



**Washington State
Department of Transportation**



SR 160 Long Lake Road SE Planning Study

MP 2.04 to MP 3.57

March 2018

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WASHINGTON STATE DEPARTMENT OF TRANSPORTATION
OLYMPIC REGION

SR 160 LONG LAKE ROAD SE PLANNING STUDY

Study Limits: SR 160 / Phillips Road SE to Mayvolt Road SE / Lake Valley Road SE
Milepost 2.04 to Milepost 3.57

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SR 160 Long Lake Road SE Planning Study

Table of Contents

| | |
|---|-----------------|
| Executive Summary | ES - 1 |
| Chapter 1: Introduction | Page 1-1 |
| 1.1 What is the purpose of the Study | Page 1-2 |
| 1.2 What are the Study Limits..... | Page 1-3 |
| 1.3 How was the Study Funded..... | Page 1-5 |
| 1.4 Why study this Highway Segment..... | Page 1-5 |
| Chapter 2: Route Characteristics | Page 2-1 |
| 2.1 What is the character and land use in the study area | Page 2-2 |
| 2.2 Who are the users along the Corridor | Page 2-3 |
| 2.3 What are the Safety Concerns..... | Page 2-4 |
| 2.4 What are the Environmental Resources | Page 2-4 |
| 2.5 What are the Different Modes of Travel | Page 2-6 |
| Chapter 3: Alternatives Analysis and Evaluation | Page 3-1 |
| 3.1 What are the Alternatives | Page 3-2 |
| 3.2 What Safety Analysis was conducted | Page 3-2 |
| 3.3 What Traffic Operations Analysis was conducted | Page 3-5 |
| 3.4 What is the Estimated Cost of each Alternative | Page 3-10 |
| 3.5 How were the Alternatives Evaluated | Page 3-11 |
| Chapter 4: Community Engagement | Page 4-1 |
| 4.1 How the Stakeholder Committee Participated in the Study | Page 4-2 |
| 4.2 What We Heard from the Community | Page 4-4 |
| Chapter 5: Final Recommendations and Next Steps | Page 5-1 |
| 5.1 What is the Final Recommendation | Page 5-2 |
| 5.2 What additional work has been done | Page 5-2 |
| 5.3 What are the Next Steps..... | Page 5-4 |

Appendices

Appendix A – Safety and Traffic Analysis

Appendix B – Stakeholder Committee Meetings

Appendix C – Community Engagement Comments

Appendix D – Recommended Alternative Profiles and Scoping Work

List of Figures

| | |
|--|----------|
| Figure 1 – Safety Priority Programming and Public Process | Page 1-2 |
| Figure 2 – SR 160 Long Lake Road SE Study Area..... | Page 1-4 |
| Figure 3 – Study Timeline | Page 1-5 |
| Figure 4 – Kitsap County Land Use map (June 2016)..... | Page 2-3 |
| Figure 5 – Environmental Resources | Page 2-5 |
| Figure 6 – SR 160 & Long Lake Rd Intersection Related Crashes (2011-2015)..... | Page 3-4 |
| Figure 7 – SR 160 & Long Lake Road Conceptual Roundabout..... | Page 5-3 |

List of Tables

| | |
|--|-----------|
| Table 1 – Summary of Long Lake Road Intersection Crash Data (2011-2015)..... | Page 3-3 |
| Table 2 – Safety Analysis Results..... | Page 3-5 |
| Table 3 – 2016 Existing Intersection Conditions..... | Page 3-6 |
| Table 4 – 2016 Existing Mainline Conditions..... | Page 3-7 |
| Table 5 – Historic Growth Rates | Page 3-7 |
| Table 6 – Traffic Analysis 2016 and 2036 AM and PM Intersection LOS..... | Page 3-9 |
| Table 7 – Traffic Analysis 2036 AM and PM Peak Mainline LOS | Page 3-10 |
| Table 8 – Alternatives Cost Estimates..... | Page 3-11 |
| Table 9 – Evaluation Criteria Point System | Page 3-11 |
| Table 10 – Alternatives and Criteria Information..... | Page 3-12 |
| Table 11 – Alternatives Scoring Results..... | Page 3-13 |

Executive Summary

Executive Summary

Why did we study the SR 160 Long Lake Road SE intersection?

The Washington State Department of Transportation (WSDOT) identified the intersection of State Route (SR) 160 (Sedgwick Road SE) and Long Lake Road Southeast as a safety concern through the WSDOT Target Zero Highway Safety Plan due to the crash type, the frequency and the number of serious injury crashes. In 2010 and again in 2016 this intersection was on the Intersection Analysis Location (IAL) list. In the fall of 2016, WSDOT began the SR 160 Long Lake Road SE Study with the study limits being SR 160 from Phillips Road to Mayvolt Road/Lake Valley Road (shown in the Study Area Map). The goal of the study was to identify solutions to reduce or eliminate serious injury crashes occurring at the intersection. The WSDOT study team and the stakeholder committee developed a needs statement to guide the study. The needs statement reads, “SR 160 and Long Lake Road SE is an at-grade two-way stop intersection that is experiencing a number of severe injury crashes. The need of the study is to develop potential solutions to improve the safety at the intersection in a way that will balance local and regional needs while also managing highway performance”.

STUDY NEED

Study Area Map



How was the study conducted?

WSDOT staff working with a stakeholder committee and local community members developed and evaluated five potential alternatives in this study process. The stakeholder committee included representatives from Kitsap County, Kitsap Transit, the US Navy, the Suquamish Tribe and WSDOT Headquarters and Olympic Region. WSDOT held two stakeholder committee meetings to develop and evaluate potential alternatives. The committee also aided with establishing four criteria (improves safety, improves operations, cost and multimodal), for evaluating each alternative. As part of the study, two public meetings occurred, which provided an opportunity to gather input and share information with local community members. Chapter 4, Appendix B and Appendix C contain more information about the community engagement efforts.

PROCESS

What alternatives were considered?

The study evaluated five intersection improvement alternatives:

- Roundabout at the intersection of SR 160 and Long Lake Road.
- Roundabouts at two intersections, SR 160 and Phillips Road and SR 160 and Mayvolt Road/Lake Valley Road. Access is limited at the SR 160 and Long Lake Road intersection to right-in and right-out only.
- Install a new traffic signal with additional channelization at the intersection of SR 160 and Long Lake Road.
- Long Lake Road Bridge over SR 160 with ramps connecting to SR 160.
- Speed limit reduction on SR 160 and installation of permanent radar signs.

ALTERNATIVES

Reduces crash potential, improves operations, cost and multimodal are the four evaluation criteria that were used to measure and rank the alternatives. This information was presented to the stakeholder committee to aid in the alternative evaluation and ranking process.

Safety and traffic operations analyses were performed for each alternative. The safety analysis applied crash data information from January 2011 to December 2015 to calculate an expected crash reduction. The traffic operations analysis examined the existing year 2016 and forecast year 2036 traffic volumes in the morning and afternoon peak hours at each of the three intersections along SR 160 (Phillips Road, Long Lake Road and Mayvolt/Lake Valley Roads) to determine which alternative performs with the least amount of delay. The results of the

safety and traffic analyses were used in the evaluation and ranking process for determining the recommended solution.

Determining if an alternative is feasible in terms of cost and how the alternative accommodates all modes of transportation was also part of the evaluation and ranking process in the study. Chapter 3 in the report describes in more detail the process used to evaluate and rank the five alternatives.

What is the final recommendation?

The recommended alternative chosen by WSDOT and the stakeholder committee members is the single-lane roundabout at the intersection of SR 160 and Long Lake Road.

The key benefits of the recommended alternative are it improves and promotes continuous traffic flow reducing conflicting movements reducing the potential for injury, bicycle and pedestrian intersection crossing crashes, and it accommodates all vehicles including trucks and buses. The single lane roundabout is a practical solution that achieves the highest potential to reduce serious injury crashes.

RECOMMENDATION

WSDOT staff and local stakeholder members worked together through the study process of establishing the needs, analyzing the data to measure the benefits and impacts of the potential alternatives, and developed criteria to choose the best alternative for improving the intersection. The study results and the recommendation were communicated to the public through an open house. Community members overall were supportive of the recommendation.

What are the next steps?

Additional work on the recommended alternative was completed. A refined cost estimate for a single lane roundabout at the intersection of SR 160 and Long Lake Road was \$1.5 to \$2 million dollars.

NEXT STEPS

The next steps following the completed study is to present the information and the recommended alternative to the WSDOT I2 Safety Panel where it will compete on a statewide level for design and construction funding in accordance with WSDOT's priority programming approach.

Introduction

Chapter 1 – Introduction

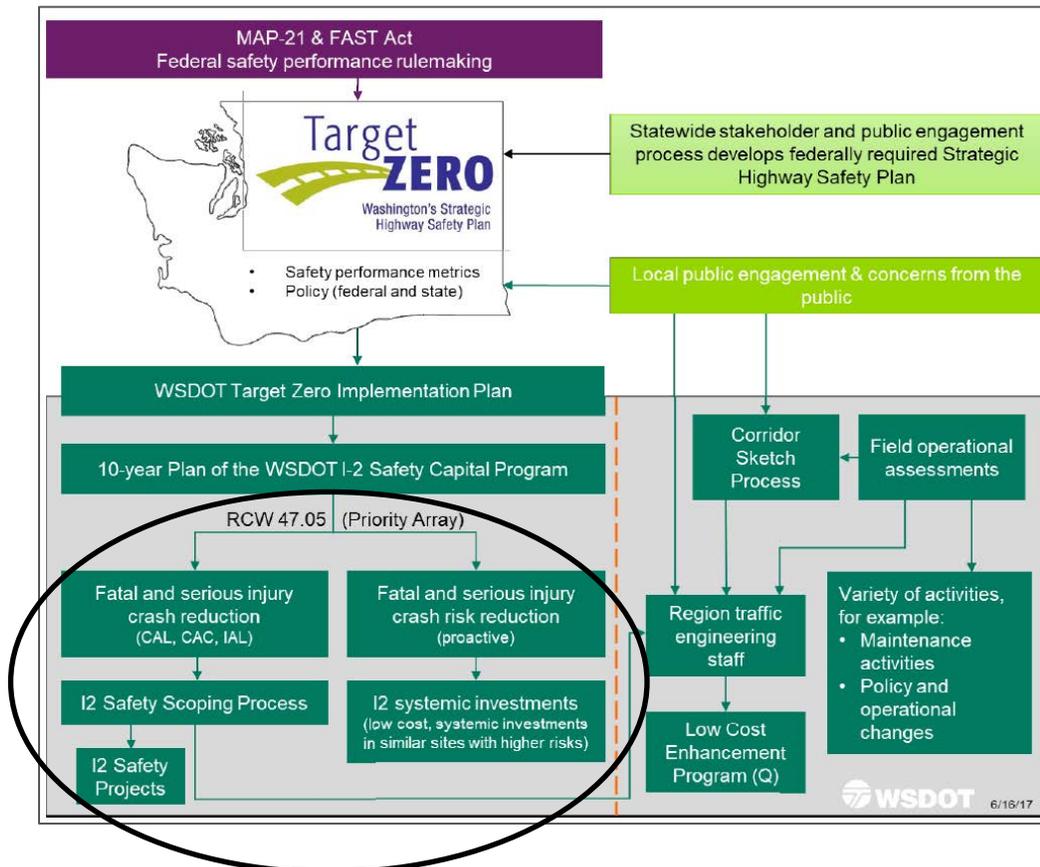
1.1 What is the purpose of the Study

The intersection of SR 160 and Long Lake Road SE was identified as a safety concern through the WSDOT Target Zero Implementation Plan. Under this plan, WSDOT’s safety priority array process identifies locations with the highest potential to reduce fatal and serious injury crashes with the greatest benefit to the cost of a project. Figure 1 shows the safety priority programming process that is used to determine a ranked list of projects where countermeasures are evaluated and priorities are determined using a benefit cost analysis.



SR 160 / Long Lake Road SE Intersection

Figure 1 – Safety Priority Programming and Public Process



A Needs Statement was developed to guide the study, identify performance gaps and evaluate potential alternatives. The Needs Statement for the SR 160 Long Lake Road SE Planning Study is:

“SR 160 and Long Lake Road SE is an at-grade two-way stop intersection that is experiencing a number of severe injury crashes. The need of the study is to develop potential solutions to improve the safety at the intersection in a way that will balance local and regional needs while also managing highway performance.”

The Needs Statement identifies the transportation facility needs that exist and the potential improvements implemented to address those needs. The statement was used for identifying and comparing reasonable alternatives and for identifying a recommended solution.

As the scope of the study was developed, concerns arose about the vertical grade at the intersection, and the likely difficulty of installing an intersection control with the existing geometric conditions. With this in mind, the limits of the study were expanded to include the section of highway between Phillips Road and Mayvolt/Lake Valley Road (see Figure 6). The intent of the study is to address crash potential at SR 160 and Long Lake Road. The additional intersections located within the study area are not currently on the current Priority Array list.

The study includes a compilation of traffic, safety, environmental, future growth and multimodal information within the study area. The study is also a collaboration with the community and other local stakeholders. This portion of highway is a four-legged, two-way stop controlled intersection, which is an Intersection Analysis Location (IAL) due to the frequency and number of serious injury crashes.

1.2 What are the Study Limits

State Route 160 (Sedgwick Road SE) is a 7-mile east-west corridor in Kitsap County that stretches from the SR 16 interchange through the City of Port Orchard and to the Southworth ferry terminal. Within this corridor, the limits of the study area make up a mile and a half long section of SR 160 between Phillips Road SE and Mayvolt/Lake Valley Roads (see Figure 2).

Intersection Analysis Location (IAL)

Within the I2 program, the state highway system is screened every two years to identify segments and intersections that, when compared to similar locations, experience more fatal and serious injury crashes.

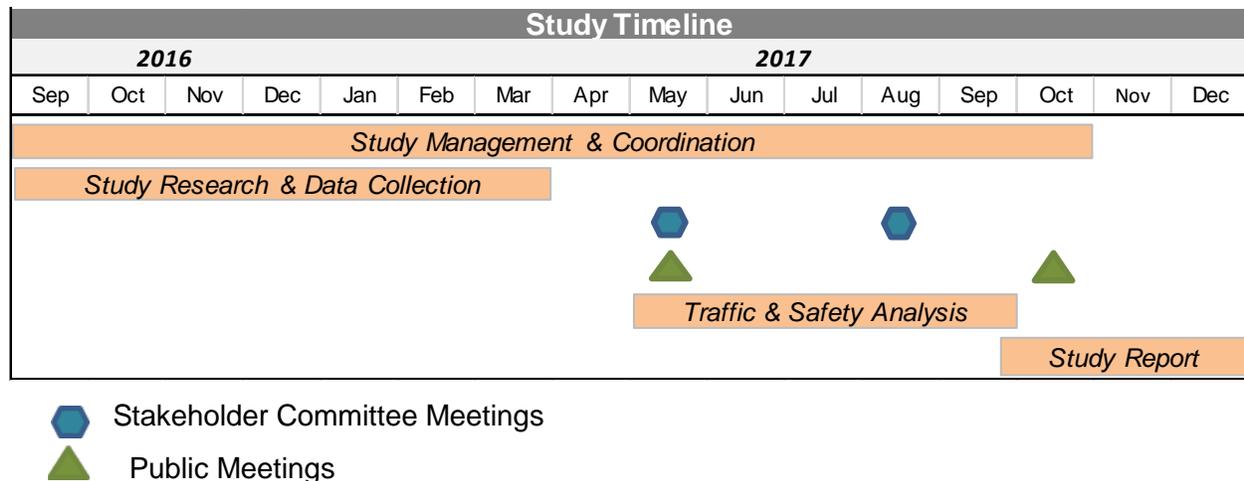
Figure 2 – SR 160 Long Lake Road SE Study Area



1.3 How was the Study Funded

The Washington State Department of Transportation (WSDOT) study began in the fall of 2016 (see Study Timeline, Figure 3), with funding provided through the Federal Highway Safety Improvement Program and the State Motor Vehicle Account for \$200,000 dollars. The study was completed February of 2018.

Figure 3 – Study Timeline



1.4 Why Study this Highway Segment

The intersection of SR 160 and Long Lake Road Southeast is currently an Intersection Analysis Location (IAL). This location was identified through the WSDOT safety priority array. For a project to be identified as a location funded by the I-2 Safety Program, it must be identified, analyzed and programmed through the priority programming based on observed and expected future crashes; and only after it is ranked in comparison to other like locations throughout the state.

The following chapters present a summary of relevant background documentation and analysis of the existing safety and operational performance of the intersection, a review of public and stakeholder input and suggestions and a final recommended safety improvement.

Safety Improvement Program (I-2)

The Safety Improvement Program is a targeted program developed to reduce fatal and serious crashes, including bicycle and pedestrian related crashes, on the state highway system. The program is a part of Target Zero and WSDOT's Target Zero Implementation Plan.

Route Characteristics

Chapter 2 – Route Characteristics

2.1 What is the character and land use in the study area

SR 160 is a two-lane undivided highway. This stretch of highway is an Urban Minor Arterial with speeds ranging from 35 mph to 45-mph. This route currently has suburban-scale type development and rural residential housing. Driveways of homes and businesses directly access SR 160 (Sedgwick Road).

The intersections along SR 160 that are within the study area are Phillips, Aiken, Long Lake, Lakeview, Peppermill, Bodle and Lake Valley/Mayvolt Roads. These intersections along the highway system are at grade, two-way stopped controlled intersections with two lane county roads connecting from the north or south, or both legs. SR 160 is also two lanes, but has additional left-turn pockets on both the west and east legs at the Phillips Road and Long Lake Road intersections.

A portion of the SR 160 study area is positioned on a half-mile long steep hill (11% grade), and Long Lake Road intersects the highway in the approximate middle of the hill. Trees and bushes line most of the highway right-of-way within study area, and the northeast quadrant of the Long Lake Road intersection has existing trees up to the right-of-way line. However, the northwest, southwest and southeast quadrants do not have trees up to the right-of-way line and sight distance is improved. The Apostolic Light House church and rural residential housing occupies the land surrounding the intersection. Overhead primary and secondary power lines exist with associated utility poles, and four overhead caution beacons are strung across three legs of the intersection.

Counties and cities coordinate and plan together to establish land use zoning regulations as part of their comprehensive planning effort. This helps to ensure a balance between development, such as housing and commercial structures, public facilities, and infrastructure like roadways and with minimal impacts to sensitive environmental resources. The surrounding land use (shown in Figure 4) along this section of SR 160 between Phillips Road and Mayvolt/Lake Valley Road is primarily zoned Rural Protection. Kitsap County's comprehensive plan states this type of zoning promotes low-density rural development and agricultural activities that are consistent with rural character and protects environmental features such as significant visual, historic and natural features, wildlife corridors, steep slopes, wetlands, streams and adjacent critical areas.

Urban Minor Arterials

Interconnect and augment the higher level Arterials

Serve trips of moderate length at a somewhat lower level of travel mobility

Distributes traffic to smaller geographic areas than those served by higher-level Arterials

Provide more land access than Principal Arterials without penetrating identifiable neighborhoods

Provide urban connections for Rural Collectors

2.3 What are the Safety Concerns

The SR 160 and Long Lake Road intersection is identified in the WSDOT Intersection Safety Priority Array as having a high potential for the reduction of serious injury crashes. The state highway system is screened every two years to identify intersections that have experienced more fatal and serious injury crashes than what is expected at intersections with similar characteristics. In the 5-year period from January 1, 2011, through December 31, 2015, there were 22 intersection related crashes at the SR 160 and Long Lake Road intersection. Two of these crashes resulted in serious injuries. Most of the crashes were angle type crashes that involved vehicles entering SR 160 from Long Lake Road and were struck by vehicles traveling on mainline SR 160. There were no bicycle or pedestrian related crashes at the intersection, however one pedestrian crash occurred approximately one mile east on SR 160 near Mayvolt Road.

Safety Data Disclaimer

Under 23 U.S. Code § 409, safety data, reports, surveys, schedules, lists compiled or collected for the purpose of identifying, evaluating, or planning the safety enhancement of potential crash sites, hazardous roadway conditions, or railway-highway crossings are not subject to discovery or admitted into evidence in a Federal or State court proceeding or considered for other purposes in any action for damages arising from any occurrence at a location mentioned or addressed in such reports, surveys, schedules, lists, or data.

2.4 What are the Environmental Resources

The environmental elements that are described in the study consist of general information collected to identify and document potential issues as part of this transportation study process. The specific impacts to the environment would be determined when a project has been funded for design and construction.

Fish Passage

WSDOT has been working to improve fish passages statewide. There are two fish passage barriers (see Figure 7, Page 2-6) within the SR 160 study area, which are in need of correction. One is located at milepost 1.92, which is west of the Phillips Road intersection, and the second is at milepost 2.29 east of Phillips Road along Salmonberry Creek. The repair of these fish passages has not yet been programmed. WSDOT is committed to correcting fish passage barriers and may be included as part of a transportation project if the barrier falls within the project limits.



Unnamed stream located west of Phillips Rd

Wildlife Habitat Connectivity

The Statewide Habitat Connectivity Analysis was developed by WSDOT and the Washington Department of Fish and Wildlife and identifies areas along the state highway system with wildlife movements. Through this

2.5 What are the Different Modes of Travel

In order to be efficient and fair a transportation system must serve diverse demands. Inadequate multimodal options force commuters to drive because few opportunities for rideshare or transit use are currently available.

SR 160 may connect the traveling population in different ways including walking and cycling, however, this stretch of the highway corridor presents some challenges with narrow shoulders in some areas, and gaps in the existing transit route. At the east end of the highway, the Washington State Ferries operates daily ferry service from Southworth to Vashon Island and West Seattle. In 2020, Kitsap Transit will begin a passenger only Cross-Sound Fast Ferry Program with service from Southworth to Seattle. SR 160 is also listed as a future transit corridor linking to the Southworth Fast Ferry service. Various transportation users from ferry traffic to freight to local commuters travel along SR 160 westbound toward Port Orchard and on to SR 16. Long Lake Road from Mile High Road southbound and across SR 160 to Mullenix Road is part of Kitsap County's designated bicycle route.

The study limits are located within the South Kitsap School District boundary with John Sedgwick Junior High to the east on SR 160 and Hidden Creek Elementary School to the south of the highway. The bus route for both schools runs east and west along SR 160 between Phillips and Mayvolt Roads.

The U.S. Naval Base Kitsap is the third largest Navy base in the U.S. and includes three major port facilities. One of these is the Manchester Fuel Depot, which is the largest underground Navy fuel storage facility on the West Coast. Fuel is transported both by barge and by truck. The SR 160 corridor and Long Lake Road intersection are an important part of the Navy's freight route for their fuel tankers.

The future transportation solution will need to consider the opportunities for adding bicycle facilities in compliance with Kitsap County plans, may also consider safe routes to schools, while accommodating truck traffic on the corridor.

Alternatives Analysis and Evaluation

Chapter 3 – Alternatives Analysis and Evaluation

3.1 What are the Alternatives

The study began with three preliminary alternatives to consider for addressing the crashes at the SR 160 and Long Lake Road SE intersection. The preliminary alternatives include:

- ❖ Construct a roundabout at the intersection of SR 160 and Long Lake Road.
- ❖ Construct roundabouts at the intersection of SR 160 and Phillips Road and the intersection of SR 160 and Mayvolt Road/Lake Valley Road. This option would limit access at the intersection of SR 160 and Long Lake Road to right-in and right-out only. Vehicles seeking to cross SR 160 would turn right onto SR 160, proceed to a roundabout to make a U-turn, and then turn back onto Long Lake Road.
- ❖ Install a new traffic signal with additional channelization at the intersection of SR 160 and Long Lake Road.

Two additional alternative ideas, which local community members attending the first public meeting suggested, were subsequently added. These ideas met the purpose of the study and were included in the evaluation of alternatives. These additional alternatives are:

- ❖ Construct a Long Lake Road bridge over SR 160, including ramps that will connect to SR 160.
- ❖ Speed limit reduction on SR 160 and installation of permanent radar signs.

The study team examined the five alternatives for potential safety improvement to the intersection of SR 160 and Long Lake Road SE.

3.2 What Safety Analysis was conducted

The intersection of SR 160 and Long Lake Road SE was identified as an Intersection Analysis Location (IAL) in 2013. The study team conducted a review of the history of crashes from January 2011 to December 2015, looking for most common types of crashes, contributing factors, and serious and fatal injuries in the crash data. The data shown in Table 1 is

derived from police reports completed by law enforcement officers responding to crash incidents.

Table 1 - Summary of Long Lake Road Intersection Crash Data (2011-2015)

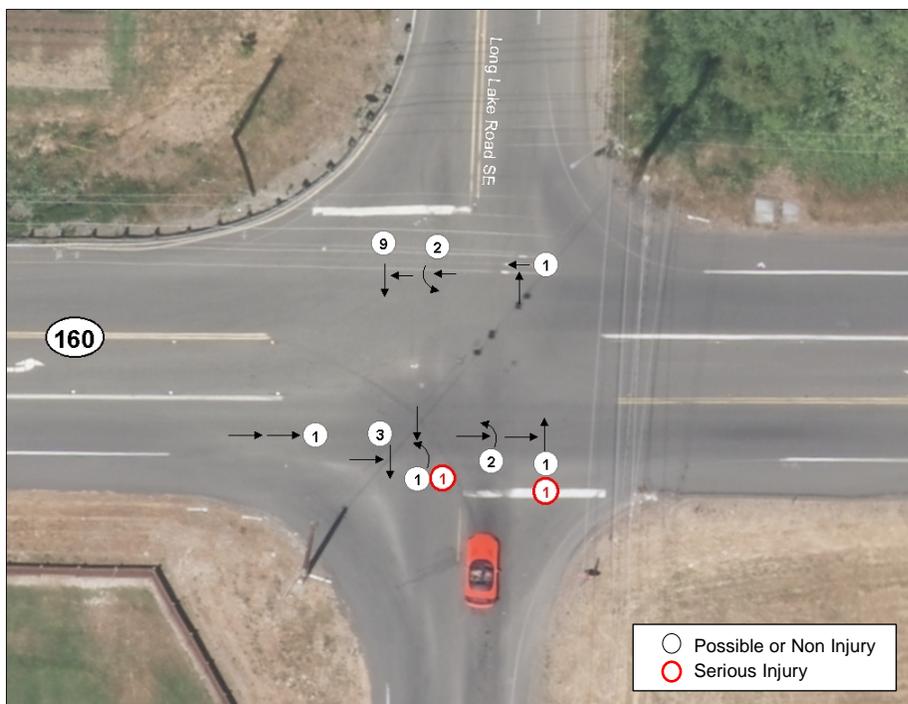
| | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|----------|----------|----------|----------|----------|
| Severity | | | | | |
| Property Damage | 4 | 3 | 2 | 3 | 1 |
| Possible Injury | 1 | 1 | | | 1 |
| Evident Injury | | 1 | | | 3 |
| Serious Injury | 1 | | | | 1 |
| Fatality | | | | | |
| Unknown | | | | | |
| Crash Type | | | | | |
| Angle | 6 | 5 | 1 | 3 | 4 |
| Hit object | | | | | 1 |
| Same direction - one right turn - one straight | | | 1 | | |
| Opposite direction - one left turn - one straight | | | | | 1 |
| Contributing Circumstances | | | | | |
| Did not grant right-of-way | 3 | 1 | | 2 | 4 |
| Disregard stop sign | | 2 | 1 | | 2 |
| Speeding | | | | 1 | |
| Alcohol/Drug related | 1 | 1 | | | |
| Other/Unknown | 2 | 1 | 1 | | |
| Time of Day | | | | | |
| 6:01 AM - 10:00 AM | 1 | 2 | | | 2 |
| 10:01 AM - 4:00 PM | 2 | 2 | 1 | 1 | 1 |
| 4:01 PM - 7:00 PM | 2 | 1 | | 2 | 2 |
| 7:01 PM - 6:00 AM | 1 | | 1 | | 1 |
| Roadway Conditions | | | | | |
| Dry | 6 | 3 | 2 | 3 | 5 |
| Wet | | 2 | | | 1 |
| Snow/Ice | | | | | |
| Other/Unknown | | | | | |
| Season | | | | | |
| Dec-Feb | | 1 | | | 1 |
| Mar-May | | 3 | | 2 | 1 |
| June-Aug | 3 | 1 | 2 | | 3 |
| Sept-Nov | 3 | | | 1 | 1 |
| Light Conditions | | | | | |
| Daylight | 4 | 4 | 2 | 2 | 6 |
| Dawn/Dusk | | | | | |
| Dark (unlit) | 2 | 1 | | 1 | |
| Unknown | | | | | |
| Totals | 6 | 5 | 2 | 3 | 6 |

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In the 5-years of crash history information, the records indicated there were 22 intersection related crashes with two of the crashes resulting in serious injuries. The data shows most common types of crashes that occurred at the intersection were entering at angle crashes. As shown in the crash diagram, Figure 6, most crashes involve drivers traveling on Long Lake Road who chose inadequate gaps to travel across or to enter onto SR 160. This resulted in 10 crashes at the intersection with the primary contributing cause of “not granting right of way”.

The majority of crashes happened on dry pavement in the daylight hours. Most of which happened in the afternoon/evening time.

Figure 6 - SR 160 & Long Lake Rd Intersection Related Crashes (2011-2015)



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The crash prediction models in the Highway Safety Manual (HSM), Chapter 10 and Chapter 12 were used to calculate baseline crash numbers. Crash Modification Factors (CMF) from the CMF Clearinghouse were applied to the baseline crash numbers to estimate the crash reductions for each option. This methodology was used to determine the expected crash reductions for each of the proposed alternatives shown in Table 2.

Table 2 – Safety Analysis Results

| HIGHWAY SAFETY MANUAL ANALYSIS | | | |
|---|--|------------------------------------|----------------------------|
| | <i>Crashes Per Year</i> | | |
| | <i>Baseline Crashes (HSM Analysis)</i> | <i># Crashes After Improvement</i> | <i>Net Crash Reduction</i> |
| Two Roundabouts (Phillips Rd & Mayvolt/Lake Valley Rd) w/ Right-in/Right-out only at Long Lake Rd | 4.1 | 0.9 | 3.2 |
| SR 160/Long Lake Road Roundabout | 1.4 | 0.3 | 1.1 |
| SR 160/Long Lake Road Traffic Signal | 1.4 | 0.8 | 0.6 |
| Speed Reduction w/ Signage | 4.1 | 3.9 | 0.2 |
| Long Lake Road Bridge w/ Ramps | 1.4 | 0.6 | 0.8 |

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The two roundabouts with limited access options, addresses the crashes at three separate intersections, (Long Lake Rd., Phillips Rd & Mayvolt/Lake Valley Rd) and thus provides greater safety benefits potential than the other options. The remaining four alternatives address only the crashes at the Long Lake Rd. Intersection. The results of the analysis indicates the two roundabout option has the biggest crash reduction potential with the second being a roundabout at SR 160 and Long Lake Road. The next highest reduction was the Long Lake Road Bridge with ramps, then a Long Lake Road signal. The alternative with the lowest crash reduction potential is the speed reduction and signage. For additional information on the safety analysis, please see Appendix A.

3.3 What Traffic Operations Analysis was conducted

As part of the development of the study alternatives, the study team collected traffic operations information to form the basis of the traffic analysis. In order to assess the quality of traffic flow, intersection capacity analyses was conducted at the study intersections for the following three scenarios:

- 2016 Existing Conditions (intersection and segment)
- 2036 Future No Build Conditions (future traffic volumes with existing roadway/intersection and segment conditions)
- 2036 Future Build Conditions (future traffic volumes with potential intersection improvements and segment analysis)

With each scenario, analysis was conducted for weekday morning and afternoon peak hours. The intersection capacity analyses determine the vehicle delays, queuing, and intersection capacity.

