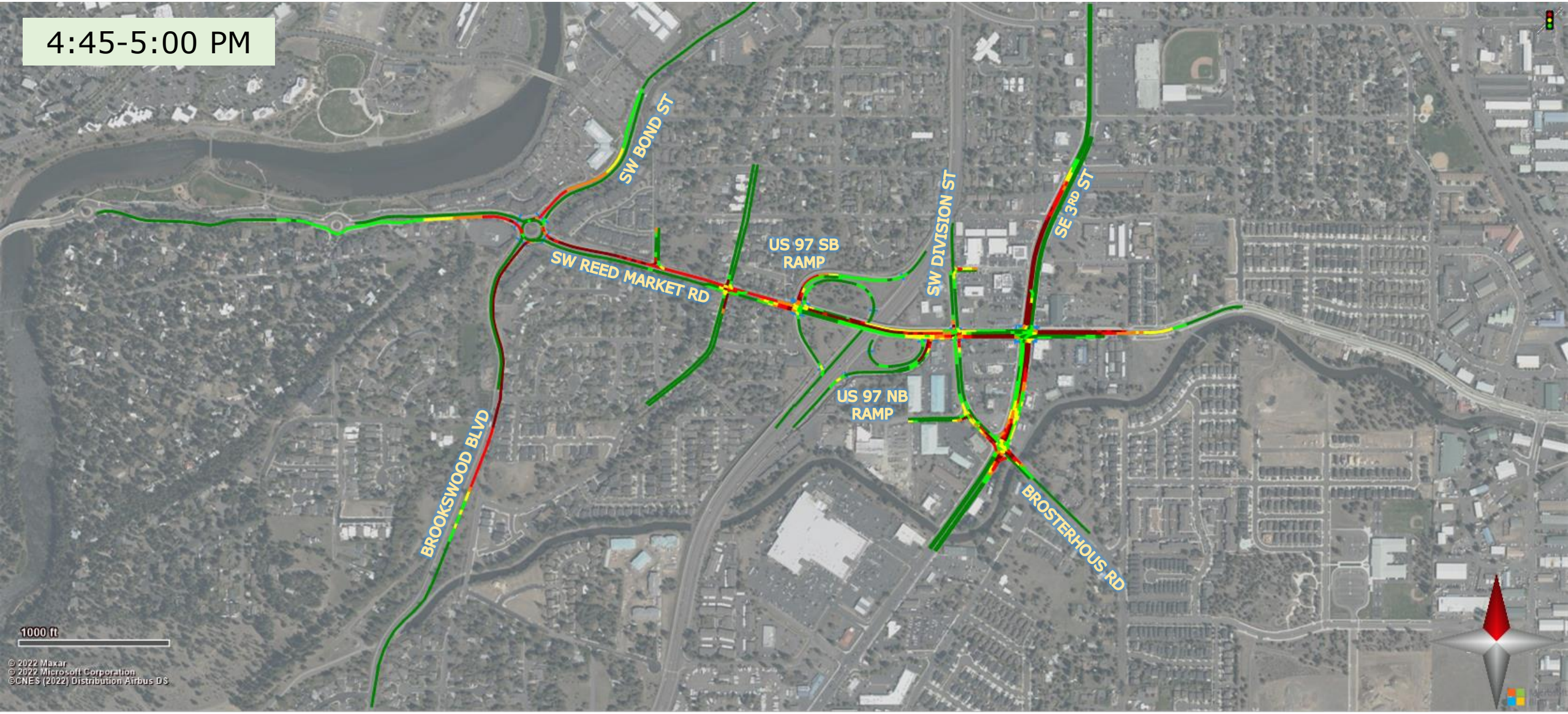
| Exit GEH (4:30-5:30 PM) | | | | | |
|---|---|---|---|---|---|
| **Exit Location** | **Count** | **Vissim Throughput** | **Diff** | **%Diff** | **GEH** |
| Reed Market and Brookswood - N | 829 | 801 | -28 | -0.034 | 1.0 |
| Reed Market and Brookswood - S | 486 | 506 | 20 | 0.041 | 0.9 |
| Reed Market and Brookswood - W | 513 | 496 | -17 | -0.033 | 0.8 |
| Reed Market and SB Ramps - S | 71 | 64 | -7 | -0.099 | 0.9 |
| Reed Market and NB Ramps - S | 136 | 137 | 1 | 0.007 | 0.1 |
| Reed Market and 3rd St - N | 846 | 848 | 2 | 0.002 | 0.1 |
| Reed Market and 3rd St - E | 789 | 849 | 60 | 0.076 | 2.1 |
| 3rd St and Brosterhous - S | 1107 | 1123 | 16 | 0.014 | 0.5 |
| 3rd St and Brosterhous - E | 508 | 546 | 38 | 0.075 | 1.6 |