“Level of Service” (LOS) is used to denote the different operating conditions for roadways and intersections using different traffic volumes. The LOS designations range from “A” at best with little or no delays to “F” at worst with long delays and forced flow conditions. The LOS ratings for an intersection are based on the average delay per approaching vehicle. SR 160 has a Tier 2 LOS D standard, which has been adopted by the Puget Sound Regional Council in consultation with WSDOT for this Highway of Regional Significance.

Current Traffic Volumes

WSDOT collected manual turning movement counts on SR 160 at the unsignalized intersections of Long Lake Road, Phillips Road and Mayvolt/Lake Valley Road on September 20, 21, 26 and 28 in 2016. Table 3 summarizes the peak hour traffic data. The SR 160 and Long Lake Road intersection volumes indicate the majority of vehicles travel southbound on Long Lake Road and turn right onto SR 160. The 2016 AM peak hour traffic volumes show an intersection Level of Service (LOS) of C southbound at Long Lake Road and LOS F northbound. In the 2016 PM peak hour, traffic volumes show an intersection LOS of E for the southbound Long Lake Road intersection and a LOS F at the northbound Long Lake Road intersection.

Traffic Analysis Toolbox

Highway Capacity Manual 2010 software applied to unsignalized intersections

SIDRA 6.1 Software applied to roundabouts

Synchro applied to signalized intersections

Table 3 – 2016 Existing Intersection Conditions

| Existing 2016 AM Intersection Peak Hour Traffic Volumes with Level of Service (LOS) | | | | | | | | | | | | |
|---|------------------|----------|------------|------------------|----------|------------|---------------------------|----------|------------|---------------------------|----------|------------|
| Intersection | Eastbound SR 160 | | | Westbound SR 160 | | | Northbound Long Lake Road | | | Southbound Long Lake Road | | |
| | Left Turn | Straight | Right Turn | Left Turn | Straight | Right Turn | Left Turn | Straight | Right Turn | Left Turn | Straight | Right Turn |
| SR 160 / Long Lake | 108 | 201 | 27 | 6 | 372 | 12 | 66 | 17 | 11 | 6 | 14 | 155 |

| Existing 2016 PM Intersection Peak Hour Traffic Volumes with Level of Service (LOS) | | | | | | | | | | | | |
|---|------------------|----------|------------|------------------|----------|------------|---------------------------|----------|------------|---------------------------|----------|------------|
| Intersection | Eastbound SR 160 | | | Westbound SR 160 | | | Northbound Long Lake Road | | | Southbound Long Lake Road | | |
| | Left Turn | Straight | Right Turn | Left Turn | Straight | Right Turn | Left Turn | Straight | Right Turn | Left Turn | Straight | Right Turn |
| SR 160 / Long Lake | 210 | 394 | 107 | 10 | 354 | 30 | 48 | 31 | 4 | 7 | 26 | 146 |

LOS A ■ LOS B ■ LOS C ■ LOS D ■ LOS E ■ LOS F ■

In Table 4, the 2016 mainline segment from Phillips Road to Long Lake Road shows a LOS E for Design Hour Volumes (DHV) and LOS D for weekday PM peak hour volumes. The 2016 mainline segment from Long Lake Road to Mayvolt Road indicates a LOS D for DHV and LOS C for weekday PM Peak.

Table 4 – 2016 Existing Mainline Conditions

| Segment | Design Hour Volume | Design Hour Volume LOS | Weekday Hourly Volume | Weekday Hourly Volume LOS |
|--|--------------------|------------------------|-----------------------|---------------------------|
| SR 160/Phillips Road to Long Lake Road | 1400 | E | 1254 | D |
| SR 160/Long Lake Road to Mayvolt Road | 1032 | D | 744 | D |

LOS A LOS B LOS C LOS D LOS E LOS F

Future Traffic Volume Projections

A year 2036 forecast traffic volume network was developed using historical volume growth. The study team along with WSDOT Region and Headquarters technical staff reviewed the future traffic growth projections from Kitsap County and Puget Sound Regional Council (PSRC) as well as WSDOT historical traffic count trends for the analysis area. The team selected to use the historic growth rates in the AM and PM between 2004 and 2016 (shown in Table 5) to project forecasts for 2036 volumes. The annual historical approach growth rates at the SR 160/Long Lake Road intersection are:

Table 5 – Historic Growth Rates

| SR 160/Long Lake Road Intersection – AM Peak Hour Historical Growth | | | |
|---|-----------|------------|------------|
| Eastbound | Westbound | Northbound | Southbound |
| 1.63% | 0.43% | 0.53% | 3.24% |
| SR 160/Long Lake Road Intersection – PM Peak Hour Historical Growth | | | |
| Eastbound | Westbound | Northbound | Southbound |
| 1.40% | 2.12% | 1.41% | 3.23% |

The study team using the applied growth rate developed a year 2036 forecast of traffic volumes. Once 2036 volumes were established, the traffic analysis determined the build scenarios for each of the three unsignalized intersections within the study area on SR 160 (Phillips Road, Long Lake Road and Mayvolt/Lake Valley Road) for the AM and PM peak hour LOS. The traffic volumes were analyzed using Highway Capacity Manual 2010 software, SIDRA and Synchro.

Traffic Analysis of the 2036 Alternatives

No Build and Speed Reduction/Signage Scenarios

The forecast 2036 no build and speed reduction/signage scenarios assumes there will be no capacity improvements with minor street shared left, thru and right turns. The delay exponentially increases at Phillips Road and Long Lake Road. The turning movements at Mayvolt/Lake Valley Roads remains low volume.

Two Roundabouts with Right-in/Right-out Only Access

The analysis assumes the minor street left and through turning movements at Long Lake Road turn right with U-turns happening at the two single-lane roundabouts. There would be right turn lanes in both directions at Long Lake Road. The vehicles on SR 160 taking left turns would also use the roundabouts for making U-turns.

Roundabout at SR 160 and Long Lake Road

A single-lane roundabout at SR 160 and Long Lake Road, this assumes 50% of Phillips Road vehicles traveling northbound making left turns and thru movements will make right turns with U-turns made at Long Lake Road. The analysis also assumes 50% of the traffic would potentially redistribute traveling along Baker and Clover Valley Roads to make a northbound left turn at Long Lake Road. Assumes 100% of the southbound left and through at Phillips redistributes to Long Lake using Salmonberry Road.

Signal at SR 160 and Long Lake Road

A signal with additional channelization at Long Lake Road assumes 100% of Phillips Road northbound and southbound left and through turning movements will redistribute vehicles to Long Lake Road. The existing parallel facilities include Salmonberry Road on the north side of SR 160 with Baker and Clover Valley Roads on the south side. Access at Phillips Road during the peak hours becomes in reality, a right-in, right-out, and left-in movement in the peak periods because of high mainline volumes in year 2036.

Construct a Bridge on Long Lake Road with Ramps

A bridge over SR 160 on Long Lake Road with on and off ramps at Long Lake Road assumes that potentially 100% of Phillips Road northbound and southbound left and through turning movements will redistribute to Long Lake Road using the parallel existing county road facilities.

Level of Service Standards

LOS A – Free flow, low volumes and densities, high speeds. Drivers can maintain their desired speeds with little or no delay.

LOS B – Reasonably free flow, operating speeds beginning to be restricted somewhat by traffic conditions. Drivers still have reasonable freedom to select their speed.

LOS C – Speeds remain near free flow, but freedom to maneuver is noticeably restricted.

LOS D – Speed begins to decline with increasing volume. Freedom to maneuver is further reduced, and the traffic stream has little space to absorb disruptions.

LOS E – Unstable flow with volume at or near capacity. Freedom to maneuver is extremely limited, and level of comfort afforded to the driver is poor.

LOS F – Breakdown in flow. Both speeds and volumes can drop to zero.

The summary in Table 6 shows the 2016 AM & PM level of service is F at Phillips and Long Lake Roads. The minor street left turn typically has the worst delay. The northbound shared left, through and right turn at all three unsignalized intersections shows the worst delay, except for the 2036 PM southbound shared left, through and right turns at the Mayvolt/Lake Valley intersection. The build scenarios were analyzed at the three intersections for AM and PM level of service. Outlined within the red box in the table are the PM level of service scores at Long Lake Road that showed the worst delay. The reducing speed with warning sign alternative received a LOS F. The two roundabouts and the SR 160/Long Lake Road signal alternatives both received LOS D results followed by the bridge on Long Lake Road with LOS C at the ramp intersections. The roundabout at SR 160/Long Lake Road alternative was a LOS B, which had the least amount of delay in the modeling analysis. There was stakeholder committee discussion about whether the analysis captured travel time with the two roundabout alternative for vehicles making U-turns at the roundabouts. It is important to recognize that the stakeholder committee members felt that the two roundabout alternative could be seen as a LOS F given the travel time distances for making U-turns as well as for diverting traffic to alternate intersections instead of using Long Lake Road.

Table 6 – Traffic Analysis 2016 and 2036 AM and PM Intersection LOS

| | | 2016 Existing | | | | | | 2036 Future | | | | | |
|--|-----|-------------------|-------------|--------------------|-------------|------------------|-------------|----------------|----|-----------------|----|---------------|----|
| | | Phillips No Build | | Long Lake No Build | | Mayvolt No Build | | Phillips Build | | Long Lake Build | | Mayvolt Build | |
| | | AM | PM | AM | PM | AM | PM | AM | PM | AM | PM | AM | PM |
| No Build and Speed Reduction/Signage Scenarios | LOS | | | | | | | F | F | F | F | C | D |
| 2 Roundabouts (Phillips & Mayvolt) & Right-in/Right-out only at Long Lake Road | LOS | | | | | | | A | C | C | D | A | A |
| SR 160/Long Lake Road Roundabout | LOS | L O S | L O S | L O S | L O S | L O S | L O S | B | B | A | B | C | D |
| SR 160/Long Lake Road Signal | LOS | F | F | F | F | C | C | B | B | C | D | C | D |
| Construct a Bridge on Long Lake Road with Ramps | LOS | | | | | | | B | B | B | C | C | D |

The study team analyzed the five alternative scenarios using the two mainline segments for the 30th highest design hour volumes and weekday volumes. Shown in Table 7, SR 160 from Phillips Road to Long Lake Road is LOS E for all of the scenarios because of high volumes and an existing uphill grade in the eastbound direction. SR 160 from Long

Lake Road to Mayvolt Road is typically LOS D in 2036 because of lower volumes (exception being the two roundabout alternative). The diversion of traffic to make U-turns increases volumes between Long Lake Road and Mayvolt Road resulting in an LOS E. For additional information about the traffic analysis, please see Appendix A.

Table 7 – Traffic Analysis 2036 AM and PM Peak Mainline LOS

| | Segment | Design Hour Volume | Design Hour Volume LOS | Weekday Hourly Volume | Weekday Hourly Volume LOS |
|--|---------------------------------|--------------------|------------------------|-----------------------|---------------------------|
| No Build and Speed Reduction/Signage Scenarios | Phillips Road to Long Lake Road | 1925 | E | 1724 | E |
| | Long Lake Road to Mayvolt Road | 1404 | D | 1084 | D |
| 2 Roundabouts (Phillips & Mayvolt) & Right-in/Right-out only at Long Lake Rd | Phillips Road to Long Lake Road | 2079 | E | 1862 | E |
| | Long Lake Road to Mayvolt Road | 2163 | E | 1844 | E |
| SR 160/Long Lake Road Roundabout | Phillips Road to Long Lake Road | 2379 | E | 2131 | E |
| | Long Lake Road to Mayvolt Road | 1404 | D | 1084 | D |
| SR 160/Long Lake Road Signal | Phillips Road to Long Lake Road | 2120 | E | 1899 | E |
| | Long Lake Road to Mayvolt Road | 1404 | D | 1084 | D |
| Construct a Bridge on Long Lake Road with Ramps | Phillips Road to Long Lake Road | 2232 | E | 1999 | E |
| | Long Lake Road to Mayvolt Road | 1404 | D | 1084 | D |

3.4 What is the Estimated Cost of each Alternative

Cost estimates for each alternative were developed using WSDOT's Planning Level Cost Estimation (PLCE) tool. The methodology is intended to perform cost estimation for projects that are conceptual, often with little to no design. The program takes the information entered and calculates a cost range approach, which allows the estimate range to be 10% lower or 20% above the estimated cost. The two roundabout alternative includes the cost of correcting two fish passages that are located in close proximity to the east and west of the SR 160 and Phillips Road intersection. The cost estimates (see Table 8) are shown in 2012 dollars and can be increased to the current year or to a future year of anticipated construction using an inflation index.

Table 8 - Alternatives Cost Estimates

| Alternative | Planning Level Cost Estimate (2012 dollars) |
|--|--|
| Speed Reduction/Signage Scenarios | \$ 75,000 |
| *Two Roundabouts (Phillips & Mayvolt/Lake Valley) & Right-in/Right-out only at Long Lake Road | \$ 7,190,000 |
| SR 160/Long Lake Road Roundabout | \$ 4,646,000 |
| SR 160/Long Lake Road Signal | \$ 3,205,000 |
| Construct a bridge on Long Lake Road with Ramps | \$ 45,236,000 |

* This cost includes required fish barrier repairs and would be higher if a jersey barrier was included between Phillips Road and Mayvolt Road.

3.5 How were the Alternatives Evaluated

In order to determine the preferred option for making an improvement to the state highway system in a planning study, this process often includes a committee of local decision makers using a qualitative method of scoring each alternative based on the information and analysis that is presented. The five alternatives went through an evaluation process in collaboration with the stakeholder committee made up of WSDOT and local jurisdiction staff. The study team considered the analysis and data collection in developing the four criteria for measuring each of the alternatives in the evaluation process. The four criteria are Improves safety, Improves operations, Constructability/Cost and Multimodal. The team presented the suggested criteria and methodology for scoring the alternatives to the stakeholder committee members for consideration and no additional criteria was proposed. The method for scoring the five alternatives is shown in Table 9. The highest number of points each alternative can receive for each chosen criteria is 25, and the total number of points an alternative can earn is 100.

Table 9 – Evaluation Criteria Point System

| Improves Safety ¹ (Net Reduction of injury crashes) | Improves Operations | Constructability/ Cost | Multimodal |
|--|--|---|--|
| 2.45 – 3.2 = 25 points 1.7 – 2.45 = 18 points 0.95 – 1.7 = 12 points 0. – 0.95 = 6 points | LOS A / LOS B = 25 points LOS C = 20 points LOS D = 15 points LOS E = 10 points LOS F = 5 points | < \$1m = 25 points \$1m - \$5m = 20 points \$5m - \$10m = 10 points > \$10m = 0 points | All Modes = 25 points Less Attractive = 15 points Restrictive = 0 points |

Table 10 is a display of information arranged by alternative and based upon the data and analysis collected. The three criteria: Improves Safety, Improves Operations and Constructability / Cost were developed based upon quantitative analysis and data. The information under the criteria of Multimodal was developed using a qualitative approach, capturing the diverse transportation experience of stakeholder committee members.

Table 10 - Alternatives and Criteria Information

| Alternative | Improves Safety ¹ | Improves Operations (2036 PM LOS) | Constructability/Cost (PLCE 2012 Dollars) | Multimodal |
|--|------------------------------|-----------------------------------|---|-----------------|
| Speed Reduction/Signage Scenarios | 0.2 | F | \$ 75,000 | All Modes |
| 2 Roundabouts (Phillips & Mayvolt/Lake Valley) & Right-in/Right-out only at Long Lake Road | 3.2 | D | \$ 7,190,000 | Restricting |
| SR 160/Long Lake Road Roundabout | 1.1 | B | \$ 4,646,000 | All Modes |
| SR 160/Long Lake Road Signal | 0.6 | D | \$ 3,205,000 | All Modes |
| Construct a bridge on Long Lake Road with Ramps | 1.4 | C | \$ 45,236,000 | Less Attractive |

¹ Under 23 U.S. Code § 409, safety data, reports, surveys, schedules, lists compiled or collected for the purpose of identifying, evaluating, or planning the safety enhancement of potential crash sites, hazardous roadway conditions, or railway-highway crossings are not subject to discovery or admitted into evidence in a Federal or State court proceeding or considered for other purposes in any action for damages arising from any occurrence at a location mentioned or addressed in such reports, surveys, schedules, lists, or data.

The final score each alternative received is shown in Table 11. The SR 160 / Long Lake Road Roundabout alternative earned the highest score with 82 points total. A signal at SR 160 and Long Lake Road was the next highest with a total score of 66 points. In discussing the score each alternative received with the stakeholder committee, members agreed a roundabout at Long Lake Road and SR 160 is the best option for improving safety at the intersection. The option to build two roundabouts (Phillips Road and Mayvolt/Lake Valley Road) and restrict left turn movements at the Long Lake Road intersection scored higher for the “Improves Safety” criteria while scoring low in the other categories. The committee’s view is it restricts movement of the different travel modes such as transit and bicyclists traveling northbound and southbound on Long Lake Road. Another concern about the two roundabout option is additional travel time for drivers forced to travel a longer distance to a roundabout to make U-turns. For this reason, “Improves Operations” received a lower score for the two roundabouts alternative.

Table 11 - Alternatives Scoring Results

| Alternative | Improves Safety | Improves Operations (2036 PM LOS) | Constructability (PLCE 2012 Dollars) | Multimodal | |
|--|-----------------|-----------------------------------|--------------------------------------|------------|--------------|
| | | | | | TOTAL |
| Speed Reduction/Signage Scenarios | 6 | 5 | 25 | 15 | 51 |
| 2 Roundabouts (Phillips & Mayvolt/Lake Valley) & Right-in/Right-out only at Long Lake Road | 25 | 5 | 10 | 0 | 40 |
| SR 160/Long Lake Road Roundabout | 12 | 25 | 20 | 25 | 82 |
| SR 160/Long Lake Road Signal | 6 | 15 | 20 | 25 | 66 |
| Construct a bridge on Long Lake Road with Ramps | 12 | 20 | 0 | 15 | 47 |

Under 23 U.S. Code § 409, safety data, reports, surveys, schedules, lists compiled or collected for the purpose of identifying, evaluating, or planning the safety enhancement of potential crash sites, hazardous roadway conditions, or railway-highway crossings are not subject to discovery or admitted into evidence in a Federal or State court proceeding or considered for other purposes in any action for damages arising from any occurrence at a location mentioned or addressed in such reports, surveys, schedules, lists, or data.

Based on the traffic and safety analyses, the evaluation and the criteria based scoring of the five alternatives, the SR 160 and Long Lake Road Roundabout alternative ranked the highest out of the five alternatives.

Community Engagement

Chapter 4 – Community Engagement

A key component of the SR 160 Long Lake Road Study was to gather input from local agencies, community members and commuters who travel the route. This ensured the study addressed the concerns that are of particular importance to the surrounding community and local partners. Information was exchanged through two primary ways; engaging a stakeholder committee of local jurisdiction technical experts, and holding public meetings in the community. Some additional methods for sharing information and gathering ideas included postings on the project webpage and distributing information through a variety of social media outlets.

4.1 How the Stakeholder Committee Participated in the Study

WSDOT staff conducted the SR 160 Long Lake Road SE Study in coordination with Kitsap County, Kitsap Transit, the U.S. Navy and the Suquamish Tribe. Two stakeholder committee meetings were held in Port Orchard, on May 17 and August 15 of 2017. Appendix B contains additional information about the stakeholder committee meetings.

Meeting 1

During the first stakeholder committee meeting, the WSDOT study team along with committee members developed the study goals, objectives and a needs statement.

Study Goals

The goal of the study is to identify solutions that reduce or eliminate the fatal and serious injury crashes at the intersection of SR 160 and Long Lake Road SE, while preserving the needs of the intersection.

Study Objectives

The study will engage local transportation partners and the community to gather information to identify and recommend suitable solutions that meet transportation and safety needs for travelers.

Study Needs Statement

SR 160 and Long Lake Road SE is an at-grade two-way stop intersection that is experiencing a number of severe injury crashes. The need of the study is to develop potential solutions to improve the safety at the intersection in a way that will balance

local and regional needs while also managing highway performance.

WSDOT shared information about the study background, environmental conditions, existing traffic and crash history data. Three preliminary ideas were presented to the committee for consideration to discuss and brainstorm possible additional alternatives.

Preliminary Alternatives –

- ∞ SR 160 and Long Lake Road Roundabout
- ∞ SR 160 and Long Lake Road Traffic Signal
- ∞ Two Roundabouts (Phillips & Mayvolt Roads) with Right-in/Right-out only at Long Lake Road

There was some concern expressed about the preliminary alternative to build two roundabouts and limit the turn movements into and out of SR 160 and Long Lake Road SE. Preventing turning movements is not always a popular choice with local communities, especially if it increases travel time for commuters. The stakeholder committee did not propose additional alternatives, because they anticipated other ideas would develop through the public process.

Meeting 2

Following the public meeting in May, the study team added two potential alternatives from comments submitted by local community members who attended.

Additional Alternatives for Consideration –

- ∞ Speed reduction with warning signage
- ∞ Long Lake Road bridge over SR 160 with ramps

The stakeholder committee met to discuss additional alternatives, the traffic and safety analyses results, the evaluation criteria and methodology for evaluating the alternatives and a recommended alternative.

The four criteria used for scoring the alternatives are Improves Safety, Improves Traffic Operations, Multimodal and Constructability/Cost. Once the criteria and the methodology for scoring was established, the committee chose the appropriate score to give each alternative under each of the four categories. Stakeholder committee members discussed

the scoring results and unanimously agreed the top scoring SR 160/Long Lake Road Roundabout alternative is the recommended option.

4.2 What We Heard from the Community

WSDOT held public meetings for the SR 160 Long Lake Road Study in May and in September of 2017. A summary of the feedback received through the community events is presented below. Additional information about the study's community engagement events is in Appendix C.

Public Meeting 1

On May 23, 2017, the study team held a Community Open House at the Long Lake Community Center in Port Orchard. Team members presented information to approximately 25 community members about the scope and schedule of the study, the highway existing conditions, key safety issues and some proposed alternatives for improving safety at the intersection of SR 160 and Long Lake Road. Community members provided feedback through conversations with staff, comment forms available at the meeting and by email throughout the course of the study. The comments the study team received are grouped into four categories: community safety concerns, community operations concerns, community suggested improvements, and community concerns about proposed improvements.

Community Safety Concerns

- Making left turns onto and off of SR 160 at the Long Lake Road intersection
- Icy road conditions cause difficulty due to stopping on the hill
- Trucks accelerating and decelerating on a steep grade
- Visibility issues at the north east corner of the Long Lake Road intersection
- Speeding from westbound traffic coming over the hill

Community Operations Concerns

- Traffic coming to/from the Ferry causes congestion and difficulty crossing SR 160
- Suggest reducing the speed limit

WSDOT
Public Meeting
SR 160 (SEDGWICK ROAD) LONG LAKE ROAD SE PLANNING STUDY

No form of presentation will occur, and participants are free to come and go at their leisure.

PUBLIC MEETING INFORMATION

WHEN:
4-6:30 p.m., Tuesday May 23

WHERE:
Long Lake Community Center,
5100 Long Lake Road SE,
Port Orchard

Comments, questions, and questions are invited to share and explore ideas for potential improvements at the intersection of state route 160 (sedgwick road) and long lake road.

The Washington State Department of Transportation will host a public meeting in Port Orchard to discuss ways to help reduce the potential for crashes at the Long Lake Road intersection. Possible information and concerns will be available for viewing by the public. WSDOT is seeking comments on how to better the safety of the concerns should be investigated. For more information, visit www.wsdot.wa.gov/planning/studies/sr160-long-lake-road-se-planning-study.

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- Drivers wait several minutes to turn onto the highway

Community Concerns about Proposed Improvements

- Concern with vehicles slowing or stopping at roundabout or signal during icy road conditions
- Restricting turns at Long Lake Road will cause additional travel time to turn around at roundabouts
- Is a roundabout at Long Lake Road feasible with the steep grades
- Stopping or starting at a signal with steep grades will be difficult, especially for truck traffic
- Traffic light will cause gridlock like other lights on SR 160

Community Suggested Improvements

- Make an overpass over Long Lake Road with on/off ramps to access SR 160
- Add slip lanes to the roundabout improvement
- Lower the speed limit to slow down traffic and add warning lights
- Add right turn lanes to Long Lake Road
- Add a roundabout at Lakeview Drive instead of Mayvolt Road

The feedback received from public meeting 1 was carefully considered in the process of identifying potential improvements that meet the needs statement. The study team chose to add two improvements to the list of potential alternatives, which are reduce speed limit with warning signs and build a bridge on Long Lake Road with ramps to SR 160.

Overall, attendees appreciated WSDOT's efforts to address the safety concerns at SR 160 and Long Lake Road and were mostly supportive of a signal or a roundabout at Long Lake Road. There was little support for the two roundabouts with limiting turn movements at Long Lake Road alternative.

Public Meeting 2

On September 11, 2017, the study team held a second Community Open House at the Long Lake Community Center in Port Orchard. There were approximately 20 community members in attendance at the meeting. Team members presented the findings of the safety and traffic analyses (described in Chapter 3), the alternatives scoring process and the recommended alternative. The notable concerns and suggestions the study team received during the second open house meeting are summarized below.

Overall, attendees appreciated that the safety concerns at the SR 160 and Long Lake Road intersection were being studied, and they were supportive of a roundabout. The following bullets were the comments about the recommended alternative:

- Roundabout needs 2 lanes to allow for future growth in the area
- The roundabout needs to be 2 lanes to accommodate larger vehicles like buses and trucks

In reviewing feedback from the second open house meeting, the community members provided the following comments that were more general in nature relating to the highway corridor.

- Adding lanes on SR 160 would help with heavy vehicle slowdowns uphill
- Center turn lane on SR 160 in the study limits will help vehicles turning into and out of driveways and minor roads
- Concerned with snow and ice on roadway mixed with vehicles stopping and slowing on steep incline and decline
- Sight distance issues on the north leg of SR 160 and Long Lake Road

The comments that the study team received from the community during the public meetings helped to shape the proposed alternatives, which were analyzed and evaluated as part of the study process.

WSDOT

SR 160 (Sedgwick Road) Long Lake Road SE Planning Study

State Route 160 (Sedgwick Road) is an important east-west connection that provides primary access between State Route 16 and the Southworth Ferry. SR 160 also serves local drivers, and regional commuters. WSDOT is studying SR 160 between Phillips Road and Mayvolt Road Southeast/Lake Valley Road Southeast. The purpose of this study is to identify solutions that reduce fatal and serious injury crashes at the intersection of SR 160 and Long Lake Road SE.

Working with local stakeholders, and hearing from the community, WSDOT has examined five potential alternatives for this intersection:

1. Roundabout at intersection of SR 160 and Long Lake Road Southeast.
2. Roundabouts at the intersection of SR 160 and Phillips Road and the intersection of SR 160 and Mayvolt Road Southeast/Lake Valley Road Southeast. In addition, the intersection of SR 160 and Long Lake Road Southeast would limit traffic to right-in and right-out only.
3. New traffic signal at the intersection of SR 160 and Long Lake Road Southeast.
4. Construct bridge over SR 160 with ramps.
5. Speed limit reduction.

The alternatives have been evaluated and a roundabout at SR 160 and Long Lake Road is the recommended improvement.

Next Steps

The study team will develop a report (expected Fall 2017), and the recommended alternative will be presented to the WSDOT Highway Safety Executive Committee.

For More Information

www.wsdot.wa.gov/planning/studies/sr-160-long-lake-rd-se-planning-study

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Final Recommendations
And
Next Steps

Chapter 5 – Final Recommendations and Next Steps

5.1 What is the Final Recommendation

The need of the study was to develop potential solutions to improve the safety at SR 160 and Long Lake Road Southeast intersection. Five possible alternatives were developed, analyzed and evaluated through the study process. This process included safety and traffic volume analyses, reviewing environmental resources, developing planning level cost estimates, multimodal opportunities, and local agency and public engagement to determine the recommended alternative. Based on the information collected throughout the study process, constructing a single-lane roundabout at the intersection of SR 160 and Long Lake Road Southeast is the recommended alternative. Anticipated transit accommodations near the recommended roundabout may be considered as part of the design process.

Planning Level Cost Estimates (PLCE) were developed for each of the five proposed alternatives. Conceptual information about the alternatives was entered into the cost-estimating tool to generate a cost for each alternative. The cost of the recommended alternative, a single-lane roundabout at the intersection of SR 160 and Long Lake Road Southeast is \$4.6 million dollars. However, additional preliminary engineering work was done on this preferred alternative and a refined cost estimate of \$1.5 to \$2 million was determined.

Some of the key benefits of the recommended alternative are:

- Reduces the number and severity of injury crashes at the intersection by slowing traffic coming into and out of the roundabout.
- Improves safety for bicycle and pedestrian crossings at the intersection.
- Designed for all vehicles types including trucks and buses.
- Supports future transit routes that serve area residents.
- Provides a balanced flow between the mainline and side street with the least amount of delay.

5.2 What additional work has been done

Additional work on the recommended alternative has begun. An engineering roadway profile and a scoping level cost estimate was developed. The profiles give a vertical layout of the roadway and captures

the existing slopes of the road. The profile aided in refining the cost estimate for the single-lane roundabout, as shown in the conceptual drawing (Figure 9). Additional information about the profiles and cost estimates is in Appendix D. The cost of the recommended alternative is \$1.5 to \$2 million dollars. The assumptions used in the refined estimate include:

- Long Lake Road SE using much of the existing vertical profile.
- An adjustment to the profile of SR 160 to tie in closer to the roundabout.
- The roundabout material in the estimate is Hot Mix Asphalt.
- The roundabout size and shape would be an oval shape and 120' by 100' in diameter to accommodate the three existing power poles at the intersection.
- Constructing a low wall in the southwest corner of the intersection.

Figure 7 – SR 160 & Long Lake Road Conceptual Roundabout



5.3 What are the Next Steps

The SR 160 Long Lake Road Study began as a process for addressing the injury crashes at the intersection. The WSDOT Highway Safety Improvement Program is an important part of Washington State's Target Zero goal to reduce fatalities and serious injury crashes using a data driven approach. The next step in moving toward project design and construction is to present the information from this study to the WSDOT I2 Safety Panel. Following the I2 Safety Panel meeting, it is anticipated the project will compete with other similar projects statewide for funding.

Appendices

Safety and Traffic Operations Analyses

Appendix A – Safety and Traffic Operations Analyses

Safety Analysis

HSM Analysis (Expected Crashes per year)

| | Fatal & Injury | PDO | Total |
|---------------|----------------|----------|-------------|
| Long Lake Rd. | 1.4 | 2.1 | 3.5 |
| Phillips Rd. | 2.3 | 3.4 | 5.7 |
| Mayvolt Rd. | 0.4 | 0.5 | 0.9 |
| Total | 4.1 | 6 | 10.1 |

CMFs

| | |
|--------------------------|--|
| Roundabout | 0.22 Fatal and Injury Crashes 0.61 all crashes/all severity |
| Signal | 0.6 Fatal and Injury Crashes 0.66 all crashes/all severity |
| Dynamic Feed Back | 0.95 all crashes/all severity |
| Long Lake Access Control | 0.25 all crashes/all severity |

Of the 21 crashes, 3 crashes involved vehicles that were making movements that would still be allowed under the access management option. That comes to a 0.14 CMF - to be conservative I rounded up to 0.25 (this is assuming some illegal turns might happen)

Crash Reductions

Roundabout at Phillips and Mayvolt Option

| Fatal & Injury | Crashes | | |
|----------------|------------|------|-------------------|
| | Crashes | CMF | After Improvement |
| Long Lake Rd. | 1.4 | 0.25 | 0.35 |
| Phillips Rd. | 2.3 | 0.22 | 0.506 |
| Mayvolt Rd. | 0.4 | 0.22 | 0.088 |
| Total | 4.1 | | 0.944 |

Net Reduction 3.2 F & I Crashes per year

| Total Crashes (F&I and PDO) | Crashes | | |
|-----------------------------|-------------|------|-------------------|
| | Crashes | CMF | After Improvement |
| Long Lake Rd. | 3.5 | 0.25 | 0.875 |
| Phillips Rd. | 5.7 | 0.61 | 3.477 |
| Mayvolt Rd. | 0.9 | 0.61 | 0.549 |
| Total | 10.1 | | 4.901 |

Net Reduction 5.2 Crashes per year

Long Lake Signal Option

| Fatal & Injury | Crashes | | |
|----------------|---------|-----|-------------------|
| | Crashes | CMF | After Improvement |
| Long Lake Rd. | 1.4 | 0.6 | 0.84 |

Net Reduction 0.6 Crashes per year

| Total Crashes (F&I and PDO) | Crashes | | |
|-----------------------------|---------|------|-------------------|
| | Crashes | CMF | After Improvement |
| Long Lake Rd. | 3.5 | 0.66 | 2.31 |

Net Reduction 1.2 Crashes per year

Long Lake Roundabout

| Fatal & Injury | Crashes | CMF | Crashes |
|----------------|---------|------|-------------------|
| | | | After Improvement |
| Long Lake Rd. | 1.4 | 0.22 | 0.308 |

Net Reduction 1.1 Crashes per year

Total Crashes (F&I and PDO)

| | Crashes | CMF | Crashes |
|---------------|---------|------|-------------------|
| | | | After Improvement |
| Long Lake Rd. | 3.5 | 0.61 | 2.135 |

Net Reduction 1.4 Crashes per year

Dynamic Speed Feed Back Sign

| Fatal & Injury | Crashes | CMF | Crashes |
|----------------|---------|------|-------------------|
| | | | After Improvement |
| Long Lake Rd. | 1.4 | 0.95 | 1.33 |
| Phillips Rd. | 2.3 | 0.95 | 2.185 |
| Mayvolt Rd. | 0.4 | 0.95 | 0.38 |
| Total | 4.1 | | 3.895 |

Net Reduction 0.2 Crashes per year

Total Crashes (F&I and PDO)

| | Crashes | CMF | Crashes |
|---------------|---------|------|-------------------|
| | | | After Improvement |
| Long Lake Rd. | 3.5 | 0.95 | 3.325 |
| Phillips Rd. | 5.7 | 0.95 | 5.415 |
| Mayvolt Rd. | 0.9 | 0.95 | 0.855 |
| Total | 10.1 | | 9.595 |

Net Reduction 0.5 Crashes per year

Summary

Crash Reduction (crashes per year)

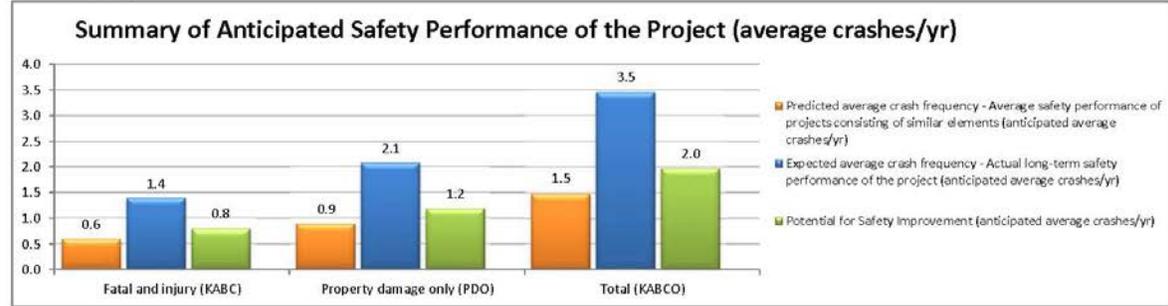
| | F&I Crashes | All Crashes |
|------------------------------|-------------|-------------|
| 2 RAB Option | 3.2 | 5.2 |
| Long Lake Signal | 0.6 | 1.2 |
| Long Lake Roundabout | 1.1 | 1.4 |
| Dynamic Speed Feed Back Sign | 0.2 | 0.5 |

PROJECT SAFETY PERFORMANCE SUMMARY REPORT

General Information

| | | |
|---------------------|----------------------|---|
| Project Name | Long Lake Rd | |
| Project Description | HSM analysis - urban | |
| Reference Number | SR 160 at Phillips | |
| Analyst | DNP | |
| Agency/Company | WSDOT | |
| Contact Email | email | |
| Contact Phone | (123) 456-7891 | |
| Date Completed | 05/12/11 | Years of crash data incorporated into the analysis: 5 |

PROJECT SUMMARY



| Project Element | Total Crashes/yr (KABCO) | | | Fatal and Injury Crashes/yr (KABC) | | | Property Damage Only Crashes/yr (PDO) | | |
|---------------------------------|-----------------------------------|----------------------------------|---------------------------|------------------------------------|----------------------------------|---------------------------|---------------------------------------|----------------------------------|---------------------------|
| | Predicted average crash frequency | Expected average crash frequency | Potential for Improvement | Predicted average crash frequency | Expected average crash frequency | Potential for Improvement | Predicted average crash frequency | Expected average crash frequency | Potential for Improvement |
| | N _{predicted} (KABCO) | N _{expected} (KABCO) | | N _{predicted} (KABC) | N _{expected} (KABC) | | N _{predicted} (PDO) | N _{expected} (PDO) | |
| INDIVIDUAL INTERSECTIONS | | | | | | | | | |
| Intersection 1 | 1.5 | 3.5 | 2.0 | 0.6 | 1.4 | 0.8 | 0.9 | 2.1 | 1.2 |
| COMBINED (sum of column) | 1.5 | 3.5 | 2.0 | 0.6 | 1.4 | 0.8 | 0.9 | 2.1 | 1.2 |

PROJECT SUMMARY -- Site-Specific EB Method Summary Results for Urban and Suburban Arterial Project

| Crash severity level | N _{predicted} (PROJECT) | N _{expected} (PROJECT) | N _{potential for improvement} (PROJECT) |
|----------------------------|--|--|---|
| | Predicted average crash frequency - Average safety performance of projects consisting of similar elements (anticipated average crashes/yr) | Expected average crash frequency - Actual long-term safety performance of the project (anticipated average crashes/yr) | Potential for Safety Improvement (anticipated average crashes/yr) |
| Fatal and injury (KABC) | 0.6 | 1.4 | 0.8 |
| Property damage only (PDO) | 0.9 | 2.1 | 1.2 |
| Total (KABCO) | 1.5 | 3.5 | 2.0 |

HSM1 Extended Spreadsheet for Part C Chapter 12 v.9

Discussion of Results

Given the potential effects of project characteristics on safety performance, results indicate that:

1. It is anticipated that the project will, on average, experience 3.5 crashes per year (1.4 fatal and injury crashes per year; and 2.1 property damage only crashes per year).
2. A similar project is anticipated, on average, to experience 1.5 crashes per year (0.6 fatal and injury crashes per year; and 0.9 property damage only crashes per year).
3. It is anticipated the project has, on average, a potential for safety improvement of 2 crashes per year (0.8 fatal and injury crashes per year; and 1.2 property damage only crashes per year).

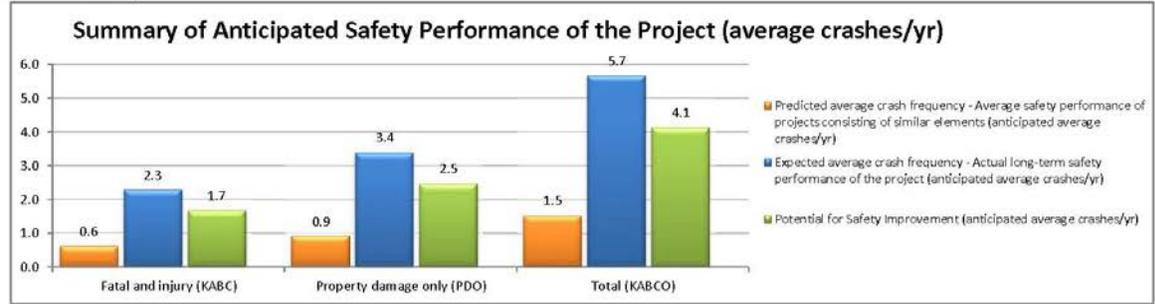
Federal law 23 USC § 409 prohibits the discovery or admission into evidence of "reports, surveys, schedules, lists, or data" compiled or collected for the purpose of highway safety improvement projects that might qualify for federal safety improvement funding.

PROJECT SAFETY PERFORMANCE SUMMARY REPORT

General Information

| | | |
|---------------------|----------------------|---|
| Project Name | Phillips Rd | |
| Project Description | HSM analysis - urban | |
| Reference Number | SR 160 at Phillips | |
| Analyst | DNP | |
| Agency/Company | WSDOT | |
| Contact Email | email | |
| Contact Phone | (123) 456-7891 | |
| Date Completed | 05/12/11 | Years of crash data incorporated into the analysis: 5 |

PROJECT SUMMARY



| Project Element | Total Crashes/yr (KABCO) | | | Fatal and Injury Crashes/yr (KABC) | | | Property Damage Only Crashes/yr (PDO) | | |
|---------------------------------|-----------------------------------|----------------------------------|---------------------------|------------------------------------|----------------------------------|---------------------------|---------------------------------------|----------------------------------|---------------------------|
| | Predicted average crash frequency | Expected average crash frequency | Potential for Improvement | Predicted average crash frequency | Expected average crash frequency | Potential for Improvement | Predicted average crash frequency | Expected average crash frequency | Potential for Improvement |
| | N _{predicted (KABCO)} | N _{expected (KABCO)} | | N _{predicted (KABC)} | N _{expected (KABC)} | | N _{predicted (PDO)} | N _{expected (PDO)} | |
| INDIVIDUAL INTERSECTIONS | | | | | | | | | |
| Intersection 1 | 1.5 | 5.7 | 4.1 | 0.6 | 2.3 | 1.7 | 0.9 | 3.4 | 2.5 |
| COMBINED (sum of column) | 1.5 | 5.7 | 4.1 | 0.6 | 2.3 | 1.7 | 0.9 | 3.4 | 2.5 |

PROJECT SUMMARY -- Site-Specific EB Method Summary Results for Urban and Suburban Arterial Project

| Crash severity level | N _{predicted (PROJECT)} | N _{expected (PROJECT)} | N _{potential for improvement (PROJECT)} |
|----------------------------|--|--|---|
| | Predicted average crash frequency - Average safety performance of projects consisting of similar elements (anticipated average crashes/yr) | Expected average crash frequency - Actual long-term safety performance of the project (anticipated average crashes/yr) | Potential for Safety Improvement (anticipated average crashes/yr) |
| Fatal and injury (KABC) | 0.6 | 2.3 | 1.7 |
| Property damage only (PDO) | 0.9 | 3.4 | 2.5 |
| Total (KABCO) | 1.5 | 5.7 | 4.1 |

HSM1 Extended Spreadsheet for Part C Chapter 12 v.9

Discussion of Results

Given the potential effects of project characteristics on safety performance, results indicate that:

1. It is anticipated that the project will, on average, experience 5.7 crashes per year (2.3 fatal and injury crashes per year; and 3.4 property damage only crashes per year).
2. A similar project is anticipated, on average, to experience 1.5 crashes per year (0.6 fatal and injury crashes per year; and 0.9 property damage only crashes per year).
3. It is anticipated the project has, on average, a potential for safety improvement of 4.1 crashes per year (1.7 fatal and injury crashes per year; and 2.5 property damage only crashes per year).

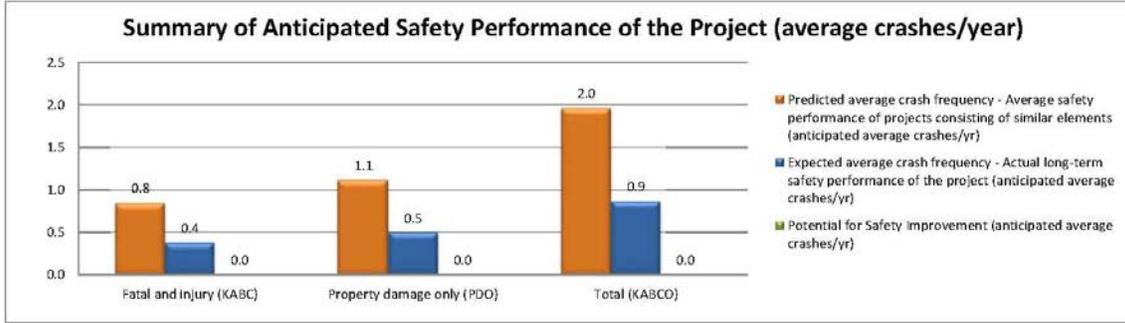
Federal law 23 USC § 409 prohibits the discovery or admission into evidence of "reports, surveys, schedules, lists, or data" compiled or collected for the purpose of highway safety improvement projects that might qualify for federal safety improvement funding.

PROJECT SAFETY PERFORMANCE SUMMARY REPORT

General Information

| | | |
|---------------------|----------------------|---|
| Project Name | Lake Valley | |
| Project Description | HSM analysis | |
| Reference Number | Route & Project Name | |
| Analyst | DNP | |
| Agency/Company | WSDOT | |
| Contact Email | Email | |
| Contact Phone | (123) 456-7891 | |
| Date Completed | 08/15/16 | Years of crash data incorporated into the analysis: 5 |

PROJECT SUMMARY



| Project Element | Total Crashes/yr (KABCO) | | | Fatal and Injury Crashes/yr (KABC) | | | Property Damage Only Crashes/yr (PDO) | | |
|---------------------------------|-----------------------------------|----------------------------------|---------------------------|------------------------------------|----------------------------------|---------------------------|---------------------------------------|----------------------------------|---------------------------|
| | Predicted average crash frequency | Expected average crash frequency | Potential for Improvement | Predicted average crash frequency | Expected average crash frequency | Potential for Improvement | Predicted average crash frequency | Expected average crash frequency | Potential for Improvement |
| | N _{predicted} (KABCO) | N _{expected} (KABCO) | | N _{predicted} (KABC) | N _{expected} (KABC) | | N _{predicted} (PDO) | N _{expected} (PDO) | |
| INDIVIDUAL INTERSECTIONS | | | | | | | | | |
| Intersection 1 | 2.0 | 0.9 | 0.0 | 0.8 | 0.4 | 0.0 | 1.1 | 0.5 | 0.0 |
| COMBINED (sum of column) | 2.0 | 0.9 | 0.0 | 0.8 | 0.4 | 0.0 | 1.1 | 0.5 | 0.0 |

PROJECT SUMMARY -- Site-Specific EB Method Summary Results for Rural 2-Lane Roads

| Crash severity level | N _{predicted} (PROJECT) | N _{expected} (PROJECT) | N _{potential for improvement} (PROJECT) |
|----------------------------|--|--|---|
| | Predicted average crash frequency - Average safety performance of projects consisting of similar elements (anticipated average crashes/yr) | Expected average crash frequency - Actual long-term safety performance of the project (anticipated average crashes/yr) | Potential for Safety Improvement (anticipated average crashes/yr) |
| Fatal and injury (KABC) | 0.8 | 0.4 | N/A |
| Property damage only (PDO) | 1.1 | 0.5 | N/A |
| Total (KABCO) | 2.0 | 0.9 | N/A |

HSM1 Extended Spreadsheet for Part C Chapter 10 v.9.1

Discussion of Results

Given the potential effects of project characteristics on safety performance, results indicate that:

1. It is anticipated that the project will, on average, experience 0.9 crashes per year (0.4 fatal and injury crashes per year; and 0.5 property damage only crashes per year).
2. A similar project is anticipated, on average, to experience 2 crashes per year (0.8 fatal and injury crashes per year; and 1.1 property damage only crashes per year).

#VALUE!

Federal law 23 USC § 409 prohibits the discovery or admission into evidence of "reports, surveys, schedules, lists, or data" compiled or collected for the purpose of highway safety improvement projects that might qualify for federal safety improvement funding.



State Route: 160
Milepost: 2.07
Location: PHILLIPS ROAD SE

Date = 4/13,2017
Time Start = 11:30 AM
Time End = 12:30 PM
Weather = Clouds
Observer = ZUBB

Direction = Inc milepost

Speed Limit = 45 mph

Recorded Speed
Minimum = 33 mph
Maximum = 57 mph

Observations = 324 vehicles

| Speed (Xi) | Frequency (Fi) | (Fi*Xi) | Cumulative Total | Cumulative % |
|------------|----------------|---------|------------------|--------------|
| 33 | 4 | 132 | 4 | 1.2 |
| 34 | 3 | 102 | 7 | 2.2 |
| 35 | 3 | 105 | 10 | 3.1 |
| 36 | 3 | 108 | 13 | 4.0 |
| 37 | 5 | 185 | 18 | 5.6 |
| 38 | 8 | 304 | 26 | 8.0 |
| 39 | 10 | 390 | 36 | 11.1 |
| 40 | 21 | 840 | 57 | 17.6 |
| 41 | 14 | 574 | 71 | 21.9 |
| 42 | 33 | 1386 | 104 | 32.1 |
| 43 | 29 | 1247 | 133 | 41.0 |
| 44 | 32 | 1408 | 165 | 50.9 |
| 45 | 40 | 1800 | 205 | 63.3 |
| 46 | 23 | 1058 | 228 | 70.4 |
| 47 | 33 | 1551 | 261 | 80.6 |
| 48 | 16 | 768 | 277 | 85.5 |
| 49 | 12 | 588 | 289 | 89.2 |
| 50 | 13 | 650 | 302 | 93.2 |
| 51 | 6 | 306 | 308 | 95.1 |
| 52 | 3 | 156 | 311 | 96.0 |
| 53 | 6 | 318 | 317 | 97.8 |
| 54 | 2 | 108 | 319 | 98.5 |
| 55 | 2 | 110 | 321 | 99.1 |
| 56 | 2 | 112 | 323 | 99.7 |
| 57 | 1 | 57 | 324 | 100.0 |
| 0 | 0 | 0 | 324 | 100.0 |
| 0 | 0 | 0 | 324 | 100.0 |
| 0 | 0 | 0 | 324 | 100.0 |
| 0 | 0 | 0 | 324 | 100.0 |
| Total = | | 14363 | 324 | |

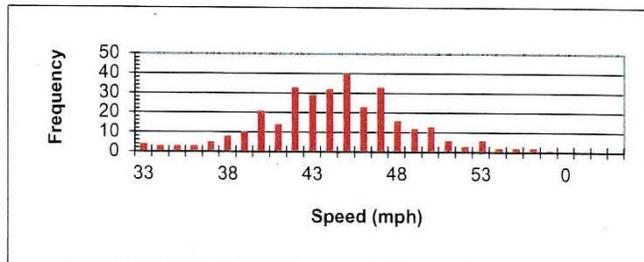
RESULTS

| Percentile (%) | Speed (mph) |
|----------------|-----------------|
| 10th = | 38.6 |
| 15th = | 39.6 |
| 50th = | 43.9 |
| 85th = | 47.9 mph |
| 90th = | 49.2 |
| 95th = | 51.0 |

Average Speed = 44.3 mph
Modal Speed = **** See Graph ****

10 MPH Pace
Low = 40 mph
High = 50 mph

Percent in Pace = 82.1 %
Vehicles in Pace = 266



Comments: LOC-E/B SIDE / NO LIGHTS-CONES

Traffic Operations Analysis

| | | 2016 Existing Phillips No Build | | 2016 Existing Long Lake No Build | | 2016 Existing Mayvold No Build | | 2036 Future Phillips Build | | 2036 Future Long Lake Build | | 2036 Future Mayvold Build | | Comments |
|---|--------------------|---------------------------------|----------------------|----------------------------------|----------------------|--------------------------------|-------------------|----------------------------|--------------|-----------------------------|-----------------------|---------------------------|-----------|--|
| | | AM | PM | AM | PM | AM | PM | AM | PM | AM | PM | AM | PM | |
| No Build and Speed Reduction/Signage Scenario | Delay (sec) LOS | | | | | | | >10 min F | >10 min F | 493.3 F | >10 min F | 16.0 C | 28.5 D | Phillips, Long Lake, and Mayvold worst no build delay is the shared Northbound left/thru/right. Exception is Mayvold in the 2036 PM peak where the shared Southbound left/thru/right is worst. |
| 2 Roundabouts (Phillips & Mayvold) | Delay (sec) LOS | | | | | | | 6.8 A | 24.6 C | 19.2 C | 27.4 D | 8.1 A | 9.2 A | Assumed 100% diversion of Long Lake Northbound left and through to Mayvold U-turn and 100% diversion of Long Lake Southbound left and through to Phillips U-turn. |
| Long Lake Rd Roundabout | Delay (sec) LOS | 147.8 and LOS F | >10 min and LOS F | 77.6 and LOS F | >10 min and LOS F | 15.0 and LOS C | 15.2 and LOS C | 10.1 B | 11.9 B | 7.1 A | 12.7 B | 16.0 C | 28.5 D | Assume 50% diversion of Phillips Northbound left and through to Baker with remaining 50% of the Northbound left and through making a right turn at Phillips and U-Turn at Long Lake. Southbound left and through is assumed to be 100% redistribution to Long Lake via Samonberry. |
| Long Lake Rd Signal | Delay (sec) LOS | | | | | | | 10.0 B | 11.7 B | 31.3 C | 53.1 D | 16.0 C | 28.5 D | Assumed 100% diversion of Phillips Northbound left and through to Baker and signal at Long Lake and 100% diversion of Southbound left and through to Salmonberry and signal at Long Lake. |
| Long Lake Road Overpass with Ramps | Delay (sec) LOS | | | | | | | 10.1 B | 11.9 B | 13.3 and 13.3 B | 16.3 and 21.0 C | 16.0 C | 28.5 D | Assumed 100% diversion of minor street left and through movements from Phillips to interchange with Phillips functioning as detracto right-in, right-out, and left-in during peak periods. Delay and LOS is for Westbound and Eastbound off/on ramps |



Olympic Region Traffic Turning Movement Count

Counter:D4-3263
Counted By: Buzz Zubb
Weather: SUN
SR 160 AT LONG LAKE RD SE MP 2.55

File Name : SR 160 AT LONG LAKE RD SE 92116 PM
Site Code : 16092116
Start Date : 9/21/2016
Page No : 1

Groups Printed- CARS - TRUCKS - PEDS

| Start Time | LONG LAKE RD SE From North | | | | | SR 160 SE SEDGWICK RD FROM FERRY TERM From East | | | | | LONG LAKE RD SE From South | | | | | SR 160 SE SEDGWICK RD FROM SR 16 From West | | | | | Int. Total |
|------------|-------------------------------|------|-------|------|------------|---|------|-------|------|------------|-------------------------------|------|-------|------|------------|--|------|-------|------|------------|------------|
| | Left | Thru | Right | Peds | App. Total | Left | Thru | Right | Peds | App. Total | Left | Thru | Right | Peds | App. Total | Left | Thru | Right | Peds | App. Total | |
| 02:00 PM | 0 | 13 | 23 | 0 | 36 | 2 | 45 | 2 | 0 | 49 | 5 | 1 | 1 | 0 | 7 | 34 | 65 | 14 | 0 | 113 | 205 |
| 02:15 PM | 2 | 8 | 23 | 0 | 33 | 0 | 40 | 2 | 0 | 42 | 7 | 7 | 0 | 0 | 14 | 34 | 79 | 16 | 0 | 129 | 218 |
| 02:30 PM | 4 | 6 | 23 | 0 | 33 | 1 | 97 | 3 | 0 | 101 | 9 | 5 | 2 | 0 | 16 | 32 | 90 | 18 | 0 | 140 | 290 |
| 02:45 PM | 5 | 4 | 32 | 0 | 41 | 2 | 88 | 4 | 0 | 94 | 15 | 7 | 0 | 0 | 22 | 36 | 65 | 17 | 0 | 118 | 275 |
| Total | 11 | 31 | 101 | 0 | 143 | 5 | 270 | 11 | 0 | 286 | 36 | 20 | 3 | 0 | 59 | 136 | 299 | 65 | 0 | 500 | 988 |
| 03:00 PM | 5 | 8 | 37 | 0 | 50 | 1 | 59 | 6 | 0 | 66 | 17 | 8 | 1 | 0 | 26 | 36 | 88 | 27 | 0 | 151 | 293 |
| 03:15 PM | 2 | 8 | 26 | 0 | 36 | 2 | 56 | 4 | 0 | 62 | 7 | 8 | 2 | 0 | 17 | 33 | 88 | 19 | 0 | 140 | 255 |
| 03:30 PM | 1 | 2 | 33 | 0 | 36 | 1 | 51 | 1 | 0 | 53 | 14 | 7 | 4 | 0 | 25 | 54 | 81 | 22 | 0 | 157 | 271 |
| 03:45 PM | 3 | 7 | 41 | 0 | 51 | 2 | 60 | 6 | 0 | 68 | 7 | 6 | 2 | 0 | 15 | 46 | 97 | 23 | 0 | 166 | 300 |
| Total | 11 | 25 | 137 | 0 | 173 | 6 | 226 | 17 | 0 | 249 | 45 | 29 | 9 | 0 | 83 | 169 | 354 | 91 | 0 | 614 | 1119 |
| 04:00 PM | 2 | 5 | 34 | 0 | 41 | 2 | 92 | 6 | 0 | 100 | 5 | 10 | 0 | 0 | 15 | 39 | 85 | 17 | 0 | 141 | 297 |
| 04:15 PM | 1 | 8 | 30 | 0 | 39 | 2 | 117 | 10 | 0 | 129 | 10 | 6 | 2 | 0 | 18 | 49 | 86 | 15 | 0 | 150 | 336 |
| 04:30 PM | 2 | 3 | 32 | 0 | 37 | 0 | 57 | 6 | 0 | 63 | 6 | 1 | 0 | 0 | 7 | 55 | 109 | 26 | 0 | 190 | 297 |
| 04:45 PM | 0 | 7 | 28 | 0 | 35 | 6 | 64 | 5 | 0 | 75 | 12 | 6 | 0 | 0 | 18 | 53 | 100 | 35 | 0 | 188 | 316 |
| Total | 5 | 23 | 124 | 0 | 152 | 10 | 330 | 27 | 0 | 367 | 33 | 23 | 2 | 0 | 58 | 196 | 380 | 93 | 0 | 669 | 1246 |
| 05:00 PM | 5 | 10 | 42 | 0 | 57 | 3 | 138 | 13 | 0 | 154 | 11 | 10 | 1 | 0 | 22 | 52 | 80 | 24 | 0 | 156 | 389 |
| 05:15 PM | 0 | 6 | 44 | 0 | 50 | 1 | 95 | 6 | 0 | 102 | 19 | 14 | 3 | 0 | 36 | 50 | 105 | 22 | 0 | 177 | 365 |
| 05:30 PM | 1 | 1 | 31 | 0 | 33 | 0 | 75 | 2 | 0 | 77 | 12 | 9 | 3 | 0 | 24 | 49 | 83 | 23 | 0 | 155 | 289 |
| 05:45 PM | 2 | 3 | 21 | 0 | 26 | 1 | 62 | 2 | 0 | 65 | 6 | 7 | 0 | 0 | 13 | 48 | 75 | 33 | 0 | 156 | 260 |
| Total | 8 | 20 | 138 | 0 | 166 | 5 | 370 | 23 | 0 | 398 | 48 | 40 | 7 | 0 | 95 | 199 | 343 | 102 | 0 | 644 | 1303 |



Olympic Region Traffic Turning Movement Count

Counter:D4-3263
Counted By: Buzz Zubb
Weather: SUN
SR 160 AT LONG LAKE RD SE MP 2.55

File Name : SR 160 AT LONG LAKE RD SE 92116 PM
Site Code : 16092116
Start Date : 9/21/2016
Page No : 2

Groups Printed- CARS - TRUCKS - PEDS

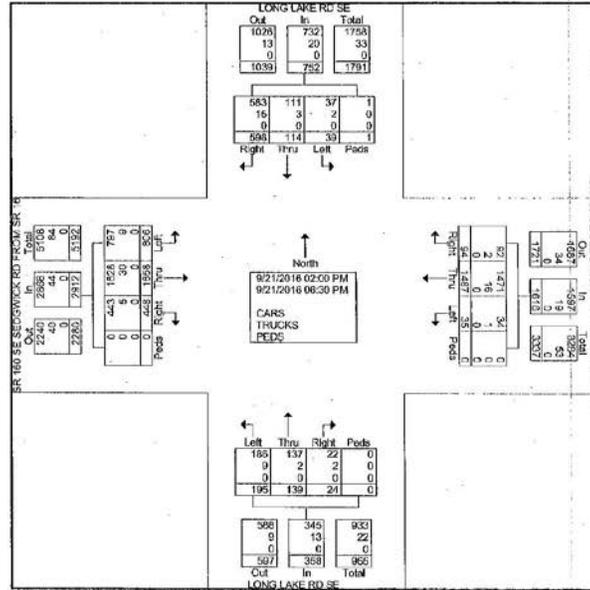
| Start Time | LONG LAKE RD SE From North | | | | | SR 160 SE SEDGWICK RD FROM FERRY TERM From East | | | | | LONG LAKE RD SE From South | | | | | SR 160 SE SEDGWICK RD FROM SR 16 From West | | | | | Int. Total |
|-------------|-------------------------------|------|-------|------|------------|---|------|-------|------|------------|-------------------------------|------|-------|------|------------|--|------|-------|------|------------|------------|
| | Left | Thru | Right | Peds | App. Total | Left | Thru | Right | Peds | App. Total | Left | Thru | Right | Peds | App. Total | Left | Thru | Right | Peds | App. Total | |
| 06:00 PM | 0 | 1 | 37 | 0 | 38 | 3 | 119 | 6 | 0 | 128 | 15 | 5 | 1 | 0 | 21 | 34 | 89 | 30 | 0 | 153 | 340 |
| 06:15 PM | 2 | 6 | 36 | 1 | 45 | 1 | 64 | 2 | 0 | 67 | 8 | 14 | 0 | 0 | 22 | 48 | 96 | 28 | 0 | 172 | 306 |
| 06:30 PM | 2 | 8 | 25 | 0 | 35 | 5 | 108 | 8 | 0 | 121 | 10 | 8 | 2 | 0 | 20 | 24 | 97 | 39 | 0 | 160 | 336 |
| Grand Total | 39 | 114 | 598 | 1 | 752 | 35 | 1487 | 94 | 0 | 1616 | 195 | 139 | 24 | 0 | 358 | 806 | 1658 | 448 | 0 | 2912 | 5638 |
| Approch % | 5.2 | 15.2 | 79.5 | 0.1 | | 2.2 | 92 | 5.8 | 0 | | 54.5 | 38.8 | 6.7 | 0 | | 27.7 | 56.9 | 15.4 | 0 | | |
| Total % | 0.7 | 2 | 10.6 | 0 | 13.3 | 0.6 | 28.4 | 1.7 | 0 | 28.7 | 3.5 | 2.5 | 0.4 | 0 | 6.3 | 14.3 | 29.4 | 7.9 | 0 | 51.6 | |
| CARS | 37 | 111 | 583 | 1 | 732 | 34 | 1471 | 92 | 0 | 1597 | 186 | 137 | 22 | 0 | 345 | 797 | 1628 | 443 | 0 | 2868 | 5542 |
| % CARS | 94.9 | 97.4 | 97.5 | 100 | 97.3 | 97.1 | 98.9 | 97.9 | 0 | 98.8 | 95.4 | 98.6 | 91.7 | 0 | 96.4 | 98.9 | 98.2 | 98.9 | 0 | 98.5 | 98.3 |
| TRUCKS | 2 | 3 | 15 | 0 | 20 | 1 | 16 | 2 | 0 | 19 | 9 | 2 | 2 | 0 | 13 | 9 | 30 | 5 | 0 | 44 | 96 |
| % TRUCKS | 5.1 | 2.6 | 2.5 | 0 | 2.7 | 2.9 | 1.1 | 2.1 | 0 | 1.2 | 4.6 | 1.4 | 8.3 | 0 | 3.6 | 1.1 | 1.8 | 1.1 | 0 | 1.5 | 1.7 |
| PEDS | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| % PEDS | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |