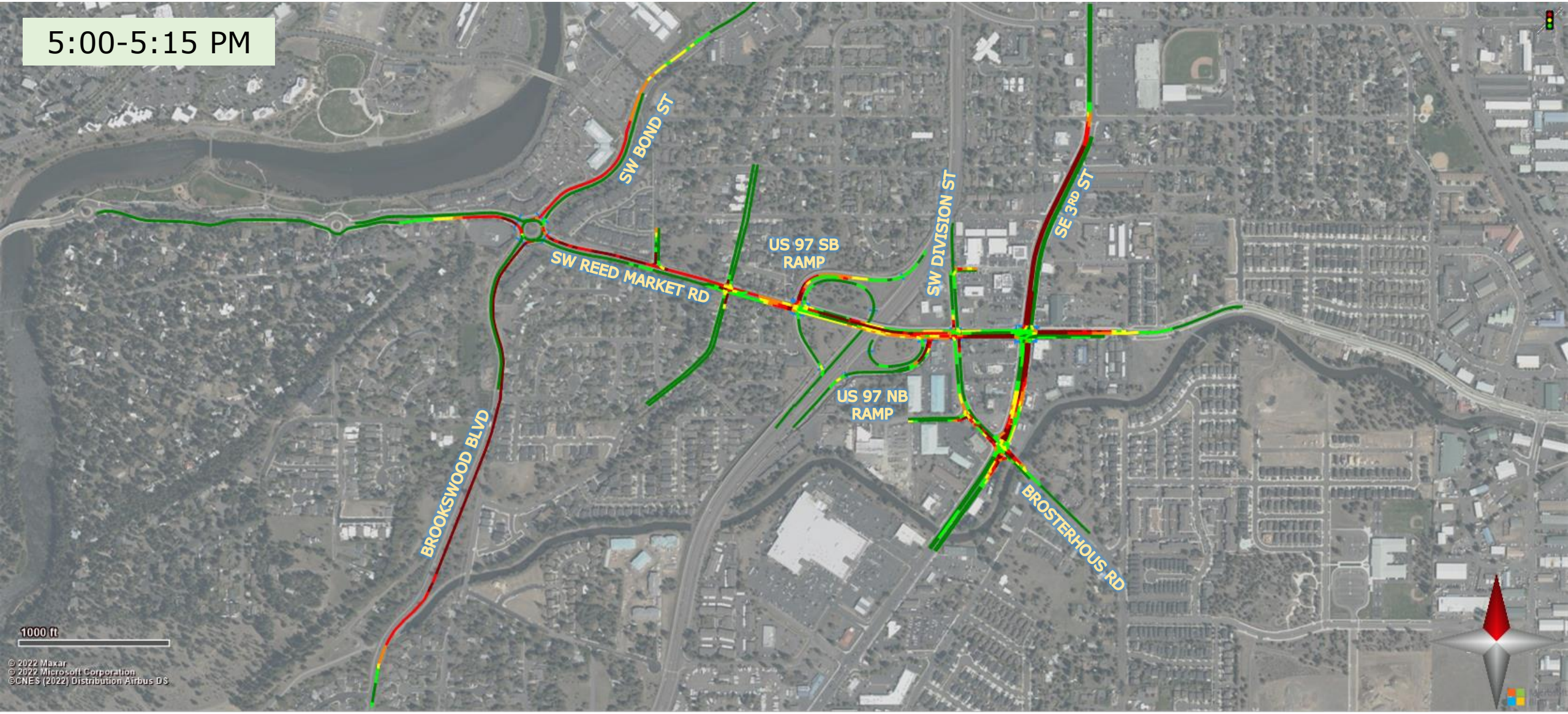
# APPENDIX E: VISSIM MODEL QUEUE PLOTS

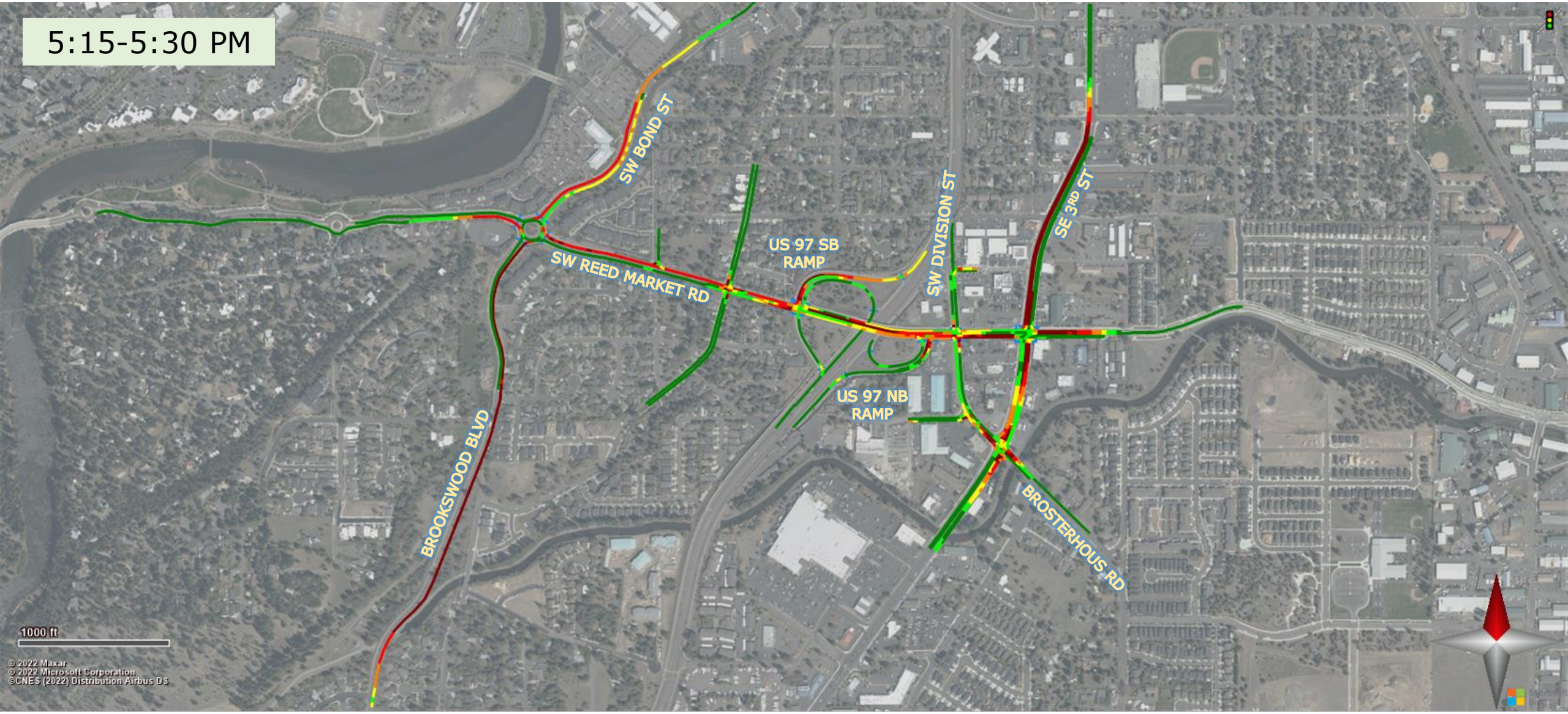

4:00-4:15 PM
SW BOND ST
SW REED MARKET RD
US 97 SB RAMP
SW DIVISION ST
SE 3RD ST
US 97 NB RAMP
BROOKSWOOD BLVD
BROSTERHOUS RD
1000 ft
© 2022 Maxar
© 2022 Microsoft Corporation
©CNES (2022) Distribution Airbus DS