Olympic Region Traffic Turning Movement Count

Counter: D4-3263
 Counted By: Buzz Zubb
 Weather: SUN
 SR 160 AT LONG LAKE RD SE MP 2.55

File Name : SR 160 AT LONG LAKE RD SE 92116 PM
 Site Code : 16092116
 Start Date : 9/21/2016
 Page No : 3



Olympic Region Traffic Turning Movement Count

Counter: D4-3263
 Counted By: Buzz Zubb
 Weather: SUN
 SR 160 AT LAKE VALLEY/MAYVOLT RD MP 3.59

File Name : SR 160 AT LAKE VALLEY RD SE 92616 PM
 Site Code : 16092616
 Start Date : 9/26/2016
 Page No : 2

Groups Printed- CARS - TRUCKS - PEDS

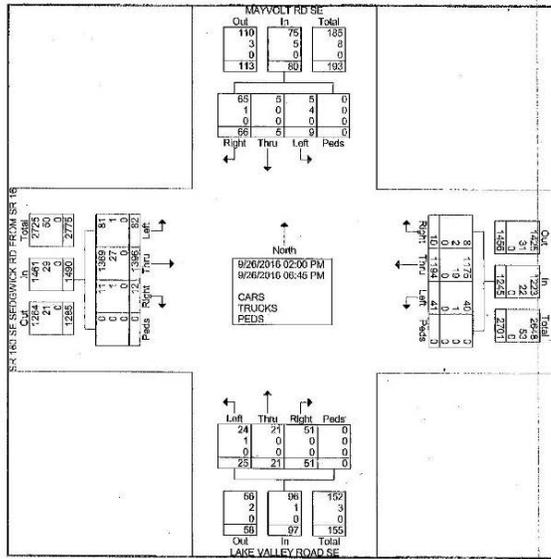
| Start Time | MAYVOLT RD SE From North | | | | | SR 160 SE SEDGWICK RD FROM FERRY TERM From East | | | | | LAKE VALLEY ROAD SE From South | | | | | SR 160 SE SEDGWICK RD FROM SR 16 From West | | | | | Int. Total |
|--------------------|-----------------------------|------------|-------------|----------|-------------|---|-------------|------------|----------|-------------|-----------------------------------|-------------|-------------|----------|------------|--|-------------|-------------|----------|-------------|-------------|
| | Left | Thru | Right | Peds | App. Total | Left | Thru | Right | Peds | App. Total | Left | Thru | Right | Peds | App. Total | Left | Thru | Right | Peds | App. Total | |
| 06:00 PM | 0 | 0 | 8 | 0 | 8 | 0 | 36 | 2 | 0 | 38 | 2 | 0 | 2 | 0 | 4 | 0 | 74 | 1 | 0 | 75 | 125 |
| 06:15 PM | 0 | 0 | 4 | 0 | 4 | 0 | 25 | 0 | 0 | 25 | 2 | 2 | 3 | 0 | 7 | 6 | 77 | 0 | 0 | 83 | 119 |
| 06:30 PM | 0 | 1 | 1 | 0 | 2 | 4 | 78 | 0 | 0 | 82 | 0 | 1 | 0 | 0 | 1 | 6 | 51 | 0 | 0 | 57 | 142 |
| 06:45 PM | 0 | 1 | 1 | 0 | 2 | 1 | 33 | 0 | 0 | 34 | 0 | 1 | 0 | 0 | 1 | 2 | 44 | 1 | 0 | 47 | 84 |
| Total | 0 | 2 | 14 | 0 | 16 | 5 | 172 | 2 | 0 | 179 | 4 | 4 | 5 | 0 | 13 | 14 | 246 | 2 | 0 | 262 | 470 |
| Grand Total | 9 | 5 | 66 | 0 | 80 | 41 | 1194 | 10 | 0 | 1245 | 25 | 21 | 51 | 0 | 97 | 82 | 1396 | 12 | 0 | 1490 | 2912 |
| Apprch % | 11.2 | 6.2 | 82.5 | 0 | | 3.3 | 95.9 | 0.8 | 0 | | 25.8 | 21.6 | 52.6 | 0 | | 5.5 | 93.7 | 0.8 | 0 | | |
| Total % | 0.3 | 0.2 | 2.3 | 0 | 2.7 | 1.4 | 41 | 0.3 | 0 | 42.8 | 0.9 | 0.7 | 1.8 | 0 | 3.3 | 2.8 | 47.9 | 0.4 | 0 | 51.2 | |
| CARS | 5 | 5 | 65 | 0 | 75 | 40 | 1175 | 8 | 0 | 1223 | 24 | 21 | 51 | 0 | 96 | 81 | 1369 | 11 | 0 | 1481 | 2855 |
| % CARS | 55.6 | 100 | 98.5 | 0 | 93.8 | 97.6 | 98.4 | 80 | 0 | 98.2 | 96 | 100 | 100 | 0 | 99 | 98.8 | 98.1 | 91.7 | 0 | 98.1 | 98 |
| TRUCKS | 4 | 0 | 1 | 0 | 5 | 1 | 19 | 2 | 0 | 22 | 1 | 0 | 0 | 0 | 1 | 1 | 27 | 1 | 0 | 29 | 57 |
| % TRUCKS | 44.4 | 0 | 1.5 | 0 | 6.2 | 2.4 | 1.6 | 20 | 0 | 1.8 | 4 | 0 | 0 | 0 | 1 | 1.2 | 1.9 | 8.3 | 0 | 1.9 | 2 |
| PEDS | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| % PEDS | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |



Olympic Region Traffic Turning Movement Count

Counter:D4-3263
Counted By: Buzz Zubb
Weather:SUN
SR 160 AT LAKE VALLEY/MAYVOLT RD MP 3.59

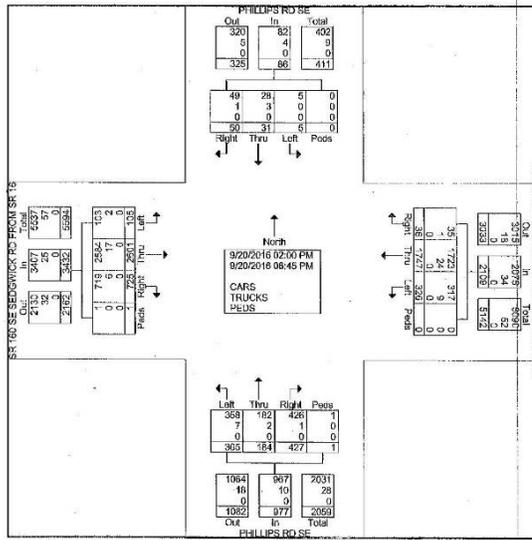
File Name : SR 160 AT LAKE VALLEY RD SE 92616 PM
Site Code : 16092616
Start Date : 9/26/2016
Page No : 3



Olympic Region Traffic Turning Movement Count

Counter:D4-3263
Counted By: Buzz Zubb
Weather: SUN
SR 160 AT PHILLIPS RD SE MP 2.04

File Name : SR 160 AT PHILLIPS RD SE 92016 PM
Site Code : 16092016
Start Date : 9/20/2016
Page No : 3





Olympic Region Traffic Turning Movement Count

Counter:D4-3263
Counted By: Buzz Zubb
Weather: SUN
SR 160 AT PHILLIPS RD SE MP 2.04

File Name : SR 160 AT PHILLIPS RD SE 92016 PM
Site Code : 16092016
Start Date : 9/20/2016
Page No : 2

Groups Printed- CARS - TRUCKS - PEDS

| Start Time | PHILLIPS RD SE From North | | | | | SR 160 SE SEDGWICK RD FROM FERRY TERM From East | | | | | PHILLIPS RD SE From South | | | | | SR 160 SE SEDGWICK RD FROM SR 16 From West | | | | | Int. Total |
|--------------|------------------------------|----------|----------|----------|------------|---|------------|----------|----------|------------|------------------------------|-----------|-----------|----------|------------|--|------------|------------|----------|------------|-------------|
| | Left | Thru | Right | Peds | App. Total | Left | Thru | Right | Peds | App. Total | Left | Thru | Right | Peds | App. Total | Left | Thru | Right | Peds | App. Total | |
| 06:00 PM | 1 | 3 | 1 | 0 | 5 | 15 | 107 | 4 | 0 | 126 | 19 | 8 | 25 | 0 | 52 | 6 | 118 | 28 | 0 | 152 | 335 |
| 06:15 PM | 0 | 1 | 3 | 0 | 4 | 12 | 61 | 1 | 0 | 74 | 18 | 3 | 17 | 0 | 38 | 3 | 110 | 28 | 0 | 141 | 257 |
| 06:30 PM | 0 | 1 | 2 | 0 | 3 | 7 | 45 | 0 | 0 | 52 | 20 | 13 | 19 | 0 | 52 | 5 | 147 | 24 | 0 | 176 | 283 |
| 06:45 PM | 0 | 2 | 2 | 0 | 4 | 13 | 75 | 0 | 0 | 88 | 20 | 9 | 18 | 0 | 47 | 5 | 83 | 28 | 0 | 116 | 255 |
| Total | 1 | 7 | 8 | 0 | 16 | 47 | 288 | 5 | 0 | 340 | 77 | 33 | 79 | 0 | 189 | 19 | 458 | 108 | 0 | 585 | 1130 |
| Grand Total | 5 | 31 | 50 | 0 | 86 | 326 | 1747 | 36 | 0 | 2109 | 365 | 184 | 427 | 1 | 977 | 105 | 2601 | 725 | 1 | 3432 | 6604 |
| Apprch % | 5.8 | 36 | 58.1 | 0 | | 15.5 | 82.8 | 1.7 | 0 | | 37.4 | 18.8 | 43.7 | 0.1 | | 3.1 | 75.8 | 21.1 | 0 | | |
| Total % | 0.1 | 0.5 | 0.8 | 0 | 1.3 | 4.9 | 26.5 | 0.5 | 0 | 31.9 | 5.5 | 2.8 | 6.5 | 0 | 14.8 | 1.6 | 39.4 | 11 | 0 | 52 | |
| CARS | 5 | 28 | 49 | 0 | 82 | 317 | 1723 | 35 | 0 | 2075 | 358 | 182 | 426 | 1 | 967 | 103 | 2584 | 719 | 1 | 3407 | 6531 |
| % CARS | 100 | 90.3 | 98 | 0 | 95.3 | 97.2 | 98.6 | 97.2 | 0 | 98.4 | 98.1 | 98.9 | 99.8 | 100 | 99 | 98.1 | 99.3 | 99.2 | 100 | 99.3 | 98.9 |
| TRUCKS | 0 | 3 | 1 | 0 | 4 | 9 | 24 | 1 | 0 | 34 | 7 | 2 | 1 | 0 | 10 | 2 | 17 | 6 | 0 | 25 | 73 |
| % TRUCKS | 0 | 9.7 | 2 | 0 | 4.7 | 2.8 | 1.4 | 2.8 | 0 | 1.6 | 1.9 | 1.1 | 0.2 | 0 | 1 | 1.9 | 0.7 | 0.8 | 0 | 0.7 | 1.1 |
| PEDS | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| % PEDS | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |



Olympic Region Traffic Turning Movement Count

Counter:D4-3263
Counted By: Buzz Zubb
Weather: SUN
SR 160 AT PHILLIPS RD SE MP 2.04

File Name : SR 160 AT PHILLIPS RD SE 92016 PM
Site Code : 16092016
Start Date : 9/20/2016
Page No : 1

Groups Printed- CARS - TRUCKS - PEDS

| Start Time | PHILLIPS RD SE From North | | | | | SR 160 SE SEDGWICK RD FROM FERRY TERM From East | | | | | PHILLIPS RD SE From South | | | | | SR 160 SE SEDGWICK RD FROM SR 16 From West | | | | | Int. Total |
|--------------|------------------------------|----------|-----------|----------|------------|---|------------|-----------|----------|------------|------------------------------|-----------|------------|----------|------------|--|------------|------------|----------|------------|-------------|
| | Left | Thru | Right | Peds | App. Total | Left | Thru | Right | Peds | App. Total | Left | Thru | Right | Peds | App. Total | Left | Thru | Right | Peds | App. Total | |
| 02:00 PM | 0 | 1 | 2 | 0 | 3 | 12 | 86 | 1 | 0 | 99 | 9 | 4 | 11 | 1 | 25 | 2 | 107 | 38 | 0 | 147 | 274 |
| 02:15 PM | 0 | 2 | 3 | 0 | 5 | 19 | 95 | 0 | 0 | 114 | 15 | 10 | 13 | 0 | 38 | 6 | 92 | 38 | 0 | 136 | 293 |
| 02:30 PM | 0 | 3 | 2 | 0 | 5 | 13 | 72 | 2 | 0 | 87 | 16 | 9 | 18 | 0 | 43 | 9 | 124 | 29 | 0 | 162 | 297 |
| 02:45 PM | 0 | 0 | 4 | 0 | 4 | 12 | 78 | 0 | 0 | 90 | 23 | 13 | 23 | 0 | 59 | 3 | 130 | 28 | 0 | 161 | 314 |
| Total | 0 | 6 | 11 | 0 | 17 | 56 | 331 | 3 | 0 | 390 | 63 | 36 | 65 | 1 | 165 | 20 | 453 | 133 | 0 | 606 | 1178 |
| 03:00 PM | 0 | 1 | 2 | 0 | 3 | 10 | 71 | 0 | 0 | 81 | 10 | 4 | 21 | 0 | 35 | 6 | 130 | 29 | 0 | 165 | 284 |
| 03:15 PM | 0 | 1 | 2 | 0 | 3 | 14 | 85 | 1 | 0 | 100 | 18 | 5 | 21 | 0 | 44 | 7 | 150 | 30 | 0 | 187 | 334 |
| 03:30 PM | 0 | 2 | 4 | 0 | 6 | 23 | 122 | 3 | 0 | 148 | 20 | 10 | 19 | 0 | 49 | 5 | 125 | 29 | 0 | 159 | 362 |
| 03:45 PM | 0 | 1 | 0 | 0 | 1 | 18 | 89 | 4 | 0 | 111 | 22 | 14 | 22 | 0 | 58 | 9 | 128 | 32 | 0 | 169 | 339 |
| Total | 0 | 5 | 8 | 0 | 13 | 65 | 367 | 8 | 0 | 440 | 70 | 33 | 83 | 0 | 186 | 27 | 533 | 120 | 0 | 680 | 1319 |
| 04:00 PM | 2 | 2 | 2 | 0 | 6 | 22 | 77 | 6 | 0 | 105 | 10 | 9 | 28 | 0 | 47 | 4 | 164 | 51 | 1 | 220 | 378 |
| 04:15 PM | 0 | 4 | 4 | 0 | 8 | 28 | 143 | 6 | 0 | 177 | 10 | 11 | 16 | 0 | 37 | 5 | 137 | 58 | 0 | 200 | 422 |
| 04:30 PM | 0 | 2 | 7 | 0 | 9 | 18 | 92 | 1 | 0 | 111 | 29 | 13 | 39 | 0 | 81 | 2 | 131 | 45 | 0 | 178 | 379 |
| 04:45 PM | 1 | 0 | 1 | 0 | 2 | 13 | 88 | 0 | 0 | 101 | 20 | 10 | 19 | 0 | 49 | 7 | 131 | 48 | 0 | 186 | 338 |
| Total | 3 | 8 | 14 | 0 | 25 | 81 | 400 | 13 | 0 | 494 | 69 | 43 | 102 | 0 | 214 | 18 | 563 | 202 | 1 | 784 | 1517 |
| 05:00 PM | 0 | 0 | 1 | 0 | 1 | 15 | 87 | 2 | 0 | 104 | 25 | 10 | 32 | 0 | 67 | 6 | 153 | 40 | 0 | 199 | 371 |
| 05:15 PM | 0 | 2 | 2 | 0 | 4 | 21 | 111 | 3 | 0 | 135 | 12 | 7 | 27 | 0 | 46 | 4 | 156 | 45 | 0 | 205 | 390 |
| 05:30 PM | 1 | 3 | 3 | 0 | 7 | 24 | 96 | 2 | 0 | 122 | 21 | 10 | 13 | 0 | 44 | 8 | 148 | 46 | 0 | 202 | 375 |
| 05:45 PM | 0 | 0 | 3 | 0 | 3 | 17 | 67 | 0 | 0 | 84 | 28 | 12 | 26 | 0 | 66 | 3 | 137 | 31 | 0 | 171 | 324 |
| Total | 1 | 5 | 9 | 0 | 15 | 77 | 361 | 7 | 0 | 445 | 86 | 39 | 98 | 0 | 223 | 21 | 594 | 162 | 0 | 777 | 1460 |

VEHICLE VOLUME SUMMARY

Prepared By: B.ZUBB

| | | | | | | | |
|--------------|------------------------|-------------|-------------|------------|----------------|-------------------------|-------|
| State Route | <u>160</u> | MP | <u>2.55</u> | Count Date | <u>9/28/16</u> | Seasonal Factor | 0.92 |
| Intersection | <u>LONG LAKE RD SE</u> | | | 85% Speed | <u>51</u> | Minor Leg 1 % Rt. Turns | 0.00% |
| Major Lanes | <u>1</u> | Minor Lanes | <u>1</u> | | | Minor Leg 2 % Rt. Turns | 0.00% |

| TIME | MAJOR LEG | MAJOR LEG | MAJOR LEGS TOTAL | MINOR LEG 1 | SEASONAL FACTORS | MINOR LEG 2 | SEASONAL FACTORS | Warrant #1 Cond. A | Warrant #1 Cond. B |
|--------------|-------------|-------------|------------------|-------------|------------------|-------------|------------------|--------------------------|--------------------------|
| | EB | WB | | NB | | SB | | 350 | 525 |
| | | | | | | | | 105 | 53 |
| 00-0100 | 33 | 28 | 56 | 5 | 5 | 9 | 8 | | |
| 01-0200 | 18 | 13 | 29 | 2 | 2 | 5 | 5 | | |
| 02-0300 | 25 | 13 | 35 | 2 | 2 | 9 | 8 | | |
| 03-0400 | 36 | 34 | 64 | 3 | 3 | 15 | 14 | | |
| 04-0500 | 76 | 116 | 177 | 12 | 11 | 71 | 65 | | |
| 05-0600 | 100 | 251 | 323 | 34 | 31 | 94 | 86 | | |
| 06-0700 | 171 | 426 | 549 | 61 | 56 | 138 | 127 | 1 | 1 |
| 07-0800 | 271 | 526 | 733 | 94 | 86 | 180 | 166 | 1 | 1 |
| 08-0900 | 326 | 506 | 765 | 69 | 63 | 153 | 141 | 1 | 1 |
| 09-1000 | 306 | 480 | 723 | 86 | 79 | 146 | 134 | 1 | 1 |
| 10-1100 | 306 | 347 | 601 | 62 | 57 | 113 | 104 | | 1 |
| 11-1200 | 310 | 364 | 620 | 65 | 60 | 124 | 114 | 1 | 1 |
| 12-1300 | 413 | 377 | 727 | 56 | 52 | 119 | 109 | 1 | 1 |
| 13-1400 | 374 | 369 | 684 | 67 | 62 | 114 | 105 | | 1 |
| 14-1500 | 513 | 388 | 829 | 78 | 72 | 111 | 102 | | 1 |
| 15-1600 | 639 | 411 | 966 | 86 | 79 | 174 | 160 | 1 | 1 |
| 16-1700 | 661 | 493 | 1062 | 72 | 66 | 152 | 140 | 1 | 1 |
| 17-1800 | 675 | 536 | 1114 | 89 | 82 | 160 | 147 | 1 | 1 |
| 18-1900 | 646 | 543 | 1094 | 64 | 59 | 146 | 134 | 1 | 1 |
| 19-2000 | 463 | 270 | 674 | 38 | 35 | 82 | 75 | | 1 |
| 20-2100 | 375 | 200 | 529 | 45 | 41 | 48 | 44 | | |
| 21-2200 | 200 | 129 | 303 | 40 | 37 | 34 | 31 | | |
| 22-2300 | 98 | 44 | 131 | 11 | 10 | 15 | 14 | | |
| 23-2400 | 69 | 45 | 105 | 8 | 7 | 12 | 11 | | |
| TOTAL | 7104 | 6909 | 12892 | 1149 | 1057 | 2224 | 2046 | <i>Total Hours</i> 10 | <i>Total Hours</i> 14 |

$V_m =$ 876

$V_s =$ 156

WSDOT OLYMPIC REGION TRAFFIC

SIGNAL PRIORITY LIST

DATA SUMMARY SHEET

VEHICLE VOLUME SUMMARY

Prepared By: *B.ZUBB*

| | | | | | | | |
|--------------|-------------------------|-------------|-------------|------------|----------------|-------------------------|-------|
| State Route | <u>160</u> | MP | <u>2.04</u> | Count Date | <u>9/28/16</u> | Seasonal Factor | 0.91 |
| Intersection | <u>PHILLIPS ROAD SE</u> | | | 85% Speed | <u>44</u> | Minor Leg 1 % Rt. Turns | 0.00% |
| Major Lanes | <u>1</u> | Minor Lanes | <u>1</u> | | | | |

| TIME | MAJOR LEG | | MAJOR LEGS TOTAL | MINOR LEG 1 | | MINOR LEG 2 | | Warrant #1 | Warrant #1 |
|--------------|-------------|-------------|------------------|-------------|------------------|-------------|------------------|--------------------|--------------------|
| | EB | WB | | NB | SEASONAL FACTORS | SB | SEASONAL FACTORS | Cond. A | Cond. B |
| | | | | | | | | 350 | 525 |
| 00-0100 | 30 | 20 | 46 | 12 | 11 | 2 | 2 | 105 | 53 |
| 01-0200 | 19 | 5 | 22 | 3 | 3 | 0 | 0 | | |
| 02-0300 | 13 | 10 | 21 | 8 | 7 | 0 | 0 | | |
| 03-0400 | 47 | 46 | 85 | 5 | 5 | 2 | 2 | | |
| 04-0500 | 61 | 129 | 173 | 36 | 33 | 14 | 13 | | |
| 05-0600 | 99 | 246 | 314 | 57 | 52 | 14 | 13 | | |
| 06-0700 | 140 | 407 | 498 | 90 | 82 | 13 | 12 | | |
| 07-0800 | 314 | 501 | 742 | 178 | 162 | 19 | 17 | 1 | 1 |
| 08-0900 | 217 | 459 | 615 | 158 | 144 | 24 | 22 | 1 | 1 |
| 09-1000 | 268 | 400 | 608 | 179 | 163 | 18 | 16 | 1 | 1 |
| 10-1100 | 283 | 321 | 550 | 109 | 99 | 17 | 15 | | 1 |
| 11-1200 | 363 | 293 | 597 | 128 | 116 | 13 | 12 | 1 | 1 |
| 12-1300 | 402 | 362 | 695 | 126 | 115 | 11 | 10 | 1 | 1 |
| 13-1400 | 357 | 351 | 644 | 120 | 109 | 10 | 9 | 1 | 1 |
| 14-1500 | 436 | 406 | 766 | 142 | 129 | 7 | 6 | 1 | 1 |
| 15-1600 | 569 | 382 | 865 | 228 | 207 | 29 | 26 | 1 | 1 |
| 16-1700 | 638 | 485 | 1022 | 207 | 188 | 25 | 23 | 1 | 1 |
| 17-1800 | 644 | 369 | 922 | 255 | 232 | 23 | 21 | 1 | 1 |
| 18-1900 | 517 | 347 | 786 | 192 | 175 | 18 | 16 | 1 | 1 |
| 19-2000 | 389 | 203 | 539 | 147 | 134 | 15 | 14 | 1 | 1 |
| 20-2100 | 252 | 154 | 369 | 96 | 87 | 14 | 13 | | |
| 21-2200 | 167 | 110 | 252 | 67 | 61 | 4 | 4 | | |
| 22-2300 | 106 | 42 | 135 | 38 | 35 | 6 | 5 | | |
| 23-2400 | 55 | 45 | 91 | 27 | 25 | 2 | 2 | | |
| TOTAL | 6386 | 6093 | 11356 | 2608 | 2373 | 300 | 273 | <i>Total Hours</i> | <i>Total Hours</i> |
| | | | | | | | | 12 | 13 |

$V_m =$ 762 $V_s =$ 176

WSDOT OLYMPIC REGION TRAFFIC

SIGNAL PRIORITY LIST

DATA SUMMARY SHEET

VEHICLE VOLUME SUMMARY

Prepared By: B.ZUBB

| | | | | | | | |
|--------------|---------------------|-------------|------|------------|---------|-------------------------|-------|
| State Route | 160 | MP | 3.59 | Count Date | 9/28/16 | Seasonal Factor | 0.92 |
| Intersection | LAKE VALLEY/MAYVOLT | | | 85% Speed | 43 | Minor Leg 1 % Rt. Turns | 0.00% |
| Major Lanes | 1 | Minor Lanes | 1 | | | Minor Leg 2 % Rt. Turns | 0.00% |

| TIME | MAJOR LEG | | MAJOR LEGS TOTAL | MINOR LEG 1 | | MINOR LEG 2 | | Warrant #1 Cond. A | Warrant #1 Cond. B |
|--------------|-------------|-------------|------------------|-------------|------------------|-------------|------------------|--------------------|--------------------|
| | EB | WB | | NB | SEASONAL FACTORS | SB | SEASONAL FACTORS | | |
| | | | | | | | | | |
| 00-0100 | 11 | 17 | 26 | 1 | 1 | 1 | 1 | 350 | 525 |
| 01-0200 | 6 | 7 | 12 | 1 | 1 | 2 | 2 | 105 | 53 |
| 02-0300 | 5 | 3 | 7 | 0 | 0 | 0 | 0 | | |
| 03-0400 | 22 | 17 | 36 | 0 | 0 | 1 | 1 | | |
| 04-0500 | 28 | 47 | 69 | 1 | 1 | 8 | 7 | | |
| 05-0600 | 51 | 128 | 165 | 7 | 6 | 16 | 15 | | |
| 06-0700 | 62 | 193 | 235 | 10 | 9 | 20 | 18 | | |
| 07-0800 | 82 | 301 | 352 | 12 | 11 | 30 | 28 | | |
| 08-0900 | 125 | 275 | 368 | 15 | 14 | 28 | 26 | | |
| 09-1000 | 121 | 276 | 365 | 15 | 14 | 18 | 17 | | |
| 10-1100 | 101 | 176 | 255 | 5 | 5 | 9 | 8 | | |
| 11-1200 | 95 | 187 | 259 | 7 | 6 | 16 | 15 | | |
| 12-1300 | 143 | 218 | 332 | 11 | 10 | 19 | 17 | | |
| 13-1400 | 108 | 210 | 293 | 18 | 17 | 16 | 15 | | |
| 14-1500 | 166 | 247 | 380 | 12 | 11 | 18 | 17 | | |
| 15-1600 | 190 | 206 | 364 | 28 | 26 | 15 | 14 | | |
| 16-1700 | 151 | 331 | 443 | 28 | 26 | 22 | 20 | | |
| 17-1800 | 174 | 314 | 449 | 28 | 26 | 16 | 15 | | |
| 18-1900 | 145 | 358 | 463 | 19 | 17 | 16 | 15 | | |
| 19-2000 | 125 | 152 | 255 | 9 | 8 | 12 | 11 | | |
| 20-2100 | 108 | 124 | 213 | 8 | 7 | 4 | 4 | | |
| 21-2200 | 57 | 69 | 116 | 6 | 6 | 6 | 6 | | |
| 22-2300 | 25 | 21 | 42 | 3 | 3 | 2 | 2 | | |
| 23-2400 | 22 | 29 | 47 | 2 | 2 | 2 | 2 | | |
| TOTAL | 2123 | 3906 | 5547 | 246 | 226 | 297 | 273 | <i>Total Hours</i> | <i>Total Hours</i> |
| | | | | | | | | 0 | 0 |

$V_m = 376$ $V_s = 24$

WSDOT OLYMPIC REGION TRAFFIC

SIGNAL PRIORITY LIST

DATA SUMMARY SHEET

INTERSECTION SUMMARY

 Site: SR 160 and Long Lake - PM 2016

New Site
Roundabout
Design Life Analysis (Capacity): Results for 20 years

| Intersection Performance - Hourly Values | | |
|---|-----------------|------------------|
| Performance Measure | Vehicles | Persons |
| Travel Speed (Average) | 33.4 mph | 33.4 mph |
| Travel Distance (Total) | 1258.6 veh-mi/h | 1510.3 pers-mi/h |
| Travel Time (Total) | 37.7 veh-h/h | 45.3 pers-h/h |
| Demand Flows (Total) | 2019 veh/h | 2423 pers/h |
| Percent Heavy Vehicles (Demand) | 0.9 % | |
| Degree of Saturation | 0.907 | |
| Practical Spare Capacity | -6.3 % | |
| Effective Intersection Capacity | 2227 veh/h | |
| Control Delay (Total) | 5.22 veh-h/h | 6.26 pers-h/h |
| Control Delay (Average) | 9.3 sec | 9.3 sec |
| Control Delay (Worst Lane) | 14.2 sec | |
| Control Delay (Worst Movement) | 16.1 sec | 16.1 sec |
| Geometric Delay (Average) | 5.4 sec | |
| Stop-Line Delay (Average) | 3.9 sec | |
| Idling Time (Average) | 0.4 sec | |
| Intersection Level of Service (LOS) | LOS A | |
| 95% Back of Queue - Vehicles (Worst Lane) | 22.0 veh | |
| 95% Back of Queue - Distance (Worst Lane) | 552.0 ft | |
| Queue Storage Ratio (Worst Lane) | 0.46 | |
| Total Effective Stops | 1433 veh/h | 1720 pers/h |
| Effective Stop Rate | 0.71 per veh | 0.71 per pers |
| Proportion Queued | 0.92 | 0.92 |
| Performance Index | 127.2 | 127.2 |
| Cost (Total) | 604.05 \$/h | 604.05 \$/h |
| Fuel Consumption (Total) | 49.4 gal/h | |
| Carbon Dioxide (Total) | 440.6 kg/h | |
| Hydrocarbons (Total) | 0.040 kg/h | |
| Carbon Monoxide (Total) | 0.572 kg/h | |
| NOx (Total) | 0.341 kg/h | |

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
Intersection LOS value for Vehicles is based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

| Intersection Performance - Annual Values | | |
|--|------------------|-------------------|
| Performance Measure | Vehicles | Persons |
| Demand Flows (Total) | 969,327 veh/y | 1,163,193 pers/y |
| Delay | 2,505 veh-h/y | 3,006 pers-h/y |
| Effective Stops | 688,022 veh/y | 825,627 pers/y |
| Travel Distance | 604,125 veh-mi/y | 724,950 pers-mi/y |
| Travel Time | 18,106 veh-h/y | 21,727 pers-h/y |
| Cost | 289,946 \$/y | 289,946 \$/y |
| Fuel Consumption | 23,714 gal/y | |
| Carbon Dioxide | 211,484 kg/y | |
| Hydrocarbons | 19 kg/y | |
| Carbon Monoxide | 275 kg/y | |
| NOx | 164 kg/y | |