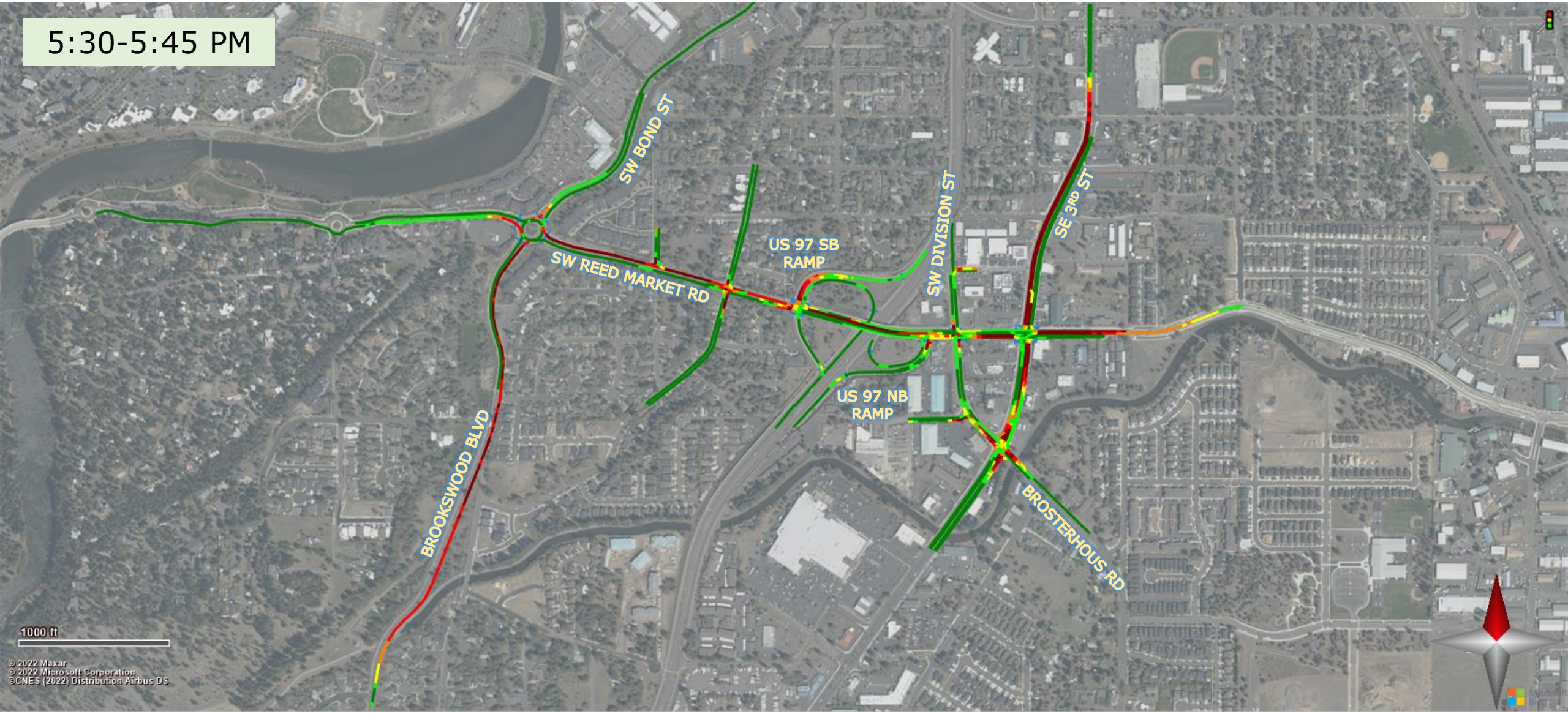

4:15-4:30 PM
SW BOND ST
SW REED MARKET RD
US 97 SB RAMP
SW DIVISION ST
SE 3RD ST
US 97 NB RAMP
BROOKSWOOD BLVD
BROSTERHOUS RD
1000 ft
© 2022 Maxar
© 2022 Microsoft Corporation
©CNES (2022) Distribution Airbus DS


4:30-4:45 PM
SW BOND ST
SW REED MARKET RD
US 97 SB RAMP
SW DIVISION ST
SE 3RD ST
US 97 NB RAMP
BROOKSWOOD BLVD
BROSTERHOUS RD
1000 ft
© 2022 Maxar
© 2022 Microsoft Corporation
©CNES (2022) Distribution Airbus DS


4:45-5:00 PM
SW BOND ST
SW REED MARKET RD
US 97 SB RAMP
SW DIVISION ST
SE 3RD ST
US 97 NB RAMP
BROOKSWOOD BLVD
BROSTERHOUS RD
1000 ft
© 2022 Maxar
© 2022 Microsoft Corporation
©CNES (2022) Distribution Airbus DS


5:00-5:15 PM
SW BOND ST
SW REED MARKET RD
US 97 SB RAMP
SW DIVISION ST
SE 3RD ST
US 97 NB RAMP
BROOKSWOOD BLVD
BROSTERHOUS RD
1000 ft
© 2022 Maxar
© 2022 Microsoft Corporation
©CNES (2022) Distribution Airbus DS


5:15-5:30 PM
SW BOND ST
SW REED MARKET RD
US 97 SB RAMP
SW DIVISION ST
SE 3RD ST
US 97 NB RAMP
BROOKSWOOD BLVD
BROSTERHOUS RD
1000 ft
© 2022 Maxar
© 2022 Microsoft Corporation
©CNES (2022) Distribution Airbus DS