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MOVEMENT SUMMARY

Site: SR 160 and Long Lake - PM 2016

New Site
Roundabout
Design Life Analysis (Capacity): Results for 20 years

| Movement Performance - Vehicles | | | | | | | | | | | |
|---------------------------------|--------|--------------------------|------|---------------|-------------------|------------------|--------------------------------|-------------|--------------|-----------------------------|-------------------|
| Mov ID | OD Mov | Demand Flows Total veh/h | HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | Distance ft | Prop. Queued | Effective Stop Rate per veh | Average Speed mph |
| South: Long Lake | | | | | | | | | | | |
| 3 | L2 | 71 | 2.4 | 0.299 | 16.1 | LOS B | 2.0 | 51.1 | 0.92 | 0.96 | 31.8 |
| 8 | T1 | 46 | 2.4 | 0.299 | 11.6 | LOS B | 2.0 | 51.1 | 0.92 | 0.96 | 31.9 |
| 18 | R2 | 6 | 2.4 | 0.299 | 11.4 | LOS B | 2.0 | 51.1 | 0.92 | 0.96 | 31.2 |
| Approach | | 123 | 2.4 | 0.299 | 14.2 | LOS B | 2.0 | 51.1 | 0.92 | 0.96 | 31.8 |
| East: SR 160 | | | | | | | | | | | |
| 1 | L2 | 15 | 0.5 | 0.704 | 15.6 | LOS B | 7.7 | 192.1 | 0.87 | 0.95 | 33.1 |
| 6 | T1 | 523 | 0.5 | 0.704 | 11.1 | LOS B | 7.7 | 192.1 | 0.87 | 0.95 | 33.3 |
| 16 | R2 | 44 | 0.5 | 0.704 | 11.0 | LOS B | 7.7 | 192.1 | 0.87 | 0.95 | 32.5 |
| Approach | | 582 | 0.5 | 0.704 | 11.2 | LOS B | 7.7 | 192.1 | 0.87 | 0.95 | 33.2 |
| North: Long Lake | | | | | | | | | | | |
| 7 | L2 | 10 | 2.2 | 0.397 | 13.4 | LOS B | 2.6 | 65.7 | 0.78 | 0.86 | 34.2 |
| 4 | T1 | 38 | 2.2 | 0.397 | 8.9 | LOS A | 2.6 | 65.7 | 0.78 | 0.86 | 34.3 |
| 14 | R2 | 216 | 2.2 | 0.397 | 8.8 | LOS A | 2.6 | 65.7 | 0.78 | 0.86 | 33.5 |
| Approach | | 264 | 2.2 | 0.397 | 9.0 | LOS A | 2.6 | 65.7 | 0.78 | 0.86 | 33.7 |
| West: SR 160 | | | | | | | | | | | |
| 5 | L2 | 310 | 0.7 | 0.907 | 10.9 | LOS B | 22.0 | 552.0 | 0.99 | 0.51 | 33.6 |
| 2 | T1 | 582 | 0.7 | 0.907 | 6.5 | LOS A | 22.0 | 552.0 | 0.99 | 0.51 | 33.7 |
| 12 | R2 | 158 | 0.7 | 0.907 | 6.3 | LOS A | 22.0 | 552.0 | 0.99 | 0.51 | 33.0 |
| Approach | | 1050 | 0.7 | 0.907 | 7.8 | LOS A | 22.0 | 552.0 | 0.99 | 0.51 | 33.6 |
| All Vehicles | | 2019 | 0.9 | 0.907 | 9.3 | LOS A | 22.0 | 552.0 | 0.92 | 0.71 | 33.4 |

Level of Service (LOS) Method: Delay (HCM 2000).
 Roundabout LOS Method: Same as Signalised Intersections.
 Vehicle movement LOS values are based on average delay per movement
 Intersection and Approach LOS values are based on average delay for all vehicle movements.
 Roundabout Capacity Model: SIDRA Standard.
 SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
 Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
 HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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LANE SUMMARY

 Site: SR 160 and Long Lake - PM 2016

New Site
Roundabout
Design Life Analysis (Capacity): Results for 20 years

| Lane Use and Performance | | | | | | | | | | | | | |
|--------------------------|--------|-------|-------|-------|-------|---------|----------|-------------------|-------|--------|--------|------|--------|
| | Demand | Flows | | Deg. | Lane | Average | Level of | 95% Back of Queue | | Lane | Lane | Cap. | Prob. |
| | Total | HV | Cap. | Satn | Util. | Delay | Service | Veh | Dist | Config | Length | Adj. | Block. |
| | veh/h | % | veh/h | v/c | % | sec | | | ft | | ft | % | % |
| South: Long Lake | | | | | | | | | | | | | |
| Lane 1 ^d | 123 | 2.4 | 410 | 0.299 | 100 | 14.2 | LOS B | 2.0 | 51.1 | Full | 1600 | 0.0 | 0.0 |
| Approach | 123 | 2.4 | | 0.299 | | 14.2 | LOS B | 2.0 | 51.1 | | | | |
| East: SR 160 | | | | | | | | | | | | | |
| Lane 1 ^d | 582 | 0.5 | 827 | 0.704 | 100 | 11.2 | LOS B | 7.7 | 192.1 | Full | 1600 | 0.0 | 0.0 |
| Approach | 582 | 0.5 | | 0.704 | | 11.2 | LOS B | 7.7 | 192.1 | | | | |
| North: Long Lake | | | | | | | | | | | | | |
| Lane 1 ^d | 264 | 2.2 | 666 | 0.397 | 100 | 9.0 | LOS A | 2.6 | 65.7 | Full | 1600 | 0.0 | 0.0 |
| Approach | 264 | 2.2 | | 0.397 | | 9.0 | LOS A | 2.6 | 65.7 | | | | |
| West: SR 160 | | | | | | | | | | | | | |
| Lane 1 ^d | 1050 | 0.7 | 1158 | 0.907 | 100 | 7.8 | LOS A | 22.0 | 552.0 | Full | 1600 | 0.0 | 0.0 |
| Approach | 1050 | 0.7 | | 0.907 | | 7.8 | LOS A | 22.0 | 552.0 | | | | |
| Intersection | 2019 | 0.9 | | 0.907 | | 9.3 | LOS A | 22.0 | 552.0 | | | | |

Level of Service (LOS) Method: Delay (HCM 2000).
 Roundabout LOS Method: Same as Signalised Intersections.
 Lane LOS values are based on average delay per lane.
 Intersection and Approach LOS values are based on average delay for all lanes.
 Roundabout Capacity Model: SIDRA Standard.
 SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
 Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
 HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

^d Dominant lane on roundabout approach

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LANE FLOWS

 Site: SR 160 and Long Lake - PM 2016

New Site
Roundabout
Design Life Analysis (Capacity): Results for 20 years

| Approach Lane Flows (veh/h) | | | | | | | | | | |
|-----------------------------|-------|-----|----------------|-------|-----|-------|-------|-------|--------|--|
| South: Long Lake | | | | | | | | | | |
| Mov. | L2 | T1 | R2 | Total | %HV | | | | | |
| From S | | | | | | Cap. | Deg. | Lane | Prob. | |
| To Exit: | W | N | E | | | veh/h | Satn | Util. | SL Ov. | |
| | | | | | | | v/c | % | % | |
| Lane 1 | 71 | 46 | 6 | 123 | 2.4 | 410 | 0.299 | 100 | NA | |
| Approach | 71 | 46 | 6 | 123 | 2.4 | | 0.299 | | | |
| East: SR 160 | | | | | | | | | | |
| Mov. | L2 | T1 | R2 | Total | %HV | | | | | |
| From E | | | | | | Cap. | Deg. | Lane | Prob. | |
| To Exit: | S | W | N | | | veh/h | Satn | Util. | SL Ov. | |
| | | | | | | | v/c | % | % | |
| Lane 1 | 15 | 523 | 44 | 582 | 0.5 | 827 | 0.704 | 100 | NA | |
| Approach | 15 | 523 | 44 | 582 | 0.5 | | 0.704 | | | |
| North: Long Lake | | | | | | | | | | |
| Mov. | L2 | T1 | R2 | Total | %HV | | | | | |
| From N | | | | | | Cap. | Deg. | Lane | Prob. | |
| To Exit: | E | S | W | | | veh/h | Satn | Util. | SL Ov. | |
| | | | | | | | v/c | % | % | |
| Lane 1 | 10 | 38 | 216 | 264 | 2.2 | 666 | 0.397 | 100 | NA | |
| Approach | 10 | 38 | 216 | 264 | 2.2 | | 0.397 | | | |
| West: SR 160 | | | | | | | | | | |
| Mov. | L2 | T1 | R2 | Total | %HV | | | | | |
| From W | | | | | | Cap. | Deg. | Lane | Prob. | |
| To Exit: | N | E | S | | | veh/h | Satn | Util. | SL Ov. | |
| | | | | | | | v/c | % | % | |
| Lane 1 | 310 | 582 | 158 | 1050 | 0.7 | 1158 | 0.907 | 100 | NA | |
| Approach | 310 | 582 | 158 | 1050 | 0.7 | | 0.907 | | | |
| | Total | %HV | Deg Satn (v/c) | | | | | | | |
| Intersectio n | 2019 | 0.9 | 0.907 | | | | | | | |

Lane flow rates given in this report are based on the arrival flow rates subject to upstream capacity constraint where applicable.

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LEVEL OF SERVICE

Site: SR 160 and Long Lake - PM 2016

New Site
Roundabout
Design Life Analysis (Capacity): Results for 20 years

All Movement Classes

| | South | East | North | West | Intersection |
|-----|-------|------|-------|------|--------------|
| LOS | B | B | A | A | A |

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

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Organisation: WASHINGTON STATE DEPARTMENT OF TRANSPORTATION | Processed: Wednesday, October 19, 2016 8:48:38 AM
Project: \\Orolym\01\planning\2.2 Projects & Studies\Studies Current\SR 160 MP 2.04 - 3.57 Safety Study\Traffic\Traffic Analysis\SR 160 and Long Lake.sip6

MOVEMENT SUMMARY

Site: SR 160/Phillips 2036 AM

2036 AM

Roundabout

| Movement Performance - Vehicles | | | | | | | | | | | |
|---------------------------------|--------|--------------------|------------|---------------|-------------------|------------------|--------------------------------|-------------|--------------|-----------------------------|-------------------|
| Mov ID | OD Mov | Demand Total veh/h | Flows HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | Distance ft | Prop. Queued | Effective Stop Rate per veh | Average Speed mph |
| South: Phillips Rd | | | | | | | | | | | |
| 3 | L2 | 138 | 1.5 | 0.345 | 11.7 | LOS B | 2.3 | 57.0 | 0.74 | 0.80 | 31.1 |
| 8 | T1 | 58 | 1.5 | 0.345 | 6.7 | LOS A | 2.3 | 57.0 | 0.74 | 0.80 | 31.1 |
| 18 | R2 | 91 | 1.5 | 0.345 | 6.8 | LOS A | 2.3 | 57.0 | 0.74 | 0.80 | 30.4 |
| Approach | | 287 | 1.5 | 0.345 | 9.1 | LOS A | 2.3 | 57.0 | 0.74 | 0.80 | 30.9 |
| East: SR 160 | | | | | | | | | | | |
| 1u | U | 43 | 1.5 | 0.689 | 12.7 | LOS B | 7.2 | 181.3 | 0.71 | 0.67 | 32.2 |
| 1 | L2 | 141 | 1.5 | 0.689 | 10.7 | LOS B | 7.2 | 181.3 | 0.71 | 0.67 | 31.6 |
| 6 | T1 | 592 | 1.5 | 0.689 | 5.7 | LOS A | 7.2 | 181.3 | 0.71 | 0.67 | 31.5 |
| 16 | R2 | 10 | 1.5 | 0.689 | 5.8 | LOS A | 7.2 | 181.3 | 0.71 | 0.67 | 30.8 |
| Approach | | 787 | 1.5 | 0.689 | 7.0 | LOS A | 7.2 | 181.3 | 0.71 | 0.67 | 31.6 |
| North: Phillips Rd | | | | | | | | | | | |
| 7 | L2 | 4 | 1.5 | 0.117 | 14.0 | LOS B | 0.8 | 19.3 | 0.83 | 0.79 | 31.0 |
| 4 | T1 | 17 | 1.5 | 0.117 | 9.0 | LOS A | 0.8 | 19.3 | 0.83 | 0.79 | 31.0 |
| 14 | R2 | 47 | 1.5 | 0.117 | 9.1 | LOS A | 0.8 | 19.3 | 0.83 | 0.79 | 30.2 |
| Approach | | 68 | 1.5 | 0.117 | 9.4 | LOS A | 0.8 | 19.3 | 0.83 | 0.79 | 30.5 |
| West: SR 160 | | | | | | | | | | | |
| 5 | L2 | 25 | 1.5 | 0.664 | 10.2 | LOS B | 6.4 | 160.8 | 0.67 | 0.60 | 32.1 |
| 2 | T1 | 527 | 1.5 | 0.664 | 5.2 | LOS A | 6.4 | 160.8 | 0.67 | 0.60 | 32.1 |
| 12 | R2 | 216 | 1.5 | 0.664 | 5.3 | LOS A | 6.4 | 160.8 | 0.67 | 0.60 | 31.3 |
| Approach | | 768 | 1.5 | 0.664 | 5.4 | LOS A | 6.4 | 160.8 | 0.67 | 0.60 | 31.9 |
| All Vehicles | | 1911 | 1.5 | 0.689 | 6.8 | LOS A | 7.2 | 181.3 | 0.70 | 0.66 | 31.5 |

Level of Service (LOS) Method: Delay (HCM 2000).

Roundabout LOS Method: Same as Signalised Intersections.

Vehicle movement LOS values are based on average delay per movement

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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Project: H:\SR 160 SIDRA\SR 160 Phillips 2036 AM.sip6

MOVEMENT SUMMARY

Site: SR 160/Phillips 2036 PM

2036 PM

Roundabout

| Movement Performance - Vehicles | | | | | | | | | | | | |
|---------------------------------|--------|-----------------------|---------------|------------------|----------------------|------------------|--------------------------------------|-------------------------|--------------|--------------------------------|----------------------|--|
| Mov ID | OD Mov | Demand Total veh/h | Flows HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | Queue Distance ft | Prop. Queued | Effective Stop Rate per veh | Average Speed mph | |
| South: Phillips Rd | | | | | | | | | | | | |
| 3 | L2 | 197 | 1.5 | 1.025 | 64.4 | LOS E | 27.0 | 682.5 | 1.00 | 1.90 | 18.1 | |
| 8 | T1 | 91 | 1.5 | 1.025 | 59.4 | LOS E | 27.0 | 682.5 | 1.00 | 1.90 | 18.1 | |
| 18 | R2 | 258 | 1.5 | 1.025 | 59.5 | LOS E | 27.0 | 682.5 | 1.00 | 1.90 | 17.8 | |
| Approach | | 546 | 1.5 | 1.025 | 61.3 | LOS E | 27.0 | 682.5 | 1.00 | 1.90 | 18.0 | |
| East: SR 160 | | | | | | | | | | | | |
| 1u | U | 75 | 1.5 | 0.884 | 19.6 | LOS B | 17.5 | 441.8 | 1.00 | 1.04 | 29.8 | |
| 1 | L2 | 141 | 1.5 | 0.884 | 17.6 | LOS B | 17.5 | 441.8 | 1.00 | 1.04 | 29.3 | |
| 6 | T1 | 673 | 1.5 | 0.884 | 12.7 | LOS B | 17.5 | 441.8 | 1.00 | 1.04 | 29.2 | |
| 16 | R2 | 29 | 1.5 | 0.884 | 12.8 | LOS B | 17.5 | 441.8 | 1.00 | 1.04 | 28.6 | |
| Approach | | 918 | 1.5 | 0.884 | 14.0 | LOS B | 17.5 | 441.8 | 1.00 | 1.04 | 29.2 | |
| North: Phillips Rd | | | | | | | | | | | | |
| 7 | L2 | 7 | 1.5 | 0.131 | 16.6 | LOS B | 0.9 | 23.8 | 0.95 | 0.87 | 29.8 | |
| 4 | T1 | 17 | 1.5 | 0.131 | 11.7 | LOS B | 0.9 | 23.8 | 0.95 | 0.87 | 29.8 | |
| 14 | R2 | 29 | 1.5 | 0.131 | 11.8 | LOS B | 0.9 | 23.8 | 0.95 | 0.87 | 29.1 | |
| Approach | | 53 | 1.5 | 0.131 | 12.3 | LOS B | 0.9 | 23.8 | 0.95 | 0.87 | 29.4 | |
| West: SR 160 | | | | | | | | | | | | |
| 5 | L2 | 34 | 1.5 | 0.942 | 20.1 | LOS C | 25.2 | 638.5 | 1.00 | 1.04 | 28.7 | |
| 2 | T1 | 766 | 1.5 | 0.942 | 15.2 | LOS B | 25.2 | 638.5 | 1.00 | 1.04 | 28.7 | |
| 12 | R2 | 242 | 1.5 | 0.942 | 15.3 | LOS B | 25.2 | 638.5 | 1.00 | 1.04 | 28.0 | |
| Approach | | 1042 | 1.5 | 0.942 | 15.3 | LOS B | 25.2 | 638.5 | 1.00 | 1.04 | 28.5 | |
| All Vehicles | | 2560 | 1.5 | 1.025 | 24.6 | LOS C | 27.0 | 682.5 | 1.00 | 1.22 | 25.6 | |

Level of Service (LOS) Method: Delay (HCM 2000).
 Roundabout LOS Method: Same as Signalised Intersections.
 Vehicle movement LOS values are based on average delay per movement
 Intersection and Approach LOS values are based on average delay for all vehicle movements.
 Roundabout Capacity Model: SIDRA Standard.
 SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
 Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
 HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: SR 160/Mayvolt 2036 AM

2036 AM

Roundabout

| Movement Performance - Vehicles | | | | | | | | | | | |
|---------------------------------|--------|--------------------|------------|---------------|-------------------|------------------|--------------------------------|-------------|--------------|-----------------------------|-------------------|
| Mov ID | OD Mov | Demand Total veh/h | Flows HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | Distance ft | Prop. Queued | Effective Stop Rate per veh | Average Speed mph |
| South: Lake Valley Rd | | | | | | | | | | | |
| 3 | L2 | 12 | 1.5 | 0.038 | 11.6 | LOS B | 0.2 | 4.9 | 0.62 | 0.66 | 31.4 |
| 8 | T1 | 5 | 1.5 | 0.038 | 6.6 | LOS A | 0.2 | 4.9 | 0.62 | 0.66 | 31.4 |
| 18 | R2 | 14 | 1.5 | 0.038 | 6.7 | LOS A | 0.2 | 4.9 | 0.62 | 0.66 | 30.6 |
| Approach | | 32 | 1.5 | 0.038 | 8.6 | LOS A | 0.2 | 4.9 | 0.62 | 0.66 | 31.0 |
| East: SR 160 | | | | | | | | | | | |
| 1 | L2 | 17 | 1.5 | 0.387 | 12.0 | LOS B | 2.3 | 57.7 | 0.53 | 0.63 | 37.9 |
| 6 | T1 | 400 | 1.5 | 0.387 | 6.9 | LOS A | 2.3 | 57.7 | 0.53 | 0.63 | 38.1 |
| 16 | R2 | 7 | 1.5 | 0.387 | 6.7 | LOS A | 2.3 | 57.7 | 0.53 | 0.63 | 37.1 |
| Approach | | 424 | 1.5 | 0.387 | 7.1 | LOS A | 2.3 | 57.7 | 0.53 | 0.63 | 38.1 |
| North: Mayvolt Rd | | | | | | | | | | | |
| 7 | L2 | 9 | 1.5 | 0.044 | 11.8 | LOS B | 0.2 | 6.0 | 0.65 | 0.67 | 31.6 |
| 4 | T1 | 3 | 1.5 | 0.044 | 6.8 | LOS A | 0.2 | 6.0 | 0.65 | 0.67 | 31.5 |
| 14 | R2 | 23 | 1.5 | 0.044 | 7.0 | LOS A | 0.2 | 6.0 | 0.65 | 0.67 | 30.8 |
| Approach | | 35 | 1.5 | 0.044 | 8.2 | LOS A | 0.2 | 6.0 | 0.65 | 0.67 | 31.0 |
| West: SR 160 | | | | | | | | | | | |
| 5u | U | 295 | 1.5 | 0.512 | 12.8 | LOS B | 4.0 | 101.0 | 0.20 | 0.58 | 38.1 |
| 5 | L2 | 11 | 1.5 | 0.512 | 10.4 | LOS B | 4.0 | 101.0 | 0.20 | 0.58 | 37.4 |
| 2 | T1 | 384 | 1.5 | 0.512 | 5.4 | LOS A | 4.0 | 101.0 | 0.20 | 0.58 | 37.6 |
| 12 | R2 | 2 | 1.5 | 0.512 | 5.1 | LOS A | 4.0 | 101.0 | 0.20 | 0.58 | 36.7 |
| Approach | | 691 | 1.5 | 0.512 | 8.6 | LOS A | 4.0 | 101.0 | 0.20 | 0.58 | 37.8 |
| All Vehicles | | 1182 | 1.5 | 0.512 | 8.1 | LOS A | 4.0 | 101.0 | 0.34 | 0.60 | 37.5 |

Level of Service (LOS) Method: Delay (HCM 2000).
 Roundabout LOS Method: Same as Signalised Intersections.
 Vehicle movement LOS values are based on average delay per movement
 Intersection and Approach LOS values are based on average delay for all vehicle movements.
 Roundabout Capacity Model: SIDRA Standard.
 SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
 Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
 HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: SR 160/Mayvolt 2036 PM

2036 PM

Roundabout

| Movement Performance - Vehicles | | | | | | | | | | | |
|---------------------------------|--------|--------------------|------------|---------------|-------------------|------------------|--------------------------------|-------------------|--------------|-----------------------------|-------------------|
| Mov ID | OD Mov | Demand Total veh/h | Flows HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | Queue Distance ft | Prop. Queued | Effective Stop Rate per veh | Average Speed mph |
| South: Lake Valley Rd | | | | | | | | | | | |
| 3 | L2 | 9 | 1.5 | 0.077 | 15.1 | LOS B | 0.5 | 12.2 | 0.81 | 0.77 | 30.3 |
| 8 | T1 | 11 | 1.5 | 0.077 | 10.1 | LOS B | 0.5 | 12.2 | 0.81 | 0.77 | 30.3 |
| 18 | R2 | 26 | 1.5 | 0.077 | 10.2 | LOS B | 0.5 | 12.2 | 0.81 | 0.77 | 29.6 |
| Approach | | 46 | 1.5 | 0.077 | 11.1 | LOS B | 0.5 | 12.2 | 0.81 | 0.77 | 29.9 |
| East: SR 160 | | | | | | | | | | | |
| 1 | L2 | 23 | 1.5 | 0.591 | 14.6 | LOS B | 5.1 | 129.5 | 0.75 | 0.83 | 37.0 |
| 6 | T1 | 550 | 1.5 | 0.591 | 9.5 | LOS A | 5.1 | 129.5 | 0.75 | 0.83 | 37.2 |
| 16 | R2 | 3 | 1.5 | 0.591 | 9.3 | LOS A | 5.1 | 129.5 | 0.75 | 0.83 | 36.3 |
| Approach | | 576 | 1.5 | 0.591 | 9.7 | LOS A | 5.1 | 129.5 | 0.75 | 0.83 | 37.2 |
| North: Mayvolt Rd | | | | | | | | | | | |
| 7 | L2 | 2 | 1.5 | 0.061 | 14.9 | LOS B | 0.4 | 9.8 | 0.82 | 0.75 | 30.6 |
| 4 | T1 | 2 | 1.5 | 0.061 | 9.9 | LOS A | 0.4 | 9.8 | 0.82 | 0.75 | 30.6 |
| 14 | R2 | 30 | 1.5 | 0.061 | 10.0 | LOS B | 0.4 | 9.8 | 0.82 | 0.75 | 29.9 |
| Approach | | 35 | 1.5 | 0.061 | 10.3 | LOS B | 0.4 | 9.8 | 0.82 | 0.75 | 29.9 |
| West: SR 160 | | | | | | | | | | | |
| 5u | U | 413 | 1.5 | 0.743 | 12.9 | LOS B | 10.8 | 274.2 | 0.34 | 0.54 | 37.7 |
| 5 | L2 | 36 | 1.5 | 0.743 | 10.6 | LOS B | 10.8 | 274.2 | 0.34 | 0.54 | 37.0 |
| 2 | T1 | 548 | 1.5 | 0.743 | 5.5 | LOS A | 10.8 | 274.2 | 0.34 | 0.54 | 37.3 |
| 12 | R2 | 5 | 1.5 | 0.743 | 5.3 | LOS A | 10.8 | 274.2 | 0.34 | 0.54 | 36.3 |
| Approach | | 1002 | 1.5 | 0.743 | 8.7 | LOS A | 10.8 | 274.2 | 0.34 | 0.54 | 37.4 |
| All Vehicles | | 1659 | 1.5 | 0.743 | 9.2 | LOS A | 10.8 | 274.2 | 0.51 | 0.65 | 36.9 |

Level of Service (LOS) Method: Delay (HCM 2000).

Roundabout LOS Method: Same as Signalised Intersections.

Vehicle movement LOS values are based on average delay per movement

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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Organisation: WASHINGTON STATE DEPARTMENT OF TRANSPORTATION | Processed: Tuesday, July 25, 2017 9:54:41 AM

Project: H:SR 160 SIDRA:SR 160 Mayvolt 2036 PM.sip6

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: Forest Sutmiller
 Agency/Co.: WSDOT
 Date Performed: 7/24/2017
 Analysis Time Period: AM Peak Hour
 Intersection: SR 160 at Phillips Road
 Jurisdiction: Kitsap County
 Units: U. S. Customary
 Analysis Year: 2036
 Project ID: SR 160 Build Roundabout at Long Lake
 East/West Street: SR 160
 North/South Street: Phillips Road
 Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

| Major Street: | Approach Movement | Eastbound | | | | Westbound | | |
|------------------------|-------------------|-----------|--------|--------|--------|-----------|--------|--|
| | | 1 L | 2 T | 3 R | 4 L | 5 T | 6 R | |
| Volume | | 23 | 485 | 199 | 146 | 672 | 62 | |
| Peak-Hour Factor, PHF | | 0.92 | 0.92 | 0.92 | 0.88 | 0.88 | 0.88 | |
| Hourly Flow Rate, HFR | | 24 | 527 | 216 | 165 | 763 | 70 | |
| Percent Heavy Vehicles | | 3 | -- | -- | 2 | -- | -- | |
| Median Type/Storage | | Undivided | | | | / | | |
| RT Channelized? | | | | | | | | |
| Lanes | | 1 | 1 | 0 | 1 | 1 | 0 | |
| Configuration | | L | | TR | L | | TR | |
| Upstream Signal? | | No | | | No | | | |

| Minor Street: | Approach Movement | Northbound | | | Southbound | | |
|----------------------------------|-------------------|------------|--------|--------|------------|---------|---------|
| | | 7 L | 8 T | 9 R | 10 L | 11 T | 12 R |
| Volume | | 0 | 0 | 175 | 0 | 0 | 43 |
| Peak Hour Factor, PHF | | 0.92 | 0.92 | 0.92 | 0.88 | 0.88 | 0.88 |
| Hourly Flow Rate, HFR | | 0 | 0 | 190 | 0 | 0 | 48 |
| Percent Heavy Vehicles | | 3 | 3 | 3 | 1 | 1 | 1 |
| Percent Grade (%) | | 0 | | | 0 | | |
| Flared Approach: Exists?/Storage | | | | Yes /2 | | | Yes /2 |
| Lanes | | 0 | 1 | 0 | 0 | 1 | 0 |
| Configuration | | LTR | | | LTR | | |

Delay, Queue Length, and Level of Service

| Approach Movement | EB | WB | Northbound | | | Southbound | | |
|-------------------|------|------|------------|---|---|------------|----|----|
| | | | 7 | 8 | 9 | 10 | 11 | 12 |
| Lane Config | L | L | LTR | | | LTR | | |
| v (vph) | 24 | 165 | 190 | | | 48 | | |
| C(m) (vph) | 796 | 864 | | | | | | |
| v/c | 0.03 | 0.19 | | | | | | |
| 95% queue length | 0.09 | 0.70 | | | | | | |
| Control Delay | 9.7 | 10.1 | | | | | | |
| LOS | A | B | | | | | | |
| Approach Delay | | | | | | | | |
| Approach LOS | | | | | | | | |

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: Forest Sutmiller
 Agency/Co.: WSDOT
 Date Performed: 7/24/2017
 Analysis Time Period: PM Peak Hour
 Intersection: SR 160 at Phillips Road
 Jurisdiction: Kitsap County
 Units: U. S. Customary
 Analysis Year: 2036
 Project ID: SR 160 Build Roundabout at Long Lake
 East/West Street: SR 160
 North/South Street: Phillips
 Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

| Major Street: | Approach Movement | Eastbound | | | Westbound | | |
|------------------------|-------------------|-----------|--------|--------|-----------|--------|--------|
| | | 1 L | 2 T | 3 R | 4 L | 5 T | 6 R |
| Volume | | 31 | 705 | 223 | 146 | 800 | 111 |
| Peak-Hour Factor, PHF | | 0.92 | 0.92 | 0.92 | 0.88 | 0.88 | 0.88 |
| Hourly Flow Rate, HFR | | 33 | 766 | 242 | 165 | 909 | 126 |
| Percent Heavy Vehicles | | 0 | -- | -- | 2 | -- | -- |
| Median Type/Storage | | Undivided | | | / | | |
| RT Channelized? | | | | | | | |
| Lanes | | 1 | 1 | 0 | 1 | 1 | 0 |
| Configuration | | L | | TR | L | | TR |
| Upstream Signal? | | No | | | No | | |

| Minor Street: | Approach Movement | Northbound | | | Southbound | | |
|----------------------------------|-------------------|------------|--------|--------|------------|---------|---------|
| | | 7 L | 8 T | 9 R | 10 L | 11 T | 12 R |
| Volume | | 0 | 0 | 369 | 0 | 0 | 27 |
| Peak Hour Factor, PHF | | 0.92 | 0.92 | 0.92 | 0.88 | 0.88 | 0.88 |
| Hourly Flow Rate, HFR | | 0 | 0 | 401 | 0 | 0 | 30 |
| Percent Heavy Vehicles | | 1 | 1 | 1 | 4 | 4 | 4 |
| Percent Grade (%) | | 0 | | | 0 | | |
| Flared Approach: Exists?/Storage | | | | | Yes /2 | Yes /2 | |
| Lanes | | 0 | 1 | 0 | 0 | 1 | 0 |
| Configuration | | LTR | | | LTR | | |

Delay, Queue Length, and Level of Service

| Approach | EB | WB | Northbound | | | Southbound | | | | |
|------------------|------|------|------------|-----|---|------------|----|-----|----|----|
| | | | 7 | 8 | 9 | 10 | 11 | 12 | | |
| Movement | 1 | 4 | | 7 | 8 | 9 | | 10 | 11 | 12 |
| Lane Config | L | L | | LTR | | | | LTR | | |
| v (vph) | 33 | 165 | | 401 | | | | 30 | | |
| C(m) (vph) | 679 | 687 | | | | | | | | |
| v/c | 0.05 | 0.24 | | | | | | | | |
| 95% queue length | 0.15 | 0.93 | | | | | | | | |
| Control Delay | 10.6 | 11.9 | | | | | | | | |
| LOS | B | B | | | | | | | | |
| Approach Delay | | | | | | | | | | |
| Approach LOS | | | | | | | | | | |