5:30-5:45 PM
SW BOND ST
SW REED MARKET RD
US 97 SB RAMP
SW DIVISION ST
SE 3RD ST
US 97 NB RAMP
BROOKSWOOD BLVD
BROSTERHOUS RD
1000 ft
© 2022 Maxar
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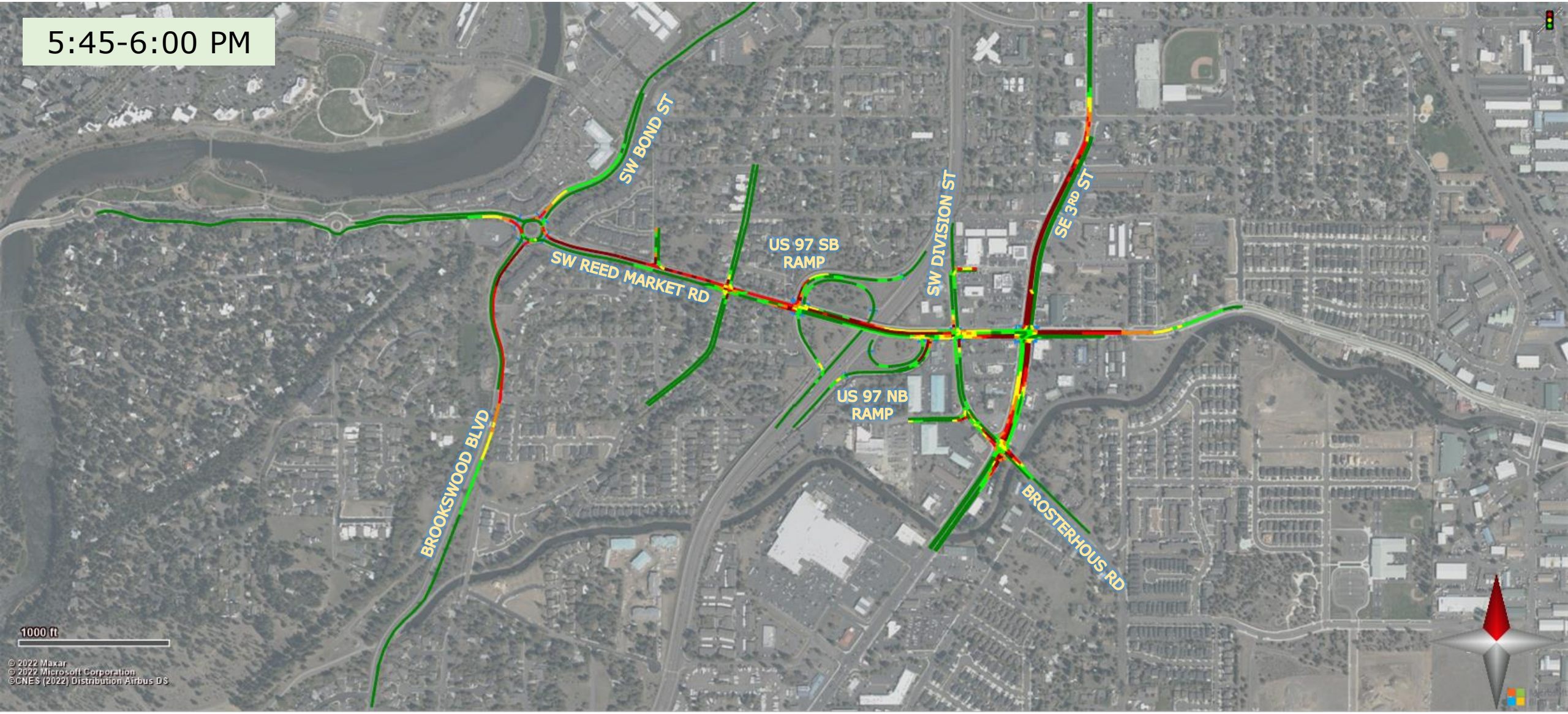
5:45-6:00 PM
SW BOND ST
SW REED MARKET RD
US 97 SB RAMP
SW DIVISION ST
SE 3RD ST
US 97 NB RAMP
BROOKSWOOD BLVD
BROSTERHOUS RD
1000 ft
© 2022 Maxar
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# APPENDIX F: 95TH PERCENTILE QUEUE TABLE