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: Forest Suttmiller
 Agency/Co.: WSDOT
 Date Performed: 7/27/2017
 Analysis Time Period: AM Peak Hour
 Intersection: Long Lake EB Ramp
 Jurisdiction: Kitsap County
 Units: U. S. Customary
 Analysis Year: 2036
 Project ID: SR 160 Long Lake with Interchange
 East/West Street: EB Off/On Ramp
 North/South Street: Long Lake Road
 Intersection Orientation: NS Study period (hrs): 0.25

Vehicle Volumes and Adjustments

| Major Street: Approach Movement | Northbound | | | Southbound | | |
|------------------------------------|------------|--------|--------|------------|--------|--------|
| | 1 L | 2 T | 3 R | 4 L | 5 T | 6 R |
| Volume | | 267 | 12 | 14 | 30 | |
| Peak-Hour Factor, PHF | | 0.92 | 0.92 | 0.92 | 0.92 | |
| Hourly Flow Rate, HFR | | 290 | 13 | 15 | 32 | |
| Percent Heavy Vehicles | | -- | -- | 2 | -- | -- |
| Median Type/Storage | Undivided | | | / | | |
| RT Channelized? | | | | | | |
| Lanes | | 1 | 0 | | 0 | 1 |
| Configuration | | | TR | | LT | |
| Upstream Signal? | | No | | | No | |

| Minor Street: Approach Movement | Westbound | | | Eastbound | | |
|------------------------------------|-----------|--------|--------|-----------|---------|---------|
| | 7 L | 8 T | 9 R | 10 L | 11 T | 12 R |
| Volume | | | | 184 | 0 | 46 |
| Peak Hour Factor, PHF | | | | 0.92 | 0.92 | 0.92 |
| Hourly Flow Rate, HFR | | | | 199 | 0 | 49 |
| Percent Heavy Vehicles | | | | 2 | 2 | 2 |
| Percent Grade (%) | | 0 | | | 0 | |
| Flared Approach: Exists?/Storage | | | | / | | |
| Lanes | | | | 0 | 1 | 1 |
| Configuration | | | | LT | | R |

Delay, Queue Length, and Level of Service

| Approach Movement Lane Config | NB | SB | Westbound | | | Eastbound | | |
|-------------------------------------|----|------|-----------|---|---|-----------|------|------|
| | 1 | 4 | 7 | 8 | 9 | 10 | 11 | 12 |
| | | LT | | | | LT | | R |
| v (vph) | | 15 | | | | 199 | | 49 |
| C(m) (vph) | | 1258 | | | | 632 | | 1042 |
| v/c | | 0.01 | | | | 0.31 | | 0.05 |
| 95% queue length | | 0.04 | | | | 1.35 | | 0.15 |
| Control Delay | | 7.9 | | | | 13.3 | | 8.6 |
| LOS | | A | | | | B | | A |
| Approach Delay | | | | | | | 12.4 | |
| Approach LOS | | | | | | | B | |

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: Forest Suttmiller
 Agency/Co.: WSDOT
 Date Performed: 7/27/2017
 Analysis Time Period: AM Peak Hour
 Intersection: Long Lake WB Ramp
 Jurisdiction: Kitsap County
 Units: U. S. Customary
 Analysis Year: 2036
 Project ID: SR 160 Long Lake with Interchange
 East/West Street: WB Off/On Ramp
 North/South Street: Long Lake Road
 Intersection Orientation: NS Study period (hrs): 0.25

Vehicle Volumes and Adjustments

| Major Street: | Approach Movement | Northbound | | | | Southbound | |
|------------------------|-------------------|------------|--------|--------|--------|------------|--------|
| | | 1 L | 2 T | 3 R | 4 L | 5 T | 6 R |
| Volume | | 248 | 203 | | | 37 | 252 |
| Peak-Hour Factor, PHF | | 0.92 | 0.92 | | | 0.92 | 0.92 |
| Hourly Flow Rate, HFR | | 269 | 220 | | | 40 | 273 |
| Percent Heavy Vehicles | | 2 | -- | -- | | -- | -- |
| Median Type/Storage | | Undivided | | | | / | |
| RT Channelized? | | | | | | | No |
| Lanes | | 1 | 1 | | | 1 | 1 |
| Configuration | | L | T | | | T | R |
| Upstream Signal? | | | No | | | No | |

| Minor Street: | Approach Movement | Westbound | | | Eastbound | | |
|----------------------------------|-------------------|-----------|--------|--------|-----------|---------|---------|
| | | 7 L | 8 T | 9 R | 10 L | 11 T | 12 R |
| Volume | | 7 | 0 | 13 | | | |
| Peak Hour Factor, PHF | | 0.88 | 0.88 | 0.88 | | | |
| Hourly Flow Rate, HFR | | 7 | 0 | 14 | | | |
| Percent Heavy Vehicles | | 2 | 2 | 2 | | | |
| Percent Grade (%) | | | 0 | | | 0 | |
| Flared Approach: Exists?/Storage | | | | Yes | /2 | | / |
| Lanes | | 0 | 1 | 0 | | | |
| Configuration | | | LTR | | | | |

Delay, Queue Length, and Level of Service

| Approach Movement | NB | SB | Westbound | | | Eastbound | | |
|-------------------|------|----|-----------|------|---|-----------|----|----|
| | | | 7 | 8 | 9 | 10 | 11 | 12 |
| Lane Config | L | | | LTR | | | | |
| v (vph) | 269 | | | 21 | | | | |
| C(m) (vph) | 1247 | | | 693 | | | | |
| v/c | 0.22 | | | 0.03 | | | | |
| 95% queue length | 0.82 | | | 0.09 | | | | |
| Control Delay | 8.7 | | | 13.3 | | | | |
| LOS | A | | | B | | | | |
| Approach Delay | | | | 13.3 | | | | |
| Approach LOS | | | | B | | | | |

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: Forest Sutmiller
 Agency/Co.: WSDOT
 Date Performed: 7/12/2017
 Analysis Time Period: AM Peak Hour
 Intersection: SR 160 at Phillips Road
 Jurisdiction: Kitsap County
 Units: U. S. Customary
 Analysis Year: 2036
 Project ID: SR 160 Build Signal at Long Lake
 East/West Street: SR 160
 North/South Street: Phillips Road
 Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

| Major Street: Approach Movement | Eastbound | | | Westbound | | |
|------------------------------------|-----------|--------|--------|-----------|--------|--------|
| | 1 L | 2 T | 3 R | 4 L | 5 T | 6 R |
| Volume | 23 | 485 | 199 | 130 | 672 | 9 |
| Peak-Hour Factor, PHF | 0.92 | 0.92 | 0.92 | 0.88 | 0.88 | 0.88 |
| Hourly Flow Rate, HFR | 24 | 527 | 216 | 147 | 763 | 10 |
| Percent Heavy Vehicles | 3 | -- | -- | 2 | -- | -- |
| Median Type/Storage | Undivided | | | / | | |
| RT Channelized? | | | | | | |
| Lanes | 1 | 1 | 0 | 1 | 1 | 0 |
| Configuration | L | | TR | L | | TR |
| Upstream Signal? | No | | | No | | |

| Minor Street: Approach Movement | Northbound | | | Southbound | | |
|------------------------------------|------------|--------|--------|------------|---------|---------|
| | 7 L | 8 T | 9 R | 10 L | 11 T | 12 R |
| Volume | 0 | 0 | 84 | 0 | 0 | 43 |
| Peak Hour Factor, PHF | 0.92 | 0.92 | 0.92 | 0.88 | 0.88 | 0.88 |
| Hourly Flow Rate, HFR | 0 | 0 | 91 | 0 | 0 | 48 |
| Percent Heavy Vehicles | 3 | 3 | 3 | 1 | 1 | 1 |
| Percent Grade (%) | 0 | | | 0 | | |
| Flared Approach: Exists?/Storage | | | Yes | /2 | | Yes /2 |
| Lanes | 0 | 1 | 0 | 0 | 1 | 0 |
| Configuration | LTR | | | LTR | | |

Delay, Queue Length, and Level of Service

| Approach Movement | EB | WB | Northbound | | | Southbound | | |
|----------------------|------|-------|------------|-----|---|------------|-----|----|
| | 1 | 4 | 7 | 8 | 9 | 10 | 11 | 12 |
| Lane Config | L | L | | LTR | | | LTR | |
| v (vph) | 24 | 147 | 91 | | | 48 | | |
| C(m) (vph) | 838 | 864 | | | | | | |
| v/c | 0.03 | 0.17 | | | | | | |
| 95% queue length | 0.09 | 0.61 | | | | | | |
| Control Delay | 9.4 | 10.0+ | | | | | | |
| LOS | A | B | | | | | | |
| Approach Delay | | | | | | | | |
| Approach LOS | | | | | | | | |

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: Forest Suttmiller
 Agency/Co.: WSDOT
 Date Performed: 7/12/2017
 Analysis Time Period: PM Peak Hour
 Intersection: SR 160 at Phillips Road
 Jurisdiction: Kitsap County
 Units: U. S. Customary
 Analysis Year: 2036
 Project ID: SR 160 Build Signal at Long Lake
 East/West Street: SR 160
 North/South Street: Phillips
 Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

| Major Street: Approach Movement | Eastbound | | | | Westbound | | |
|---------------------------------|-----------|--------|--------|--------|-----------|--------|--|
| | 1 L | 2 T | 3 R | 4 L | 5 T | 6 R | |
| Volume | 31 | 705 | 223 | 130 | 800 | 27 | |
| Peak-Hour Factor, PHF | 0.92 | 0.92 | 0.92 | 0.88 | 0.88 | 0.88 | |
| Hourly Flow Rate, HFR | 33 | 766 | 242 | 147 | 909 | 30 | |
| Percent Heavy Vehicles | 0 | -- | -- | 2 | -- | -- | |
| Median Type/Storage | Undivided | | | / | | | |
| RT Channelized? | | | | | | | |
| Lanes | 1 | 1 | 0 | 1 | 1 | 0 | |
| Configuration | L | TR | | L | TR | | |
| Upstream Signal? | No | | | No | | | |

| Minor Street: Approach Movement | Northbound | | | Southbound | | |
|----------------------------------|------------|--------|--------|------------|---------|---------|
| | 7 L | 8 T | 9 R | 10 L | 11 T | 12 R |
| Volume | 0 | 0 | 237 | 0 | 0 | 27 |
| Peak Hour Factor, PHF | 0.92 | 0.92 | 0.92 | 0.88 | 0.88 | 0.88 |
| Hourly Flow Rate, HFR | 0 | 0 | 257 | 0 | 0 | 30 |
| Percent Heavy Vehicles | 1 | 1 | 1 | 4 | 4 | 4 |
| Percent Grade (%) | 0 | | | 0 | | |
| Flared Approach: Exists?/Storage | | | Yes | /2 | Yes /2 | |
| Lanes | 0 | 1 | 0 | 0 | 1 | 0 |
| Configuration | LTR | | | LTR | | |

Delay, Queue Length, and Level of Service

| Approach Movement | EB | WB | Northbound | | | Southbound | | |
|-------------------|------|------|------------|-----|---|------------|-----|----|
| | 1 | 4 | 7 | 8 | 9 | 10 | 11 | 12 |
| Lane Config | L | L | | LTR | | | LTR | |
| v (vph) | 33 | 147 | | 257 | | | 30 | |
| C(m) (vph) | 738 | 687 | | | | | | |
| v/c | 0.04 | 0.21 | | | | | | |
| 95% queue length | 0.14 | 0.81 | | | | | | |
| Control Delay | 10.1 | 11.7 | | | | | | |
| LOS | B | B | | | | | | |
| Approach Delay | | | | | | | | |
| Approach LOS | | | | | | | | |

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: Forest Sutmiller
 Agency/Co.: WSDOT
 Date Performed: 7/27/2017
 Analysis Time Period: AM Peak Hour
 Intersection: SR 160 at Phillips Road
 Jurisdiction: Kitsap County
 Units: U. S. Customary
 Analysis Year: 2036
 Project ID: SR 160 with Interchange at Long Lake
 East/West Street: SR 160
 North/South Street:
 Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

| Major Street: | Approach Movement | Eastbound | | | Westbound | | |
|------------------------|----------------------|-----------|--------|--------|-----------|--------|--------|
| | | 1 L | 2 T | 3 R | 4 L | 5 T | 6 R |
| Volume | | 23 | 485 | 199 | 146 | 672 | 62 |
| Peak-Hour Factor, PHF | | 0.92 | 0.92 | 0.92 | 0.88 | 0.88 | 0.88 |
| Hourly Flow Rate, HFR | | 24 | 527 | 216 | 165 | 763 | 70 |
| Percent Heavy Vehicles | | 3 | -- | -- | 2 | -- | -- |
| Median Type/Storage | | Undivided | | | / | | |
| RT Channelized? | | | | | | | |
| Lanes | | 1 | 1 | 0 | 1 | 1 | 0 |
| Configuration | | L | | TR | L | | TR |
| Upstream Signal? | | | No | | | No | |

| Minor Street: | Approach Movement | Northbound | | | Southbound | | |
|----------------------------------|----------------------|------------|--------|--------|------------|---------|---------|
| | | 7 L | 8 T | 9 R | 10 L | 11 T | 12 R |
| Volume | | 0 | 0 | 84 | 0 | 0 | 43 |
| Peak Hour Factor, PHF | | 0.92 | 0.92 | 0.92 | 0.88 | 0.88 | 0.88 |
| Hourly Flow Rate, HFR | | 0 | 0 | 91 | 0 | 0 | 48 |
| Percent Heavy Vehicles | | 3 | 3 | 3 | 1 | 1 | 1 |
| Percent Grade (%) | | | 0 | | | 0 | |
| Flared Approach: Exists?/Storage | | | | Yes | /2 | | Yes /2 |
| Lanes | | 0 | 1 | 0 | 0 | 1 | 0 |
| Configuration | | | LTR | | | LTR | |

Delay, Queue Length, and Level of Service

| Approach Movement | EB 1 L | WB 4 L | Northbound | | | Southbound | | |
|----------------------|--------------|--------------|------------|----------|--------|------------|-----------|---------|
| | | | 7 L | 8 LTR | 9 L | 10 L | 11 LTR | 12 L |
| Lane Config | | | | LTR | | | LTR | |
| v (vph) | 24 | 165 | | 91 | | | 48 | |
| C(m) (vph) | 796 | 864 | | | | | | |
| v/c | 0.03 | 0.19 | | | | | | |
| 95% queue length | 0.09 | 0.70 | | | | | | |
| Control Delay | 9.7 | 10.1 | | | | | | |
| LOS | A | B | | | | | | |
| Approach Delay | | | | | | | | |
| Approach LOS | | | | | | | | |

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: Forest Suttmiller
 Agency/Co.: WSDOT
 Date Performed: 7/27/2017
 Analysis Time Period: PM Peak Hour
 Intersection: SR 160 at Phillips Road
 Jurisdiction: Kitsap County
 Units: U. S. Customary
 Analysis Year: 2036
 Project ID: SR 160 with Interchange at Long Lake
 East/West Street: SR 160
 North/South Street:
 Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

| Major Street: Approach Movement | Eastbound | | | Westbound | | |
|---------------------------------|-----------|--------|--------|-----------|--------|--------|
| | 1 L | 2 T | 3 R | 4 L | 5 T | 6 R |
| Volume | 31 | 705 | 223 | 146 | 800 | 111 |
| Peak-Hour Factor, PHF | 0.92 | 0.92 | 0.92 | 0.88 | 0.88 | 0.88 |
| Hourly Flow Rate, HFR | 33 | 766 | 242 | 165 | 909 | 126 |
| Percent Heavy Vehicles | 0 | -- | -- | 2 | -- | -- |
| Median Type/Storage | Undivided | | | / | | |
| RT Channelized? | | | | | | |
| Lanes | 1 | 1 | 0 | 1 | 1 | 0 |
| Configuration | L | | TR | L | | TR |
| Upstream Signal? | No | | | No | | |

| Minor Street: Approach Movement | Northbound | | | Southbound | | |
|----------------------------------|------------|--------|--------|------------|---------|---------|
| | 7 L | 8 T | 9 R | 10 L | 11 T | 12 R |
| Volume | 0 | 0 | 237 | 0 | 0 | 27 |
| Peak Hour Factor, PHF | 0.92 | 0.92 | 0.92 | 0.88 | 0.88 | 0.88 |
| Hourly Flow Rate, HFR | 0 | 0 | 257 | 0 | 0 | 30 |
| Percent Heavy Vehicles | 1 | 1 | 1 | 4 | 4 | 4 |
| Percent Grade (%) | 0 | | | 0 | | |
| Flared Approach: Exists?/Storage | | | Yes | /2 | | Yes /2 |
| Lanes | 0 | 1 | 0 | 0 | 1 | 0 |
| Configuration | LTR | | | LTR | | |

Delay, Queue Length, and Level of Service

| Approach Movement | EB | WB | Northbound | | | Southbound | | |
|-------------------|------|------|------------|-----|---|------------|-----|----|
| | 1 | 4 | 7 | 8 | 9 | 10 | 11 | 12 |
| Lane Config | L | L | | LTR | | | LTR | |
| v (vph) | 33 | 165 | | 257 | | | 30 | |
| C(m) (vph) | 679 | 687 | | | | | | |
| v/c | 0.05 | 0.24 | | | | | | |
| 95% queue length | 0.15 | 0.93 | | | | | | |
| Control Delay | 10.6 | 11.9 | | | | | | |
| LOS | B | B | | | | | | |
| Approach Delay | | | | | | | | |
| Approach LOS | | | | | | | | |

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: Forest Sutmiller
 Agency/Co.: WSDOT
 Date Performed: 7/27/2017
 Analysis Time Period: AM Peak Hour
 Intersection: Long Lake WB Ramp
 Jurisdiction: Kitsap County
 Units: U. S. Customary
 Analysis Year: 2036
 Project ID: SR 160 Long Lake with Interchange
 East/West Street: WB Off/On Ramp
 North/South Street: Long Lake Road
 Intersection Orientation: NS Study period (hrs): 0.25

Vehicle Volumes and Adjustments

| Major Street: | Approach Movement | Northbound | | | | Southbound | |
|------------------------|----------------------|------------|--------|--------|--------|------------|--------|
| | | 1 L | 2 T | 3 R | 4 L | 5 T | 6 R |
| Volume | | 248 | 203 | | | 37 | 252 |
| Peak-Hour Factor, PHF | | 0.92 | 0.92 | | | 0.92 | 0.92 |
| Hourly Flow Rate, HFR | | 269 | 220 | | | 40 | 273 |
| Percent Heavy Vehicles | | 2 | -- | -- | | -- | -- |
| Median Type/Storage | | Undivided | | | | / | |
| RT Channelized? | | | | | | | No |
| Lanes | | 1 | 1 | | | 1 | 1 |
| Configuration | | L | T | | | T | R |
| Upstream Signal? | | | No | | | No | |

| Minor Street: | Approach Movement | Westbound | | | Eastbound | | |
|----------------------------------|----------------------|-----------|--------|--------|-----------|---------|---------|
| | | 7 L | 8 T | 9 R | 10 L | 11 T | 12 R |
| Volume | | 7 | 0 | 13 | | | |
| Peak Hour Factor, PHF | | 0.88 | 0.88 | 0.88 | | | |
| Hourly Flow Rate, HFR | | 7 | 0 | 14 | | | |
| Percent Heavy Vehicles | | 2 | 2 | 2 | | | |
| Percent Grade (%) | | | 0 | | | 0 | |
| Flared Approach: Exists?/Storage | | | | Yes | /2 | | / |
| Lanes | | 0 | 1 | 0 | | | |
| Configuration | | | LTR | | | | |

Delay, Queue Length, and Level of Service

| Approach Movement | NB | SB | Westbound | | | Eastbound | | | | |
|----------------------|------|----|-----------|---|------|-----------|---|----|----|----|
| | | | 1 | 4 | 7 | 8 | 9 | 10 | 11 | 12 |
| Lane Config | L | | | | LTR | | | | | |
| v (vph) | 269 | | | | 21 | | | | | |
| C(m) (vph) | 1247 | | | | 693 | | | | | |
| v/c | 0.22 | | | | 0.03 | | | | | |
| 95% queue length | 0.82 | | | | 0.09 | | | | | |
| Control Delay | 8.7 | | | | 13.3 | | | | | |
| LOS | A | | | | B | | | | | |
| Approach Delay | | | | | 13.3 | | | | | |
| Approach LOS | | | | | B | | | | | |

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: Forest Sutmiller
 Agency/Co.: WSDOT
 Date Performed: 7/27/2017
 Analysis Time Period: PM Peak Hour
 Intersection: Long Lake WB Ramp
 Jurisdiction: Kitsap County
 Units: U. S. Customary
 Analysis Year: 2036
 Project ID: SR 160 Long Lake with Interchange
 East/West Street: WB Off/On Ramp
 North/South Street: Long Lake Road
 Intersection Orientation: NS Study period (hrs): 0.25

Vehicle Volumes and Adjustments

| Major Street: Approach Movement | Northbound | | | | Southbound | | | |
|---------------------------------|------------|--------|--------|--------|------------|--------|--|--|
| | 1 L | 2 T | 3 R | 4 L | 5 T | 6 R | | |
| Volume | 325 | 320 | | | 55 | 247 | | |
| Peak-Hour Factor, PHF | 0.92 | 0.92 | | | 0.92 | 0.92 | | |
| Hourly Flow Rate, HFR | 353 | 347 | | | 59 | 268 | | |
| Percent Heavy Vehicles | 2 | -- | -- | | -- | -- | | |
| Median Type/Storage | Undivided | | | | / | | | |
| RT Channelized? | | | | | No | | | |
| Lanes | 1 | 1 | | | 1 | 1 | | |
| Configuration | L T | | | | T R | | | |
| Upstream Signal? | No | | | | No | | | |

| Minor Street: Approach Movement | Westbound | | | | Eastbound | | | |
|----------------------------------|-----------|--------|--------|---------|-----------|---------|---|--|
| | 7 L | 8 T | 9 R | 10 L | 11 T | 12 R | | |
| Volume | 14 | 0 | 43 | | | | | |
| Peak Hour Factor, PHF | 0.88 | 0.88 | 0.88 | | | | | |
| Hourly Flow Rate, HFR | 15 | 0 | 48 | | | | | |
| Percent Heavy Vehicles | 2 | 2 | 2 | | | | | |
| Percent Grade (%) | | | | | 0 | | | |
| Flared Approach: Exists?/Storage | | | Yes /2 | | | | / | |
| Lanes | 0 | 1 | 0 | | | | | |
| Configuration | LTR | | | | | | | |

Delay, Queue Length, and Level of Service

| Approach Movement | NB | SB | Westbound | | | Eastbound | | |
|-------------------|------|----|-----------|------|---|-----------|----|----|
| | 1 | 4 | 7 | 8 | 9 | 10 | 11 | 12 |
| Lane Config | L | | | LTR | | | | |
| v (vph) | 353 | | | 63 | | | | |
| C(m) (vph) | 1233 | | | 575 | | | | |
| v/c | 0.29 | | | 0.11 | | | | |
| 95% queue length | 1.19 | | | 0.37 | | | | |
| Control Delay | 9.1 | | | 16.3 | | | | |
| LOS | A | | | C | | | | |
| Approach Delay | | | | 16.3 | | | | |
| Approach LOS | | | | C | | | | |

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: Forest Suttmiller
 Agency/Co.: WSDOT
 Date Performed: 7/27/2017
 Analysis Time Period: AM Peak Hour
 Intersection: SR 160 and Mayvolt Rd SE
 Jurisdiction: Kitsap County
 Units: U. S. Customary
 Analysis Year: 2036
 Project ID: SR 160 with Interchange at Long Lake
 East/West Street: SR 160
 North/South Street: Mayvolt-Lake Valley Rd SE
 Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

| Major Street: | Approach Movement | Eastbound | | | | Westbound | | |
|------------------------|-------------------|-----------|--------|--------|--------|-----------|--------|--|
| | | 1 L | 2 T | 3 R | 4 L | 5 T | 6 R | |
| Volume | | 10 | 353 | 2 | 16 | 368 | 6 | |
| Peak-Hour Factor, PHF | | 0.92 | 0.92 | 0.92 | 0.88 | 0.88 | 0.88 | |
| Hourly Flow Rate, HFR | | 10 | 383 | 2 | 18 | 418 | 6 | |
| Percent Heavy Vehicles | | 4 | -- | -- | 2 | -- | -- | |
| Median Type/Storage | | Undivided | | | | / | | |
| RT Channelized? | | | | | | | | |
| Lanes | | 0 | 1 | 0 | 0 | 1 | 0 | |
| Configuration | | LTR | | | LTR | | | |
| Upstream Signal? | | No | | | No | | | |

| Minor Street: | Approach Movement | Northbound | | | Southbound | | |
|----------------------------------|-------------------|------------|--------|--------|------------|---------|---------|
| | | 7 L | 8 T | 9 R | 10 L | 11 T | 12 R |
| Volume | | 11 | 5 | 13 | 8 | 3 | 21 |
| Peak Hour Factor, PHF | | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 |
| Hourly Flow Rate, HFR | | 12 | 5 | 14 | 9 | 3 | 23 |
| Percent Heavy Vehicles | | 10 | 10 | 10 | 4 | 4 | 4 |
| Percent Grade (%) | | 0 | | | 0 | | |
| Flared Approach: Exists?/Storage | | 0 | | 1 | 0 | 0 | 1 |
| Lanes | | 0 | 1 | 0 | 0 | 1 | 0 |
| Configuration | | LTR | | | LTR | | |

Delay, Queue Length, and Level of Service

| Approach Movement | EB | WB | Northbound | | | Southbound | | |
|-------------------|------|------|------------|------|------|------------|------|------|
| | 1 | 4 | 7 | 8 | 9 | 10 | 11 | 12 |
| Lane Config | LTR | LTR | LTR | LTR | LTR | LTR | LTR | LTR |
| v (vph) | 10 | 18 | 31 | 31 | 31 | 35 | 35 | 35 |
| C(m) (vph) | 1125 | 1173 | 460 | 460 | 460 | 758 | 758 | 758 |
| v/c | 0.01 | 0.02 | 0.07 | 0.07 | 0.07 | 0.05 | 0.05 | 0.05 |
| 95% queue length | 0.03 | 0.05 | 0.22 | 0.22 | 0.22 | 0.14 | 0.14 | 0.14 |
| Control Delay | 8.2 | 8.1 | 16.0 | 16.0 | 16.0 | 13.9 | 13.9 | 13.9 |
| LOS | A | A | C | C | C | B | B | B |
| Approach Delay | | | 16.0 | 16.0 | 16.0 | 13.9 | 13.9 | 13.9 |
| Approach LOS | | | C | C | C | B | B | B |

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: Forest Suttmiller
 Agency/Co.: WSDOT
 Date Performed: 7/27/2017
 Analysis Time Period: PM Peak Hour
 Intersection: SR 160 and Mayvolt Rd SE
 Jurisdiction: Kitsap County
 Units: U. S. Customary
 Analysis Year: 2036
 Project ID: SR 160 with Interchange at Long Lake
 East/West Street: SR 160
 North/South Street: Mayvolt-Lake Valley Rd SE
 Intersection Orientation: NS Study period (hrs): 0.25

Vehicle Volumes and Adjustments

| Major Street: Approach Movement | Northbound | | | | Southbound | | |
|------------------------------------|------------|--------|--------|--------|------------|--------|---|
| | 1 L | 2 T | 3 R | 4 L | 5 T | 6 R | |
| Volume | 8 | 10 | 24 | 2 | 2 | 28 | |
| Peak-Hour Factor, PHF | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | |
| Hourly Flow Rate, HFR | 9 | 11 | 27 | 2 | 2 | 31 | |
| Percent Heavy Vehicles | 0 | -- | -- | 0 | -- | -- | |
| Median Type/Storage | Undivided | | | / | | | |
| RT Channelized? | | | | | | | |
| Lanes | 0 | 1 | 0 | | 0 | 1 | 0 |
| Configuration | LTR | | | LTR | | | |
| Upstream Signal? | No | | | No | | | |

| Minor Street: Approach Movement | Westbound | | | Eastbound | | | |
|------------------------------------|-----------|--------|--------|-----------|---------|---------|------|
| | 7 L | 8 T | 9 R | 10 L | 11 T | 12 R | |
| Volume | 21 | 506 | 3 | 33 | 504 | 5 | |
| Peak Hour Factor, PHF | 0.88 | 0.88 | 0.88 | 0.92 | 0.92 | 0.92 | |
| Hourly Flow Rate, HFR | 23 | 575 | 3 | 35 | 547 | 5 | |
| Percent Heavy Vehicles | 2 | 0 | 0 | 1 | 0 | 0 | |
| Percent Grade (%) | 0 | | | 0 | | | |
| Flared Approach: Exists?/Storage | | | No | / | | | No / |
| Lanes | 0 | 1 | 0 | | 0 | 1 | 0 |
| Configuration | LTR | | | LTR | | | |

Delay, Queue Length, and Level of Service

| Approach Movement | NB | SB | Westbound | | | Eastbound | | |
|----------------------|------|------|-----------|-----|-----|-----------|-----|-----|
| | 1 | 4 | 7 | 8 | 9 | 10 | 11 | 12 |
| Lane Config | LTR | LTR | LTR | LTR | LTR | LTR | LTR | LTR |
| v (vph) | 9 | 2 | 601 | | | 587 | | |
| C(m) (vph) | 1592 | 1585 | 754 | | | 717 | | |
| v/c | 0.01 | 0.00 | 0.80 | | | 0.82 | | |
| 95% queue length | 0.02 | 0.00 | 8.24 | | | 8.79 | | |
| Control Delay | 7.3 | 7.3 | 25.7 | | | 28.5 | | |
| LOS | A | A | D | | | D | | |
| Approach Delay | | | 25.7 | | | 28.5 | | |
| Approach LOS | | | D | | | D | | |

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: Forest Suttmiller
 Agency/Co.: WSDOT
 Date Performed: 7/25/2017
 Analysis Time Period: AM Peak Hour
 Intersection: SR 160 at Long Lake Road
 Jurisdiction: Kitsap County
 Units: U. S. Customary
 Analysis Year: 2036
 Project ID: SR 160 Right-in Right-out Only
 East/West Street: SR 160
 North/South Street: Long Lake Road
 Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

| Major Street: | Approach Movement | Eastbound | | | | Westbound | | |
|------------------------|-------------------|-----------|--------|--------|----------|-----------|--------|--|
| | | 1 L | 2 T | 3 R | 4 L | 5 T | 6 R | |
| Volume | | | 537 | 76 | | 455 | 216 | |
| Peak-Hour Factor, PHF | | | 0.92 | 0.92 | | 0.88 | 0.88 | |
| Hourly Flow Rate, HFR | | | 583 | 82 | | 517 | 245 | |
| Percent Heavy Vehicles | | | -- | -- | | -- | -- | |
| Median Type/Storage | | Undivided | | | / | | | |
| RT Channelized? | | | | No | | | No | |
| Lanes | | | 1 | 1 | | 1 | 1 | |
| Configuration | | | T | R | | T | R | |
| Upstream Signal? | | | No | | | No | | |

| Minor Street: | Approach Movement | Northbound | | | Southbound | | |
|----------------------------------|-------------------|------------|--------|--------|------------|---------|---------|
| | | 7 L | 8 T | 9 R | 10 L | 11 T | 12 R |
| Volume | | | | 59 | | | 269 |
| Peak Hour Factor, PHF | | | | 0.88 | | | 0.88 |
| Hourly Flow Rate, HFR | | | | 67 | | | 305 |
| Percent Heavy Vehicles | | | | 2 | | | 4 |
| Percent Grade (%) | | 0 | | | | 0 | |
| Flared Approach: Exists?/Storage | | | | | / | | / |
| Lanes | | | | 1 | | | 1 |
| Configuration | | | | R | | | R |

Delay, Queue Length, and Level of Service

| Approach Movement | EB | WB | Northbound | | | Southbound | | |
|-------------------|----|----|------------|---|--------|------------|----|---------|
| | | | 7 | 8 | 9 R | 10 | 11 | 12 R |
| v (vph) | | | | | 67 | | | 305 |
| C(m) (vph) | | | | | 512 | | | 554 |
| v/c | | | | | 0.13 | | | 0.55 |
| 95% queue length | | | | | 0.45 | | | 3.32 |
| Control Delay | | | | | 13.1 | | | 19.2 |
| LOS | | | | | B | | | C |
| Approach Delay | | | | | 13.1 | | | 19.2 |
| Approach LOS | | | | | B | | | C |

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: Forest Suttmiller
 Agency/Co.: WSDOT
 Date Performed: 7/25/2017
 Analysis Time Period: PM Peak Hour
 Intersection: SR 160 at Long Lake Road
 Jurisdiction: Kitsap County
 Units: U. S. Customary
 Analysis Year: 2036
 Project ID: SR 160 Right-in Right-out Only
 East/West Street: SR 160
 North/South Street: Long Lake Road
 Intersection Orientation: EW
 Study period (hrs): 0.25

Vehicle Volumes and Adjustments

| Major Street: | Approach Movement | Eastbound | | | | Westbound | |
|------------------------|----------------------|-----------|--------|--------|--------|-----------|--------|
| | | 1 L | 2 T | 3 R | 4 L | 5 T | 6 R |
| Volume | | 817 | | 200 | | 559 | 363 |
| Peak-Hour Factor, PHF | | 0.92 | | 0.92 | | 0.88 | 0.88 |
| Hourly Flow Rate, HFR | | 888 | | 217 | | 635 | 412 |
| Percent Heavy Vehicles | | -- | | -- | | -- | -- |
| Median Type/Storage | | Undivided | | | | / | |
| RT Channelized? | | No | | | | No | |
| Lanes | | 1 | 1 | | | 1 | 1 |
| Configuration | | T | R | | | T | R |
| Upstream Signal? | | No | | | | No | |

| Minor Street: | Approach Movement | Northbound | | | | Southbound | |
|----------------------------------|----------------------|------------|--------|--------|---------|------------|---------|
| | | 7 L | 8 T | 9 R | 10 L | 11 T | 12 R |
| Volume | | | | 105 | | | 286 |
| Peak Hour Factor, PHF | | | | 0.88 | | | 0.88 |
| Hourly Flow Rate, HFR | | | | 119 | | | 325 |
| Percent Heavy Vehicles | | | | 2 | | | 4 |
| Percent Grade (%) | | 0 | | | | 0 | |
| Flared Approach: Exists?/Storage | | | | | | / | |
| Lanes | | | 1 | | | 1 | |
| Configuration | | | R | | | R | |

Delay, Queue Length, and Level of Service

| Approach | EB | WB | Northbound | | | Southbound | | | | |
|------------------|----|----|------------|---|------|------------|----|----|------|------|
| | | | 7 | 8 | 9 | 10 | 11 | 12 | | |
| Movement | 1 | 4 | | 7 | 8 | 9 | | 10 | 11 | 12 |
| Lane Config | | | | | | R | | | | R |
| v (vph) | | | | | | 119 | | | | 325 |
| C(m) (vph) | | | | | | 343 | | | | 475 |
| v/c | | | | | | 0.35 | | | | 0.68 |
| 95% queue length | | | | | | 1.51 | | | | 5.11 |
| Control Delay | | | | | | 21.0 | | | | 27.4 |
| LOS | | | | | | C | | | | D |
| Approach Delay | | | | | 21.0 | | | | 27.4 | |
| Approach LOS | | | | | C | | | | D | |

Stakeholder Committee Meetings

Appendix B – Stakeholder Committee Meetings

SR 160 Long Lake Road SE Planning Study

Stakeholder Committee Meeting #1

Wednesday, May 17, 2017
10:00 a.m. to 12 noon
WSDOT OR Port Orchard Maintenance Conference Room
8293 Spring Creek Road SE, Port Orchard

Attendees

David Forte, Kitsap County
Jeff Shea, Kitsap County

Joe Perez, Olympic Region Traffic
Ken Russell, Olympic Region PEO
Brian Walsh, Headquarters Traffic
Dina Swires, Headquarters Traffic
Kumiko Izawa, Headquarters Traffic
Ida Van Schalkwyk, Headquarters Traffic

WSDOT

Dennis Engel, Olympic Region Planning
Nazmul Alam, Olympic Region Planning
Yvette Liufau, Olympic Region Planning

Welcome/Introductions

Yvette Liufau, WSDOT's study lead welcomed everyone and led the introductions around the table. The meeting agenda was reviewed with attendees. She pointed out to the group the important item on the agenda is the discussion of preliminary ideas as well as any ideas that the group would like to suggest.