| Movement | Storage Length (ft) | Average Queue | Std Dev | Max Queue | 95th Percentile Queue |
|---|---|---|---|---|---|
| Reed Market and SB Ramps:SBT | 420 | 380 | 226.7 | 1045 | 1030 |
| Reed Market and SB Ramps:EBT | 425 | 195 | 78.5 | 390 | 360 |
| Reed Market and SB Ramps:WBT | 735 | 820 | 238.6 | 1295 | 1110 |
| Reed Market and NB Ramps:NBR | 160 | 30 | 22.2 | 100 | 80 |
| Reed Market and NB Ramps:NBL | 160 | 95 | 54.9 | 195 | 185 |
| Reed Market and Division:NBR | 475 | 35 | 29.2 | 115 | 110 |
| Reed Market and Division:SBT | 180 | 10 | 11.8 | 45 | 25 |
| Reed Market and 3rd St:NBT | 680 | 345 | 106.4 | 590 | 550 |
| Reed Market and 3rd St:NBL | 150 | 350 | 99.4 | 545 | 515 |
| Reed Market and 3rd St:WBT | 580 | 605 | 298.5 | 1410 | 1220 |
| Reed Market and 3rd St:EBT | 375 | 955 | 435.0 | 1565 | 1565 |
| Reed Market and 3rd St:SBT | 720 | 1150 | 404.4 | 1710 | 1705 |
| Reed Market and 3rd St:SBL | 150 | 1115 | 474.4 | 1710 | 1710 |
| Reed Market and Brookswood:NBT | 500 | 2200 | 931.5 | 3400 | 3400 |
| Reed Market and Brookswood:SBT | 430 | 755 | 538.2 | 1915 | 1795 |
| Reed Market and Brookswood:EBT | 400 | 395 | 178.8 | 705 | 700 |
| Reed Market and Brookswood:WBT | 725 | 1860 | 465.4 | 2820 | 2455 |
| 3rd St and Brosterhous:WBT | 275 | 35 | 24.9 | 85 | 85 |
| 3rd St and Brosterhous:WBR | 130 | 100 | 57.7 | 285 | 240 |
| 3rd St and Brosterhous:NBT | 570 | 150 | 63.7 | 415 | 260 |
| 3rd St and Brosterhous:NBL | 150 | 100 | 100.6 | 415 | 265 |
| 3rd St and Brosterhous:EBT | 220 | 280 | 137.9 | 660 | 550 |
| 3rd St and Brosterhous:EBR | 75 | 140 | 134.9 | 545 | 400 |
| 3rd St and Brosterhous:SBT | 425 | 205 | 124.9 | 415 | 415 |
| 3rd St and Brosterhous:SBL | 130 | 195 | 125.6 | 425 | 420 |
| Reed Market NB on Ramp:EBT | NA | 40 | 25.9 | 110 | 100 |
| Reed Market NB on Ramp:SBR | NA | 10 | 15.3 | 55 | 50 |
| Reed Market NB on Ramp:EBT | Na | 0 | 0.0 | 0 | 0 |
| Reed Market NB on Ramp:WBT | NA | 15 | 15.7 | 65 | 45 |

# APPENDIX G: VISSIM MODEL AVERAGE DELAY TABLE

| Intersection | Approach | Movement | Volume | Average Delay (s) |
|---|---|---|---|---|
| Reed Market and Brookswood | NB | Left | 127 | 284.3 |
| | | Through | 400 | 310.6 |
| | | Right | 40 | 316.6 |
| | | U-Turn | 0 | 0 |
| | | Total | 567 | 305.1 |
| | SB | Left | 380 | 62.0 |
| | | Through | 322 | 58.8 |
| | | Right | 67 | 65.1 |
| | | U-Turn | 0 | 0 |
| | | Total | 769 | 61.0 |
| | EB | Left | 54 | 49.3 |
| | | Through | 402 | 44.1 |
| | | Right | 146 | 45.2 |
| | | U-Turn | 0 | 0 |
| | | Total | 602 | 44.8 |
| | WB | Left | 38 | 128.4 |
| | | Through | 302 | 130.1 |
| | | Right | 347 | 141.6 |
| | | U-Turn | 0 | 0 |
| | | Total | 687 | 135.8 |
| | Total | | 2625 | 129.6 |
| Reed Market and SB Ramps | NB | Left | 0 | 0 |
| | | Through | 0 | 0 |
| | | Right | 0 | 0 |
| | | U-Turn | 0 | 0 |
| | | Total | 0 | 0 |
| | SB | Left | 673 | 30.2 |
| | | Through | 0 | 0 |
| | | Right | 198 | 36.2 |
| | | U-Turn | 0 | 0 |
| | | Total | 871 | 31.5 |
| | EB | Left | 0 | 0 |
| | | Through | 758 | 17.2 |
| | | Right | 64 | 12.3 |
| | | U-Turn | 0 | 0 |
| | | Total | 822 | 16.9 |
| | WB | Left | 0 | 0 |
| | | Through | 622 | 86.7 |
| | | Right | 123 | 6.9 |
| | | U-Turn | 0 | 0 |
| | | Total | 745 | 73.5 |
| | Total | | 2438 | 39.4 |
| Reed Market and NB Ramps | NB | Left | 103 | 106.5 |
| | | Through | 0 | 0 |
| | | Right | 86 | 12.9 |
| | | U-Turn | 0 | 0 |
| | | Total | 189 | 63.9 |
| | SB | Left | 0 | 0 |
| | | Through | 0 | 0 |
| | | Right | 0 | 0 |
| | | U-Turn | 0 | 0 |
| | | Total | 0 | 0 |
| | | Left | 0 | 0 |