Study Overview

Yvette presented an overview of the SR 160 Long Lake Road Study. The study is located along SR 160, Sedgwick Road, which is a 7-mile roadway in rural Kitsap County just outside the Port Orchard city limits. SR 160 starts at SR 16 and ends at the Southworth Ferry Terminal. The Long Lake intersection is a 2-way stop controlled intersection. From Phillips Road west to SR 16 the speed limit is currently 35 MPH and east of Phillips Road the speed limit is 45 MPH. The study limits are from Phillips Road to Mayvolt/Lake Valley Road however, the focus of the study is improving the intersection of SR 160 and Long Lake Road. The Planning Office is working on the study with Region Traffic due to the complexity of this intersection. This location sits on a steep 11% grade. Current traffic analysis data will be presented as part of the meeting. The team will also conduct a 20-year traffic forecast (Year 2036) and safety data analysis. Yvette reviewed the study's schedule with the stakeholders. The study began in September 2016 with research and data collection. There will be three stakeholder meetings held between May and August with two public meetings in May and August. It is anticipated that the study will be completed by the end of September 2017. The WSDOT is studying this intersection due to the

number of serious injury crashes that occurred which labels it an Intersection Analysis Location (IAL).

Study Goals and Objectives and Needs Statement

Yvette presented to the group the draft study goal and objectives, which were developed. The group provided some suggestions about the study goals. Suggestions were made to replace the word “safety” with “reduce or eliminate the fatal and serious injury crashes”. In addition, the phrase “while preserving the needs of the intersection” was added to the end of the last sentence. The committee discussed and decided to replace the word “strategies” with solutions in the study goals and objectives as well as in the needs statement.

Environmental Conditions

Yvette mentioned there is a fish passage in need of repair located within the study limits at SR 160 and Salmonberry Creek, which is between Phillips Road and Long Lake Road. It is currently on the list for future repairs. The intersection is on a steep 11% grade. Additional information about the intersection that Yvette presented was the high power lines that mainly run along the north side of SR 160 to a substation located a third of a mile east of Long Lake Road.

Traffic Existing Conditions

Nazmul Alam presented information about existing traffic conditions. Traffic counts were taken in September of 2016. The existing 2016 AM peak hour intersection level of service (LOS) is F with a delay of 77.6 seconds per vehicle. He explained to the group that the Long Lake Road northbound left, right and thru lanes show a LOS F and the Long Lake Road southbound left, right and thru lanes are at LOS C. The SR 160 mainline east and west directions are operating at a LOS A and better. In the PM peak, the existing 2016 intersection LOS is F with a delay of 1524 seconds per vehicle. The PM peak hour traffic volumes show LOS F on the Long Lake Road northbound left, right and thru lanes and in the Long Lake Road southbound left, right and thru lanes a LOS E. The SR 160 mainline east and west directions are operating at a LOS A and better.

Crash History

Yvette provided intersection related crash information from January 2011 to December 2015 to the group. Twenty-three crashes occurred at the intersection which most of them were at angle type crashes where vehicles did not grant right of way to vehicles traveling on SR 160. Two of the crashes at the intersection were serious injury crashes. One of them occurred when the vehicle traveling northbound on Long Lake Road was hit by a vehicle traveling eastbound on SR 160. There were two people injured and alcohol was involved. The second serious injury crash occurred with a vehicle traveling southbound on Long Lake Road and hit the vehicle traveling northbound on Long Lake Road making a left turn. It involved a motorcycle and 1 person was

injured. A radar spot speed study was conducted at Long Lake Road, Phillips Road and at the crest of the hill. The results mostly showed a slight speed increase at Phillips Road intersection, which may be due to the change in speeds from 35 MPH to 45 MPH.

Disclaimer: Under 23 U.S. Code § 148 and 23 U.S. Code § 409, safety data, reports, surveys, schedules, lists compiled or collected for the purpose of identifying, evaluating, or planning the safety enhancement of potential crash sites, hazardous roadway conditions, or railway-highway crossings are not subject to discovery or admitted into evidence in a Federal or State court proceeding or considered for other purposes in any action for damages arising from any occurrence at a location mentioned or addressed in such reports, surveys, schedules, lists, or data.

Preliminary Ideas

Yvette explained the most important part of today's meeting is the discussion of preliminary ideas. The group discussed the three ideas, which are a roundabout at SR 160 and Long Lake Road, a signal at SR 160 and Long Lake Road or changing it to only right turns into and out of Long Lake Road with roundabouts at Phillips Road and Mayvolt/Lake Valley Road to facilitate traffic turn around. Yvette also asked the group for other ideas that should be considered in addition to the options being presented.

The group discussed the need to improve the cross grade of the roundabout to possibly 5%, and the roundabout should be the right size for the traffic volumes including truck traffic. Possible features at the roundabout can be put in place to help direct vehicles. The traffic signal option the group felt unsure the location would be a good fit for it. Even with advance warning signage, it may result in additional crashes occurring and there were concerns about vehicles coming down the hill being able to stop for the signal. Kitsap County brought up the possible Navy fuel depot truck route changes and plans to turn onto SR 160 at the Long Lake Road intersection. The right turns only option would not only address the safety at Long Lake Road, but also may potentially improve the Phillips Road intersection and more benefit for the cost. However, restricting movements is not a popular solution with communities especially if it adds additional travel time. There was also a suggestion to choose an east end roundabout that is closer to Long Lake Road such as Lakeview Drive or Bodle Road instead of Mayvolt/Lake Valley. The group decided to take the three current options with no additional ones to the May 23 public meeting and find out if any other ideas are suggested.

Next Steps / Action Items

Yvette announced to the group there would be an open house on May 23 from 4:00 p.m. to 6:30 p.m. at the Long Lake Community Center in Port Orchard. We will schedule the next stakeholder committee meeting sometime in the week of July 24 where the committee will hear traffic and safety analysis results and discuss the alternative screening criteria.

SR 160 Long Lake Road SE Planning Study

Stakeholder Committee Meeting #2

Wednesday, August 15, 2017

10:00 a.m. to 12 noon

WSDOT Olympic Region Port Orchard Maintenance Conference Room
8293 Spring Creek Road SE, Port Orchard

Attendees

David Forte, Kitsap County
Jeff Shea, Kitsap County
Jim Rogers, Kitsap County
Lynn Wall, Naval Base Kitsap
Ed Coviello, Kitsap Transit
Alison O'Sullivan, Suquamish Tribe

WSDOT

Dennis Engel, Olympic Region Planning
Nazmul Alam, Olympic Region Planning
Forest Suttmiller, Olympic Region Planning
Yvette Liufau, Olympic Region Planning
Joe Perez, Olympic Region Traffic
Brian Walsh, Headquarters Traffic
Dina Swires, Headquarters Traffic

Welcome/Introductions

Yvette Liufau, WSDOT's study lead welcomed everyone, conducted a safety briefing, and led the introductions around the table. The committee reviewed the meeting agenda. Yvette pointed out the important item on the meeting agenda is the discussion of the alternatives ranking process followed by the ranking of the alternatives.

Study Progress Update

Yvette presented to the committee an update of the work completed since the group last met in May. She reviewed the study goal, objectives and the needs statement. The needs statement states "The need of the SR 160 Long Lake Road Study is to develop potential solutions to improve the safety at the intersection in a way that balances local and regional needs while also managing highway performance." The alternatives that are developed should be in alignment with the needs statement. The work completed on the study to date includes a stakeholder committee meeting and a public meeting held in May. Two additional alternatives, which met the study need, were added because of the public comments received. They are 1) build a bridge on Long Lake Road with on and off ramps to SR 160 and 2) reduce speed limit with advance warning signage. Some additional environmental information, traffic and safety analyses of the alternatives and some planning level cost estimates were shared at the meeting. Yvette explained there is a public meeting planned in the September timeframe followed by the development of the study report. Dina Swires gave some additional background on the study. She mentioned the intersection of SR 160 and Long Lake Road is an Intersection Analysis

Location (IAL). The number of serious injury and fatal crashes is what puts it on the IAL list and this location was on the list in 2010 and again in 2016.

Alternatives for Consideration

The study began with three proposed alternatives. They are to build a roundabout at the SR 160/Long Lake Road intersection, build a signal at the SR 160/Long Lake Road intersection or build 2 roundabouts (Phillips Road and Mayvolt/Lake Valley Road) with right-in and right-out only turn movements to and from Long Lake Road to the north and south of SR 160. There was a public meeting held in May where attendees shared their views of the three original alternatives under consideration. Most of the 23 comments received were favorable towards a roundabout at Long Lake Road and some felt a signal at that location would be safer. There was not much positive feedback about the 2 roundabouts and modifying the access at Long Lake Road. The outcome of the public comments was to elevate the addition of two alternatives as part of the study. The two additional alternatives listed are build a bridge on Long Lake Road with ramps and reduce the speed limit with advance warning signage. Yvette mentioned these are the five alternatives evaluated.

Environmental Resources

Yvette shared with the committee some environmental information. There are two fish passages that are in need of repair, one east and one west of SR 160 and Phillips Road intersection. The fish passage barriers are on the list for repairs, but are not currently prioritized for correction within the current funding cycle. A statewide analysis of wildlife habitat shows the study area specifically between Long Lake Road and Mayvolt/Lake Valley Road is ranked as a medium priority for investing in improvements to reduce crashes with wildlife. Part of the information that is collected and goes into ranking in the wildlife connectivity database is the tracking of carcasses (roadkill). The corridor has a low vulnerability for climate change and extreme weather risks, according to WSDOT's statewide climate impacts vulnerability assessment. Yvette also informed the group there is a medium-priority stormwater drainage area located close to SR 160/Long Lake Road.

Safety Analysis

Yvette talked about the safety analysis that has been conducted. She stated a 5-year history (2011-2015) of crashes at the intersection of SR 160 and Long Lake Road was studied. During that period, two out of the 22 crashes at the location were serious injury crashes. Most of the intersection crashes were angle type of crashes and contributing circumstances include vehicles not granting right of way. A highway safety analysis was performed using the Highway Safety Manual. Yvette explained the two roundabouts with right turns only at Long Lake Road had the highest reduction of crashes. This was likely due to improvements made at three intersections. A roundabout at SR 160/Long Lake Road scored the second highest, with the bridge on Long Lake Road scoring third followed by the SR 160/long lake road signal and last was the speed reduction alternative. The committee discussed the difference between the two roundabout

alternative and the rest of the alternatives not being a fair comparison because one alternative makes improvements to three locations and the other alternatives improve one location. It was mentioned another way to view the safety performance of the alternatives is showing the percent reduction of fatal and serious injury crashes where roundabouts have been shown to reduce these crashes by approximately 75% as compared to other types of improvements.

Traffic Analysis

Forest Sutmiller presented the traffic analysis information to the group. He indicated the 2016 AM & PM level of service is F at Phillips and Long Lake Roads. The minor street left turn typically has the worst delay. The northbound shared left, through and right turn at all three unsignalized intersections shows the worst delay, except for the 2036 PM southbound shared left, through and right turns at the Mayvolt/Lake Valley intersection. The build scenarios were analyzed at the three intersections for AM and PM level of service. Outlined within the red box of the table are the PM level of service scores at Long Lake Road that showed the worst delay. The reducing speed with warning sign option received a LOS F. The two roundabouts and the SR 160/Long Lake Road signal alternatives both received LOS D scores followed by the bridge on Long Lake Road with LOS C. The roundabout at SR 160/Long Lake Road alternative received a LOS B, which had the least amount of delay in the analysis. There was some discussion about whether the analysis captured travel time with the two roundabout alternative for vehicles making U-turns at the roundabouts. The committee agreed that the two roundabout alternative could be LOS F given travel time distances for making U-turns as well for diverting traffic to alternate intersections instead of using Long Lake Road.

Alternatives Cost Estimates

Yvette presented to the committee the alternatives cost estimates. The estimates were calculated using the current statewide planning tool. The cost estimates are planning level and could range between 10% and 20% more or less. The Planning Level Cost Estimates (PLCE) are shown in 2012 dollars. The dollars can be increased to the current or build year. The Long Lake Road bridge with ramps was the most expensive and significantly more costly than the other alternatives. The second highest cost was the two roundabout alternative in the amount of \$7,190,000. The cost of \$4 million for repairing two fish passages was included in the cost estimate for that alternative. The roundabout at SR 160/Long Lake Road was a slightly higher cost than a signal however; the long-term costs associated with maintenance of a signal could be between \$5 and \$10 thousand a year. The least expensive cost alternative was the speed reduction with signage.

Multimodal

Yvette shared some multimodal information that the study team has learned. Long Lake Road to the north and south of SR 160 is a designated bicycle and pedestrian route. School buses travel along SR 160. The Navy's Manchester Fuel Depot has fuel trucks, which utilize SR 160, and has plans for a truck route traveling on Long Lake Road. Kitsap Transit has future plans to add an east west transit route on SR 160. They are planning for passenger only fast ferry service from Southworth to Seattle beginning in 2020. The Navy shared that SR 160 is an important

freight route. The Manchester Fuel Depot is the largest fuel depot in the US. Fuel convoys currently travel through the Manchester community, but future freight is likely to use Long Lake Road where there is less urban development. Kitsap Transit mentioned that the two roundabouts with right-in, right-out at Long Lake would negatively impact their ability for transit to serve area residents and that they were not supportive of that particular build alternative scenario.

Alternatives Ranking Process & Exercise

Nazmul Alam described to the group the proposed process for ranking and scoring the five alternatives. He first gave an overview of the four criteria being used to rank the alternatives. The criteria are Improves Safety, Improves Operations, Constructability/Cost and Multimodal. The group was given information about each of the criteria and asked if this was a reasonable list of criteria. The members agreed and moved forward.

| SR 160 Long Lake Road SE Study Alternative Scoring | | | |
|---|---------------------|---------------------------|----------------------|
| Improves *Safety | Improves Operations | Constructability/ Cost | Multimodal |
| 2.45 - 3.2 = 25 | LOS A/LOS B = 25 | <\$1M = 25 | All modes = 25 |
| 1.7 - 2.45 = 18 | LOS C = 20 | \$1 - \$5M = 20 | Less Attractive = 15 |
| 0.95 - 1.7 = 12 | LOS D = 15 | \$5 - \$10M = 10 | Restrictive = 0 |
| 0.2 - 0.95 = 6 | LOS E = 10 | >\$10M = 0 | |
| | LOS F = 5 | | |

* Net reduction of injury crashes

Next, Nazmul introduced the proposed methodology for measuring each alternative. He described the criteria and the maximum number of points each would receive is 25 points. The maximum number of points an alternative can receive is 100. There was some discussion about the points assigned to the Constructability/Cost and the group agreed to change the projects costing \$10 million or more to 0 points. The committee also agreed to assign 0 points to “Restrictive” shown under the Multimodal criteria.

| | Criteria | | | |
|---|-----------------|-----------------------------------|--|-----------------|
| | Improves Safety | Improves Operations (2036 PM LOS) | Constructability (Dollars are 2012 PLCE) | Multimodal |
| SR 160/Long Lake Road Roundabout | 1.1 | B | \$ 4,646,000 | All modes |
| SR 160/Long Lake Road Signal | 0.6 | D | \$ 3,205,000 | All modes |
| Right-in/right-out only at Long Lake Road with 2 Roundabouts (Phillips & Mayvolt) | 3.2 | D | \$ 7,190,000 | Restricting |
| Reduce speed on SR 160 with Advance Warning Signage | 0.2 | F | \$ 75,000 | All modes |
| Long Lake Road Bridge with Ramps | 1.4 | C | \$ 45,236,000 | Less Attractive |

Disclaimer: Under 23 U.S. Code § 148 and 23 U.S. Code § 409, safety data, reports, surveys, schedules, lists compiled or collected for the purpose of identifying, evaluating, or planning the safety enhancement of potential crash sites, hazardous roadway conditions, or railway-highway crossings are not subject to discovery or admitted into evidence in a Federal or State court proceeding or considered for other purposes in any action for damages arising from any occurrence at a location mentioned or addressed in such reports, surveys, schedules, lists, or data.

Once the group agreed on the methodology for measuring the four criteria, Nazmul presented a table that was populated with the data shared earlier about each of the alternatives. The group discussed the crash analysis and using the crashes after improvement as a measurement instead of the net reduction information. However, they decided to proceed with the net reduction. A question came up about whether the two roundabouts alternative LOS analysis took into consideration the additional travel time for vehicles that have to proceed to the roundabout to make U-turns. The stakeholder committee agreed that the LOS D at SR 160/Long Lake Road (2 roundabout alternative) should realistically be a LOS F because of the travel distances for vehicles turning around. This LOS concern was factored into the alternatives ranking process scoring under “Improves Operations”. Some discussion about the “Constructability/Cost” criteria occurred. The committee felt that if the two roundabout alternative required a median barrier the entire corridor length to prevent illegal U-turns, the cost would likely exceed \$10 million. The group proceeded with the next step to work through each alternative and assign points based on the agreed upon alternative scoring table.

| | Criteria | | | | TOTAL |
|---|-----------------|-----------------------------------|-------------------------------------|------------|-------|
| | Improves Safety | Improves Operations (2036 PM LOS) | Constructability (\$ are 2012 PLCE) | Multimodal | |
| SR 160/Long Lake Road Roundabout | 12 * | 25 | 20 | 25 | 82 |
| SR 160/Long Lake Road Signal | 6 | 15 | 20 | 25 | 66 |
| Right-in/right-out only at Long Lake Road with 2 Roundabouts (Phillips & Mayvolt) | 25 | 5 | 10 | 0 | 40 |
| Reduce speed on SR 160 with Advance Warning Signage | 6 | 5 | 25 | 15 | 51 |
| Long Lake Road Bridge with Ramps | 12 | 20 | 0 | 15 | 47 |

* Score reflects alternative was viewed as stand-alone roundabout; this scored lower than 2 roundabout alternative.

Disclaimer: Under 23 U.S. Code § 148 and 23 U.S. Code § 409, safety data, reports, surveys, schedules, lists compiled or collected for the purpose of identifying, evaluating, or planning the safety enhancement of potential crash sites, hazardous roadway conditions, or railway-highway crossings are not subject to discovery or admitted into evidence in a Federal or State court proceeding or considered for other purposes in any action for damages arising from any occurrence at a location mentioned or addressed in such reports, surveys, schedules, lists, or data.

Yvette read the results of the alternatives scores to the committee. It was determined the SR 160/Long Lake Road roundabout alternative received the highest score of 82 points. The stakeholder committee reviewed the final scores and all agreed that the SR 160/Long Lake Road roundabout is the preferred alternative.

Next Steps / Action Items

Yvette announced to the group an open house is planned for September where the results of the alternatives ranking exercise will be shared along with the preferred alternative. It was also mentioned that a timeline for project design and construction depends on the outcome of presenting it to the safety panel for funding. Implementing the solution could be approximately 2019/2021 timeframe. The committee requested a copy of the meeting presentation and Yvette will send it out by email. Due to the outcome of the alternative scoring exercise, a third stakeholder meeting was not necessary. Yvette thanked committee members for their work and participation in the study.

Community Engagement

Appendix C – Community Engagement

Goals of Public Involvement

The primary goal of the community engagement effort was to connect with community members, including residents, property owners, bicyclists and other local businesses to gather insight into the concerns and priorities of those that regularly travel State Route 160. The study team committed to a public engagement process that was:

Meaningful: Provide timely and relevant information

Accountable: Respond to inquiries in a timely manner

Inclusive: Utilize multiple methods of communicating

Transparent: Make decisions and important information publicly available

Realistic: Clearly define study constraints and objectives

Outcome-oriented: Engage the public throughout the study process

Key Public Involvement Tasks

1. Project Website – The project website www.wsdot.wa.gov/planning/studies/sr-160-long-lake-rd-se-planning-study is a central source of information for all interested parties and included the following information:
 - a. A brief description of the study
 - b. Map showing the study area
 - c. Study timeline
 - d. Public meeting information
 - e. Study team contact information
 - f. Shared preferred alternative

2. Community Open Houses – The community open house events provided opportunities for sharing information, discussing ideas, and gathering feedback at key milestones of the study. The public had the opportunity to offer input on the study need, goals and objectives, and the potential alternatives for improving the safety at the intersection. At the second meeting the public saw the preferred alternative, and how it was selected. The WSDOT held two open house meetings.
 - Open House Meeting 1: Held May 23, 2017
 - Open House Meeting 2: Held October 11, 2017

3. Public Comments – Study team members collected all stakeholder and public inquiries, questions and comments.

Public Feedback Received

Public feedback was received through email, comment forms from two public meetings and on social media. All of the comments that were submitted by the public are listed on the following pages.

Open House Meeting 1 – Display Boards

SR 160 Long Lake Road SE Planning Study



Stakeholder Committee

| | |
|---------------------------|----------------------|
| Kitsap County | Squaxin Island Tribe |
| Kitsap Transit | Suquamish Tribe |
| Port Gamble Tribe | US Navy |
| City of Port Orchard | WSDOT Olympic Region |
| Puyallup Tribe | WSDOT HQ Traffic |
| Jamestown S'Klallam Tribe | |

SR 160 Long Lake Road SE Planning Study



Study Background

- State Route 160 (Sedgwick Rd) from SR 16 to the Southworth Ferry terminal is a 7 mile east-west highway
- Serves as primary access route to and from the ferry terminal
- SR 160 from Phillips Rd to the ferry terminal is a Rural 2 lane undivided roadway with narrow shoulders and side streets and driveways throughout
- Study limits are Phillips Rd to Mayvolt/Lake Valley Rd
- Team will analyze current year 2016 and 20-year forecasted traffic data
- Safety data analysis will be conducted
- 11% steep grade at the intersection

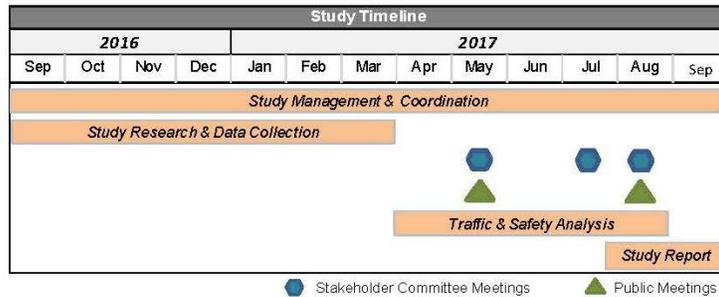


SR 160 Long Lake Road SE Planning Study



Study Schedule

- Study began September 2016 with research and data collection
- 3 Stakeholder Committee Meetings
- 2 Public Meetings
- Study Report completed in September



SR 160 Long Lake Road SE Planning Study



Why is WSDOT studying the intersection?

- Number of severe injury crashes at the intersection
- The intersection is a Intersection Analysis Location (IAL) based on the number of serious injury crashes between 2009 - 2013
- Work with the community to identify suitable strategies to improve the intersection



SR 160/Long Lake Road Intersection

SR 160 Long Lake Road SE Planning Study



Needs Statement

SR 160 and Long Lake Road SE is an at-grade two-way stop intersection that is experiencing a number of severe injury crashes. The need of the study is to develop potential solutions to improve the safety at the intersection in a way that will balance local and regional needs while also managing highway performance.

SR 160 Long Lake Road SE Planning Study



Existing Traffic Conditions – 2016 AM & PM Peak

- Long Lake Road approach is congested (LOS F) in the northbound direction in both in the AM and PM peak hours due to the shared left, straight, and right turn movements

Existing 2016 AM Intersection Peak Hour Traffic Volumes with Level of Service (LOS)

| Intersection | Eastbound SR 160 | | | Westbound SR 160 | | | Northbound Long Lake Rd | | | Southbound Long Lake Rd | | |
|-----------------------|------------------|----------|------------|------------------|----------|------------|-------------------------|----------|------------|-------------------------|----------|------------|
| | Left Turn | Straight | Right Turn | Left Turn | Straight | Right Turn | Left Turn | Straight | Right Turn | Left Turn | Straight | Right Turn |
| SR 160/Long Lake Road | 108 | 201 | 27 | 6 | 372 | 12 | 66 | 17 | 11 | 6 | 14 | 155 |

- In the PM peak hour both northbound and southbound Long Lake Road approach legs exceed a LOS C threshold standard

Existing 2016 PM Intersection Peak Hour Traffic Volumes with Level of Service (LOS)

| Intersection | Eastbound SR 160 | | | Westbound SR 160 | | | Northbound Long Lake Rd | | | Southbound Long Lake Rd | | |
|-----------------------|------------------|----------|------------|------------------|----------|------------|-------------------------|----------|------------|-------------------------|----------|------------|
| | Left Turn | Straight | Right Turn | Left Turn | Straight | Right Turn | Left Turn | Straight | Right Turn | Left Turn | Straight | Right Turn |
| SR 160/Long Lake Road | 210 | 394 | 107 | 10 | 354 | 30 | 48 | 31 | 4 | 7 | 26 | 146 |

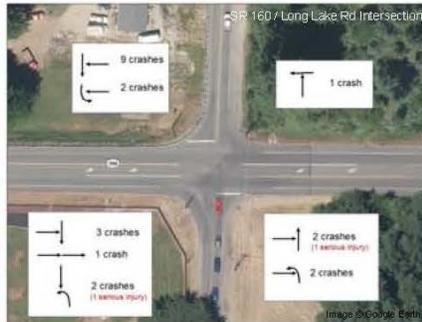


Source: McTrans HCS 2010 Software, WSDOT Traffic Counts September 2016

SR 160 Long Lake Road SE Planning Study



Crash History



- Crash history, January 1, 2011 to December 31, 2015
- 23 total intersection related crashes at SR 160 and Long Lake Road
- 2 serious injury crashes
- Mostly at angle crashes where vehicles did not grant right of way to mainline
- 61% of crashes occurred in PM

| Type of Crash | | |
|----------------|-----------|---------|
| Enter at angle | Ht object | Unknown |
| 20 | 1 | 2 |

| Severity Crashes | | | | |
|------------------|-----------------|----------------|----------------|-------|
| No injury | Possible Injury | Evident Injury | Serious Injury | Fatal |
| 13 | 4 | 4 | 2 | 0 |

| Contributing Circumstances of Crashes | | | | | | |
|---------------------------------------|---------------------|----------|-------------|-----------------|--------------|-------|
| Did not grant RW | Disregard stop sign | Speeding | Inattention | Alcohol related | Drug related | Other |
| 10 | 5 | 1 | 1 | 1 | 1 | 4 |

Under 23 U.S. Code, Section 409, this data cannot be used in discovery or as evidence at trial in any action for damages against State, Tribal or Local Government that involves the locations mentioned in this data.

SR 160 Long Lake Road SE Planning Study



Preliminary Ideas:

Roundabout at the intersection

- Traffic is constantly flowing
- Vehicles travel at lower speeds through a roundabout
- Reduces serious injury and fatal crashes
- Safer pedestrian and bicycle crossing



SR 160 Long Lake Road SE Planning Study



Preliminary Ideas:

Traffic Signal at the Intersection

- Helps control conflicting movements in an intersection
- Timing of a signal can be adjusted to increase traffic handling capacity at an intersection
- May reduce angle type crashes and increase rear end crashes
- Difficult on a steep terrain



SR 160 Long Lake Road SE Planning Study



Preliminary Ideas

Right-in/right-out only movements

- Right-in/Right-out only movements to and from Long Lake Road SE approaches with roundabouts at Phillips Road SE and Mayvolt/Lake Valley Road SE to facilitate traffic turn around
- Preventing left turns onto SR 160 may reduce crashes



Open House Meeting 1 – Public Comments

The following information was printed on the comment forms:

The current type of intersection control at Long Lake Road SE and SR 160 (Sedgwick Road) is a stop sign. WSDOT is in the process of examining three intersection improvement options.