| | | | | |
|---|---|---|---|---|
| | EB | Through | 1308 | 20.5 |
| | | Right | 137 | 19.7 |
| | | U-Turn | 0 | 0 |
| | | Total | 1445 | 20.4 |
| | WB | Left | 0 | 0 |
| | | Through | 656 | 7.9 |
| | | Right | 0 | 0 |
| | | U-Turn | 0 | 0 |
| | | Total | 656 | 7.9 |
| | Total | | 2290 | 20.4 |
| Reed Market and Division | NB | Left | 0 | 0 |
| | | Through | 0 | 0 |
| | | Right | 56 | 52.0 |
| | | U-Turn | 0 | 0 |
| | | Total | 56 | 52.0 |
| | SB | Left | 6 | 37.9 |
| | | Through | 1 | 26.5 |
| | | Right | 12 | 13.9 |
| | | U-Turn | 0 | 0 |
| | | Total | 19 | 22.2 |
| | EB | Left | 91 | 16.6 |
| | | Through | 665 | 10.0 |
| | | Right | 639 | 3.4 |
| | | U-Turn | 0 | 0 |
| | | Total | 1395 | 7.4 |
| | WB | Left | 3 | 34.3 |
| | | Through | 644 | 1.6 |
| | | Right | 330 | 3.3 |
| | | U-Turn | 0 | 0 |
| | | Total | 977 | 2.3 |
| | Total | | 2447 | 6.5 |
| Reed Market and 3rd St | NB | Left | 324 | 85.6 |
| | | Through | 617 | 47.3 |
| | | Right | 215 | 43.8 |
| | | U-Turn | 0 | 0 |
| | | Total | 1156 | 57.4 |
| | SB | Left | 137 | 263.4 |
| | | Through | 665 | 215.1 |
| | | Right | 131 | 213.4 |
| | | U-Turn | 0 | 0 |
| | | Total | 933 | 222.0 |
| | EB | Left | 153 | 84.0 |
| | | Through | 497 | 82.7 |
| | | Right | 92 | 73.2 |
| | | U-Turn | 0 | 0 |
| | | Total | 742 | 81.8 |
| | WB | Left | 239 | 92.2 |
| | | Through | 515 | 87.4 |
| | | Right | 78 | 84.2 |
| | | U-Turn | 0 | 0 |
| | | Total | 832 | 88.4 |
| | Total | | 3663 | 111.3 |
| | NB | Left | 36 | 40.3 |
| | | Through | 730 | 18.4 |
| | | Right | 54 | 11.0 |

| | | | | |
|---|---|---|---|---|
| 3rd St and Brosterhous | | U-Turn | 0 | 0 |
| | | Total | 820 | 18.9 |
| | SB | Left | 173 | 39.1 |
| | | Through | 808 | 13.0 |
| | | Right | 21 | 5.0 |
| | | U-Turn | 0 | 0 |
| | | Total | 1002 | 17.3 |
| | EB | Left | 84 | 25.6 |
| | | Through | 319 | 26.8 |
| | | Right | 267 | 17.7 |
| | | U-Turn | 0 | 0 |
| | | Total | 670 | 23.0 |
| | WB | Left | 48 | 32.6 |
| | | Through | 25 | 22.2 |
| | | Right | 339 | 11.1 |
| | | U-Turn | 0 | 0 |
| | | Total | 412 | 14.3 |
| | Total | | 2904 | 18.6 |