The three intersection improvement options that WSDOT will examine are:

- 1) A roundabout at the Long Lake Road SE intersection;
- 2) A traffic signal at the Long Lake Road SE intersection;
- 3) Right hand turn only movements at the Long Lake Road SE intersection with a roundabout at Phillips Road SE and a roundabout at Mayvolt/Lake Valley Road SE to facilitate traffic turn-around.

Note: WSDOT will also examine any other intersection improvement options suggested through the study process. Please provide your comments and suggestions below. Thank you.

| SR 160 Long Lake Road SE Planning Study Public Open House Meeting #1 Comments May 23, 2017 |
|--|
| Public Comments |
| Phillips Rd is backed up @ rush hour from people getting off SR 16. Option 3 is best. |
| Roundabout or traffic light. A concern during icy conditions on SR 160 east or westbound. Heated road in those places or other means to reduce potential icy roadways. Maybe an overpass over Long Lake Rd with on/off ramps to access SR 160. Last choice is option 3 |
| Option 3 would add a number of minutes to my morning commute. This should not be an idea. Option 1 slows traffic down but hard to mitigate ice on roads. More cost in changing hill grade. Option 2 add option for light to switch back to flashing yellow on hill sides and flashing red for cross street during ice conditions. Pro is no change to hill grade and con is long term higher cost. If option for ice days installed, this would be my best option. |
| No right hand only - bad idea. Does topography at Long Lake lend itself to a roundabout? |
| I like roundabouts; however, option 3 will not work well, because of the long distance to a turnaround. People will not drive a mile, or even a half mile, to turn around. They will find a less-safe place to turn around which may make the whole situation less safe for everyone. Stopping or starting from a traffic light on a steep hill is problematic, especially in wet or icy conditions. It's also not fuel efficient. |

Right lane turn lanes into the road. Cut vegetation from the NE corner for visibility. Right lane turn lanes from Sedgwick to Long Lake, roundabout or a stop light are not desirable due to coming down the hill and having short visibility to stop. Also starting from a stop on that slope is not desirable. Improve Phillips & Sedgwick with a nice roundabout and encourage use. This would reduce traffic at Long Lake. Some people divert from Phillips out over to Long Lake or Baker to avoid the Phillips intersection. A roundabout will be needed here in the future anyway. Then do a study to determine if Long Lake still needs improvement. Can then add the no left on Long Lake going southbound where a majority of accidents have occurred.

From a visibility standpoint what if the trees and bush was cut from the NE corner on the uphill side.

Modify option 3 and put a roundabout at Phillips Rd and a roundabout at Long Lake Rd. Design roundabouts for single lane ingress and egress = easier for drivers to navigate safely. Install Long Lake roundabout asymmetrically on southeast corner to utilize nearly flat terrain. Thanks for explaining and asking.

I like the roundabout improvement if you include slip lanes turning right from west to south and coming down the hill going west turning right through a slip lane turning right to north. This gives drivers plenty of time to get into the correct lanes and separates the cars going south from east going cars to the roundabout. Separates the cars going west from cars turning north (right) as approach roundabout.

I prefer the roundabout because it gets so tedious waiting at so many long traffic lights. Traffic seems to have increased markedly in the last 8 years. I wonder if the actual intersection could be moved eastward, toward the ferry and away from the current home at the corner.

I prefer a roundabout at Phillips Road and Mayvolt Road. Only right turns at 160 and Long Lake, no thru traffic. Can the 11% grade be reduced east of Long Lake Road? To improve sight distance? If it is needed for north south traffic on Long Lake, could excavation of the north south traffic lanes be made under the east west highway 160. Thank you

Option 1 would be a huge improvement. Option 2 is doable, but would be concerned with the traffic coming down the hill traveling westbound. Option 3 don't like a roundabout at Mayvolt at all. I live on the north side on Long Lake Rd. To take a left I would go up Lakeview & turn left there. Thanks for your time to address this serious issue. It is time for a change.

Expand traffic conditions study to account for every ferry from Vashon as well as from Fautleroy. These vehicles cause semi rush hours

Expand analysis of contributing factors for crashes to include "just off-loaded from Ferry"

Please work with Kitsap Transit on design elements as we plan to provide service here in the future

I think #2 is the best solution. I don't like option 3 at all. A roundabout slows all traffic down, but I think that B16 trucks can't handle that.

A roundabout would be nice but option 3 would also solve the problems that will be arising from additional traffic at Phillips even if it is inconvenient.

Option 1 roundabout definitely slow traffic, but being mid-hill could make a steep grade (less safe in winter conditions). Also bikes would access uphill pretty slow (a 5mph). Option 2 traffic signal might be problematic in dark on steep grade. Likely okay if timed/sensed correctly. Option 3 I think this will be problematic. Personnel living in area wouldn't be too happy. The 4th option I'd consider is slowing traffic down with speed sign and warning lights (maybe 45 - 35 or 30 MPH). Include sign denoting cross traffic risk and turning off risk. This might be a low cost first run to see if accident rate goes down.

*Note that Long Lake Road is being looked at by the non-motorized transit community advisory committee at the north south path for walkers and cyclists. On the east side of Hwy 16. In this scenario each of these three options will have to figure in the slower speed for bike-ped crossing.

Options 1 & 2 are preferred options. Option 3 is not a good idea

Option 1, a roundabout at Long Lake intersection is preferred. Phillips - another roundabout or at least some type of rumble strips before stop sign.

In regards to the traffic problem at Long Lake Road and Sedgewick Road I believe that the two plans considered are not good options. My idea will be off the board in regards to how and where roundabouts are established but I do believe that it deserves to be considered. I would propose that a roundabout be established at Lakeview Drive SE which is east of the Long Lake Road intersection with Sedgewick Road and here are my reasons why this should be considered as an option:

1. It is a more level area in which to create a roundabout
2. It would not be on the steep decline as the intersection now is
3. It would generate a slower traffic movement down the hill past the current intersection
4. Drivers who want to head west from the south side of the Long Lake intersection could take a right and utilize the roundabout to go west.
5. Drivers desiring to go east from the north side of Long Lake Road could use the Lakeview Road to utilize the roundabout

I know this plan would not be in line with current roundabout actions as they normally are positioned at the problem intersections. However, I do believe that this idea would work to drastically reduce accidents at the current intersection.

I'm not sure I'll be able to attend the public comment session due to work conflicts, but would like to respond in favor of a roundabout, over any traffic light system. The WA-160 traffic lights at Bethel road, and intersections with WA-16 frequently back up and cause gridlock,

while roundabouts with similar or even more traffic in Gig Harbor, Burnham Drive to WA-16, or even the Bethel to Mile Hill Road roundabouts allow steady traffic flow even at peak times. Please DO NOT add another gridlock causing traffic signal. The roundabout adds the benefit of keeping drivers at a lower speed when transiting WA-160, and the crashes that have been severe are nearly always due in part to excess speed coming over the hill going West, a traffic signal, when green or yellow it will cause some drivers to accelerate through this intersection, and not solve the severe accident issues. I love off Long Lake Road, between Sedgwick 9wA-160) and Mile Hill Road, and go through the intersection under consideration on a daily basis.

I use that intersection weekly I have been delivering garbage/recycle to Olalla dump or the boat to long lake. The peak hours when the south worth ferry gets in makes this road crossing hazardous. I would like to see a bridge over the long lake crossing with 4 lanes of Sedgwick Road with off ramps 4 way run one right through the light house church sanctuary ops. This ought to be the same for Bethel and Sedgwick it's a bottleneck getting into and out of Port Orchard.

Roundabouts do not work as we have seen on Borgen Boulevard off of Highway 16. Just causes more congestion because people do not know how to drive in them correctly and more accidents happen backups or even worse on Highway 16 Purdy exit that exit every day backs up onto the highway and causes accidents need to take care of the issues in hand first before starting another project and causing more issues down the road but that's my two cents.

Open House Meeting 1 – Newspaper Article

Roundabout, signal among state's options for Sedgwick-Long Lake intersection

Page 1 of 2

Roundabout, signal among state's options for Sedgwick-Long Lake intersection

Ed Friedrich, ed.friedrich@kitsapsun.com Published 1:40 p.m. PT May 24, 2017 | Updated 3:30 p.m. PT May 24, 2017



(Photo: Larry Steagall / Kitsap Sun)

SOUTH KITSAP — Turning left from Long Lake Road onto Sedgwick Road can be an adventure.

Drivers sit at the stop sign, awaiting a break in the traffic flying over the hill. Cars back up behind them. They get edgy, and dart out.

Twenty-three crashes occurred at the intersection from 2011 through 2015. Most were caused by drivers not yielding the right of way or running the stop sign. The state Department of Transportation wants it to stop.

The agency has begun a study of the intersection and presented three potential solutions during an open house Tuesday evening at Long Lake Community Center. They are a roundabout, traffic signal, and limiting turns to right-in and right-out. Though the latter would remove the primary cause of collisions — turning left onto Sedgwick — and prevent crossing the highway, it wasn't popular among residents.

"Roundabout or stop signal. Either one works for me," said Dani Hale, who lives along Long Lake Road north of Sedgwick. "Don't block my access going straight across."

The limited-turn option includes roundabouts at Phillips and Mayvolt roads, where people could spin around to the direction they want to go.

Tim and Jana Roller have lived on both sides of Sedgwick, which is also state Highway 160. He was a longtime Southworth ferry rider, many of whom commute via Sedgwick.

"When they crest that hill, sometimes I swear they're airborne," he said. "I used to ride the ferry. I know how commuters feel when they're rushing to catch the boat and rushing to get home from the boat. (Drivers on Long Lake) have been waiting and waiting and waiting and waiting, and they take a chance when they shouldn't."

A major factor in collisions — Sedgwick's steep 11 percent grade — would also complicate the roundabout option. A large area would need to be flattened for the traffic circle and Sedgwick adjusted on each side to connect, said WSDOT system engineer Horace Suttmiller.

<http://www.kitsapsun.com/story/news/2017/05/24/long-lake/342833001/>

5/26/2017

Roundabout, signal among state's options for Sedgwick-Long Lake intersection

Page 2 of 2

On the plus side, roundabouts slow traffic without entirely stopping the flow, and reduce the number of serious injury collisions.

Traffic signals also are difficult on steep terrain, especially when drivers crest a steep hill and it's right there. One would likely reduce the more serious angle-type crashes but increase rear-enders because of the inability to stop.

"Definitely not the right-in, right-out," Roller said. "That's not going to make it. A traffic signal is just going to be a nightmare because people are going to run it."

A stakeholder group has been formed and will meet three times. Another public meeting will be held. The team will analyze 2016 traffic data and 20-year forecast traffic data, and conduct a safety data analysis. The study report will be completed in September.

Solutions aren't limited to the three options presented Tuesday. The transportation department would like to hear the public's ideas, said study lead Yvette Liufau.

"There's too many accidents there," Hale concluded. "I don't want to be one of them. My daughter is 12 years old, four years from driving. I don't want her to be a statistic."

Read or Share this story: <http://www.kitsapsun.com/story/news/2017/05/24/long-lake/342833001/>

Open House Meeting 2 – Display Boards

SR 160 Long Lake Road SE Planning Study



Study Goal

The goal of the study is to identify solutions that reduce or eliminate fatal and serious injury crashes at the intersection of SR 160 and Long Lake Road SE, while preserving the needs of the intersection.

Study Objectives

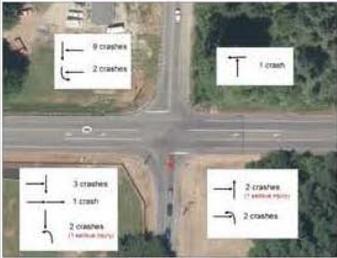
The study will engage local transportation partners and the community to gather information to identify and recommend suitable solutions that meet transportation and safety needs for travelers.

Needs Statement

SR 160 and Long Lake Road SE is an at-grade two-way stop intersection that is experiencing a number of serious injury crashes. The need of the study is to develop potential solutions to improve safety at the intersection in a way that will balance local and regional needs while also managing highway performance.

Safety Analysis





- Analysis shows two roundabouts with right turns into and out of Long Lake Road SE has the highest potential to reduce crashes
- The SR 160/Long Lake Road SE roundabout has the second highest potential to reduce crashes

Crash Analysis – Fatal & Injury (crashes per year)

| | Expected Crashes (HSM) | Crashes After Improvement | Net Reduction |
|---|------------------------|---------------------------|---------------|
| Two Roundabouts (Phillips & Mayvold/Lake Valley) w/ Right-in/Right-out only at Long Lake Road | 4.1 | 0.9 | 3.2 |
| SR 160/Long Lake Road Roundabout | 1.4 | 0.3 | 1.1 |
| SR 160/Long Lake Road Signal | 1.4 | 0.8 | 0.6 |
| Speed Reduction/Signage | 4.1 | 3.9 | 0.2 |
| Long Lake Road Bridge with Ramps | 1.4 | 0.6 | 0.8 |

- Crash history, January 2011 – December 2015 with 22 total intersection crashes
- 2 serious injuries and mostly at angle type crashes where vehicles did not grant right-of-way to other vehicles

Under 23 U.S. Code § 405, safety data, reports, surveys, schedules, lists compiled or collected for the purpose of identifying, evaluating, or planning the safety enhancement of potential crash sites, hazardous roadway conditions, or roadway/highway crossings are not subject to discovery or admitted into evidence in a Federal or State court proceeding or considered for other purposes in any action for damages arising from any occurrence at a location mentioned or addressed in such reports, surveys, schedules, lists, or data.

Traffic Analysis



Traffic Analysis – Level of Service (LOS) Scenarios

| | | 2016 Existing Phillips No Build | | 2016 Existing Long Lake No Build | | 2016 Existing Mayvold No Build | | 2036 Future Phillips Build | | 2036 Future Long Lake Build | | 2036 Future Mayvold Build | |
|--|-----|---------------------------------|-------|----------------------------------|-------|--------------------------------|-------|----------------------------|----|-----------------------------|----|---------------------------|----|
| | | AM | | PM | | AM | | PM | | AM | | PM | |
| | | AM | PM | AM | PM | AM | PM | AM | PM | AM | PM | AM | PM |
| No Build and Speed Reduction/Signage Scenario | LOS | | | | | | | F | F | F | F | C | D |
| Two Roundabouts (Phillips & Mayvold) & Right-in/Right-out only at Long Lake Road | LOS | | | | | | | A | C | C | D | A | A |
| SR 160/Long Lake Road Roundabout | LOS | LOS F | LOS F | LOS F | LOS F | LOS C | LOS C | B | B | A | B | C | D |
| SR 160/Long Lake Road Signal | LOS | | | | | | | B | B | C | D | C | D |
| Long Lake Road Bridge with Ramps | LOS | | | | | | | B | B | B | C | C | D |

- LOS A - free flow moving at desired speed
- LOS B - significant passing demand
- LOS C - significant platoon formation but stable flow
- LOS D - high passing demand/very few opportunities
- LOS E - significantly lower than desired speed
- LOS F - 100% time spent following/highly variable speeds

Alternatives Cost Estimates



| Alternatives | Cost in 2012 dollars (*PLCE) |
|--|------------------------------|
| Two Roundabouts (Phillips Road and Mayvold/Lake Valley Road) | \$ 7,190,000 |
| SR 160/Long Lake Road Roundabout | \$ 4,646,000 |
| SR 160/Long Lake Road Signal | \$ 3,205,000 |
| Speed Reduction with Advance Signage | \$ 75,000 |
| Long Lake Road Bridge with Ramps | \$ 45,236,000 |

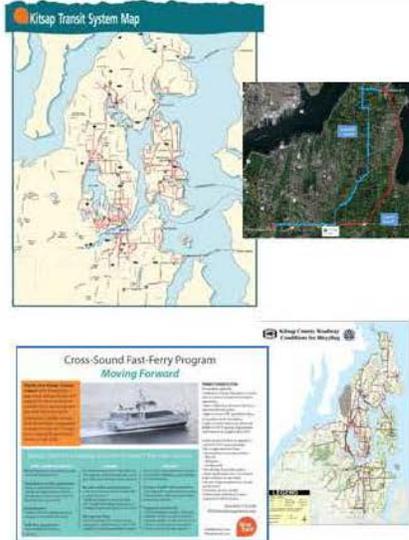
* Planning Level Cost Estimate

Multimodal



What we know about local bicycle, pedestrian, transit and freight routes

- Designated bike/pedestrian route on Long Lake Road north and south of SR 160 from Mile Hill Road to Mullenix Road
- U.S. Navy's truck route to/from Manchester Fuel Depot (possible new route location at SR 160 and Long Lake Road intersection)
- Kitsap Transit has future plans for an east-west transit route on SR 160 and Cross Sound Fast-Ferry Program, which is a passenger-only service from Southworth to Seattle beginning July 2020.



Alternatives Ranking Process



| Improves Safety | Improves Operations | Constructability/ Cost | Multimodal |
|-----------------|---------------------|------------------------|----------------------|
| 2.45 - 3.2 = 25 | LOS A/LOS B = 25 | <\$1M = 25 | All modes = 25 |
| 1.7 - 2.45 = 18 | LOS C = 20 | \$1 - \$5M = 20 | Less Attractive = 15 |
| 0.95 - 1.7 = 12 | LOS D = 15 | \$5 - \$10M = 10 | Restrictive = 0 |
| 0.2 - 0.95 = 6 | LOS E = 10 | >\$10M = 0 | |
| | LOS F = 5 | | |

* Net reduction of injury crashes

| | Criteria / Data | | | |
|---|-----------------|-------------------------------------|--|-----------------|
| | Improves Safety | Improves Operations (2036 P.M. LOS) | Constructability (Dollars are 2012 PLCE) | Multimodal |
| SR 160 Long Lake Road Roundabout | 1.1* | B | \$ 4,646,000 | All modes |
| SR 160 Long Lake Road Signal | 0.6 | D | \$ 3,205,000 | All modes |
| Right-in/right-out only at Long Lake Road with two Roundabouts (Phillips & Mayvold) | 3.2 | D** | \$ 7,190,000 | Restricting |
| Reduce speed on SR 160 with Advance Warning Signage | 0.2 | F | \$ 75,000 | All modes |
| Long Lake Road Bridge with Ramps | 1.4 | C | \$ 45,236,000 | Less Attractive |

* Score reflects alternative was viewed as *slightly* better roundabout than speed lower than 2 roundabout alternative.

** Score reflects alternative as LOS F rather than LOS D due to the level distance for L-RV vehicles.

Under 23 U.S. Code § 402, state traffic reports, surveys, schedules, lists compiled or collected for the purpose of identifying, evaluating, or planning the safe and efficient operation of potential crash sites, hazardous roadway conditions, or railway-highway crossings are not subject to discovery or admission into evidence in a Federal or State court proceeding or considered for other purposes in any action for damages arising from any occurrence at a location mentioned or addressed in such reports, surveys, schedules, lists, or data.

Alternatives Ranking Exercise



| | Criteria / Scores | | | | TOTAL |
|---|-------------------|----------------------------------|-------------------------------------|------------|-------|
| | Improves Safety | Improves Operations (2036 PMLOS) | Constructability (\$ are 2012 PLCE) | Multimodal | |
| SR 160/Long Lake Road Roundabout | 12* | 25 | 20 | 25 | 82 |
| SR 160/Long Lake Road Signal | 6 | 15 | 20 | 25 | 66 |
| Right-in/right-out only at Long Lake Road with two Roundabouts (Phillips & Mayvold) | 25 | 5** | 10 | 0 | 40 |
| Reduce speed on SR 160 with Advance Warning Signage | 6 | 5 | 25 | 15 | 51 |
| Long Lake Road Bridge with Ramps | 12 | 20 | 0 | 15 | 47 |

* Score reflects alternative was viewed as stand-alone roundabout; this scored lower than 2 roundabout alternative.

** Score reflects alternative as LOS F rather than LOS D due to travel distance for U-turn vehicles.

| Speed | Score |
|--------------|-------|
| 2.45 - 3.2 = | 25 |
| 1.7 - 2.45 = | 18 |
| 0.95 - 1.7 = | 12 |
| 0.2 - 0.95 = | 6 |

| Operational | Score |
|---------------|-------|
| LOS A/LOS B = | 25 |
| LOS C = | 20 |
| LOS D = | 15 |
| LOS E = | 10 |
| LOS F = | 5 |

| Cost | Score |
|------------------|-------|
| <\$1 M = | 25 |
| \$1 M - \$5 M = | 20 |
| \$5 M - \$10 M = | 10 |
| >\$10 M = | 0 |

| Multimodal | Score |
|-------------------|-------|
| All modes = | 25 |
| Less Attractive = | 15 |
| Restricting = | 0 |

Under 23 U.S. Code § 409, safety data, reports, surveys, schedules, lists compiled or collected for the purpose of identifying, evaluating, or planning the safety enhancement of potential crash sites, hazardous roadway conditions, or railway-highway crossings are not subject to discovery or admitted into evidence in a Federal or State court proceeding or considered for other purposes in any action for damages arising from any occurrence at a location mentioned or addressed in such reports, surveys, schedules, lists, or data.

SR 160 Long Lake Road SE Planning Study



Preferred Alternative:

SR 160/Long Lake Road Roundabout

- Provides for continuous flow of traffic
- Reduces overall number of crashes including left-turn movements
- Vehicles travel at lower speeds
- Costs more than a traffic signal, but lower cost to maintain
- Improves traffic operations to Level of Service B



SR 160 Long Lake Road SE Planning Study



Alternatives Evaluated

SR 160/Long Lake Road Signal

- Provides for controlled movement
- Reduces angle type crashes, but potentially increases rear-end crashes
- May control conflicting movements in an intersection, but difficult on steep terrain
- Ongoing operation, maintenance and electrical costs
- Improves traffic operations to LOS D



Right-in/right-out only at Long Lake with two roundabouts (Phillips Rd & Mayvold Rd)

- Right-in/Right-out only movements improve safety at the SR 160 Long Lake Road intersection
- Potential limitations for transit opportunities at Long Lake Road
- Increases travel time for some vehicles (U-turns)
- Improves traffic operations to LOS D at Long Lake Road



SR 160 Long Lake Road SE Planning Study



Alternatives Evaluated

Long Lake Road Bridge with Ramps

- Reduces conflicting movements and crashes at the intersection
- Improves traffic operations to Level of Service C at ramp intersections controlled by stop sign
- High cost of improvement will be difficult to fund
- Considerable impacts to nearby properties



Reduce Speed on SR 160 with Advance Warning Signage

- Signs warning traffic of possible traffic conflicts. Warning signs may be ignored if used too often or unnecessarily.
- Low cost improvement
- Small incremental improvement in safety.



SR 160 Long Lake Road SE Planning Study



Alternatives Evaluated

SR 160/Long Lake Road Signal

- Provides for controlled movement
- Reduces angle type crashes, but potentially increases rear-end crashes
- May control conflicting movements in an intersection, but difficult on steep terrain
- Ongoing operation, maintenance and electrical costs
- Improves traffic operations to LOS D



Right-in/right-out only at Long Lake with two roundabouts (Phillips Rd & Mayvok Rd)

- Right-in/Right-out only movements improve safety at the SR 160 Long Lake Road intersection
- Potential limitations for transit opportunities at Long Lake Road
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SR 160 Long Lake Road SE Planning Study



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Next Steps



- Develop and finalize study report
- Present recommendation to WSDOT Highway Safety Executive Committee for approval



Questions:

Yvette Liufau, Study Lead
 360-357-2738
ylufau@wsdot.wa.gov

Study Webpage: www.wsdot.wa.gov/planning/studies/sr-160-long-lake-rd-se-planning-study

Open House Meeting 2 – Public Comments

SR 160 Long Lake Road SE Planning Study

Public Open House Meeting #2 Comments

October 11, 2017

Public Comments

I'm a fan of single lane roundabouts and think that is a good solution here. I'm surprised a light doesn't score better. Mostly, I'm very glad you're addressing this dangerous intersection. Whatever you decide will be safer and better than doing nothing.

I suggest that the roundabout for the SR 160/Long Lake Road study be two lane roundabout at both Phillips Rd and Lakeview/Mayvolt intersections. Often heavy trucks or buses travel this corridor at below speeds posted causing backups. Also, I suggest a center turn lane for all roads or driveways in the area of this study. Traffic volumes are only going to worsen with increased population in this area.

1. I am not against a roundabout at Sedgwick and Long Lake, but
2. Amount of large transport vehicles creates higher degree of difficulty, especially breakdowns trying to restart movement uphill through roundabout. This needs to be a 2 lane roundabout, the second lane not only offers relief in case of a breakdown but also for further population/traffic growth.
3. Up/down hill grade also will increase degree of difficulty, it is an increasing rate of downhill approaching roundabout facing west. There will be misjudgment of downhill braking which may lead to accidents through traffic circle.
4. This is a main truck thoroughfare. Build it for the amount of traffic and type and for future/continuing growth. Better off doing 2 full lanes around to start with.

#2 need turn lanes for other roads in that area plus roundabouts at Phillips and Mayvolt Roads. Concerned about school buses and trucks having problems going up steep hill – they can hold up cars waiting for them to go up there. We need a slow lane and regular lane on both sides going up the hill.

I liked looking at the analysis, though were a bit difficult to understand in detail. Very much support the roundabout on Long Lake Road and Sedgwick. Proven to be effective, and much better than signal lights for traffic flow, speed control and safety (that's my "experience" analysis). Need one at Phillips also...

Concern – the steep incline/decline especially during inclement weather (ice and snow) will vehicles be able to gain enough traction to resume the climb or will they be able to stop suddenly if traffic is backed up to the crest of the hill.

Concern – Looking out 10-20 years since the widening of the road at the Phillips & Sedgwick intersection I anticipate another roundabout being placed there. That would create 3 traffic slowdowns, the other being the light at Jackson & Lund. All within a couple of miles of each other.

Question – has a long term plan been discussed that would encompass everything from Mayvolt to Lund along Sedgwick? As it stands we will be getting a patchwork approach.

An immediate impact would be if you narrow the lanes on both sides of Long Lake Road so that cars on both sides of Long Lake Road so that cars can't get by to make right or left turns onto Sedgwick. They impede the view of those who are going directly across. This would be a significant improvement and low cost.

Typically I consider roundabouts to improve traffic. Roundabouts should be on 2 lanes to allow for traffic in future years. Population will increase, which will require additional lanes of traffic.

As a frequent user of Sedgwick my preference would be a stoplight

I have lived off of Sedgwick on Amberly Place SE for 16 years. I think a roundabout, particularly at Long Lake intersection, would be a great help to traffic flow and safety. Because of the hill and poor visibility, I think it would serve to slow down traffic. I will not be able to participate in the public discussion event, but I am eager to hear about the solutions agreed upon. I drive 160 an average of 6 times a day crossing that intersection and am eager to see a change made that will improve safety. Thank you for your time and effort in this project.

Open House Meeting 2 – Public Comments on Social Media

- Thank you for the open house. It was great to be able to see the analysis of the options and to talk to some of your people. To me, the most important thing is that the intersection is made safer. It looks like a roundabout is the best way to accomplish that while handling future traffic volumes.
- Roundabouts in Washington are terrible. Nobody knows how to properly use them OR use their signal to indicate whether they are exiting or going around. The traffic ques are just as long as a 4 way stop. Especially when truck traffic is involved
- There are roundabouts on many, many local roads and large highways in Norway and they work very, very well. I find it hard to believe that we Americans can't figure them out.
- I grew up in NJ where roundabouts were common. I understand they are being phased out there. That said, one of the issues with putting roundabouts in existing intersections is that they are not wide enough to safely accommodate the traffic, and people don't know how to drive them, making them dangerous.
- I'm not sure that I HAVE used it, BUT in the event that I ever do, I don't want a roundabout there. Thank you.
- NO MORE ROUND ABOUTS. . . Please. They are a pain in the tail and So hard to get Trucks around, Holds up traffic to a crawl, I am sure that is the plan tho.
- I'm sure that just like most other things the govt is involved with, this is a formality and our opinions really don't matter. They're already going to do it regardless
- The more I see roundabouts the more I hate them. They almost always make things worse but for some reason the powers that be are obsessed with them
- Roundabouts are great. I find too many people narrow minded about them. They appear not to have much faith in the human race and therefore themselves.
- Roundabouts work very well, but people do have to know how they work, and who has right-of-way. They are very effective in England.
- Speeders flying over the hill won't stop in time. Bad idea!
- Cities and counties sure love their round a bouts these days. Quick way to spend some money.
- Can we just post here that it is a stupid idea?
- Hate roundabouts! People fly in them, tailgate, cut you off may I say more!
- In my opinion that is a horrible idea to put a roundabout at that intersection.

- Thank you for this post and inviting the community. It's very important to understand the dire need of Infrastructure change that needs to happen along with improvement on mass transit transportation or other in a growing populous.
- I live there..that's ridiculous

Open House Meeting 2 – Newspaper Article

Roundabout proposed at dangerous Highway 160 intersection

Chris Henry, christina.henry@kitsapsun.com Published 3:38 p.m. PT Oct. 12, 2017 | Updated 11:31 a.m. PT Oct. 13, 2017



(Photo: Larry Steagall / Kitsap Sun)

SOUTH KITSAP — State transportation officials are recommending a roundabout to improve traffic safety at the intersection of Highway 160 (Sedgwick Road) and Long Lake Road.

The intersection sits just below the crest of a steep hill on Highway 160, where the speed limit is 45 miles per hour. Highway 160 has pocket turn lanes both directions onto Long Lake but is still dangerous. The intersection was the site of 22 traffic crashes between 2011 and 2015, two with serious injuries, the Washington State Department of Transportation reports.

WSDOT on Wednesday held an open house at Kitsap County's Long Lake Park community center to catch residents up to speed on the proposal.

"Our purpose in being out here is to fix the intersection so it reduces the number of serious crashes," said Yvette Liufau, who has led a study of options to make that fix.

Four other plans were considered and rejected after a review by a stakeholders group that included Kitsap County, the Navy, the Suquamish Tribe and Kitsap Transit. The city of Port Orchard was invited, although the intersection is outside city limits.

A traffic safety analysis by WSDOT showed the plan with the greatest potential to reduce crashes was to put right-turn-only lanes in and out of Long Lake, plus roundabouts at Phillips Road (to the west) and Mayvolt/Lake Valley Road (to the east). The price tag was \$7.2 million (compared to \$4.7 million for a roundabout), and the analysis projected traffic flow would not be significantly improved, leading WSDOT to reject this option.

The state has 340 roundabouts in similar "high speed" areas, and they've proven effective in improving traffic flow, said Brian Engel, WSDOT traffic engineer. In areas where a "minor side street" like Long Lake intersects a state highway, "a roundabout is a much safer situation," he said.

Traffic in the roundabout would slow to 20 miles per hour. Engel said signs before the crest of the hill would warn people to slow down, as would a curve in the lanes feeding into the roundabout. Roughly 90 percent of people who travel the road are regulars and would become well aware of the roundabout during construction, he said.

Highway 160 is a two-lane road with pocket turn lanes and lights at major intersections from Phillips Road west to Sidney Road. From Phillips Road east, there is a pocket turn at John Sedgwick Middle School, but otherwise just highway and side streets on rollercoaster hills through rural land all the way to the Southworth ferry terminal. Shoulders are narrow.

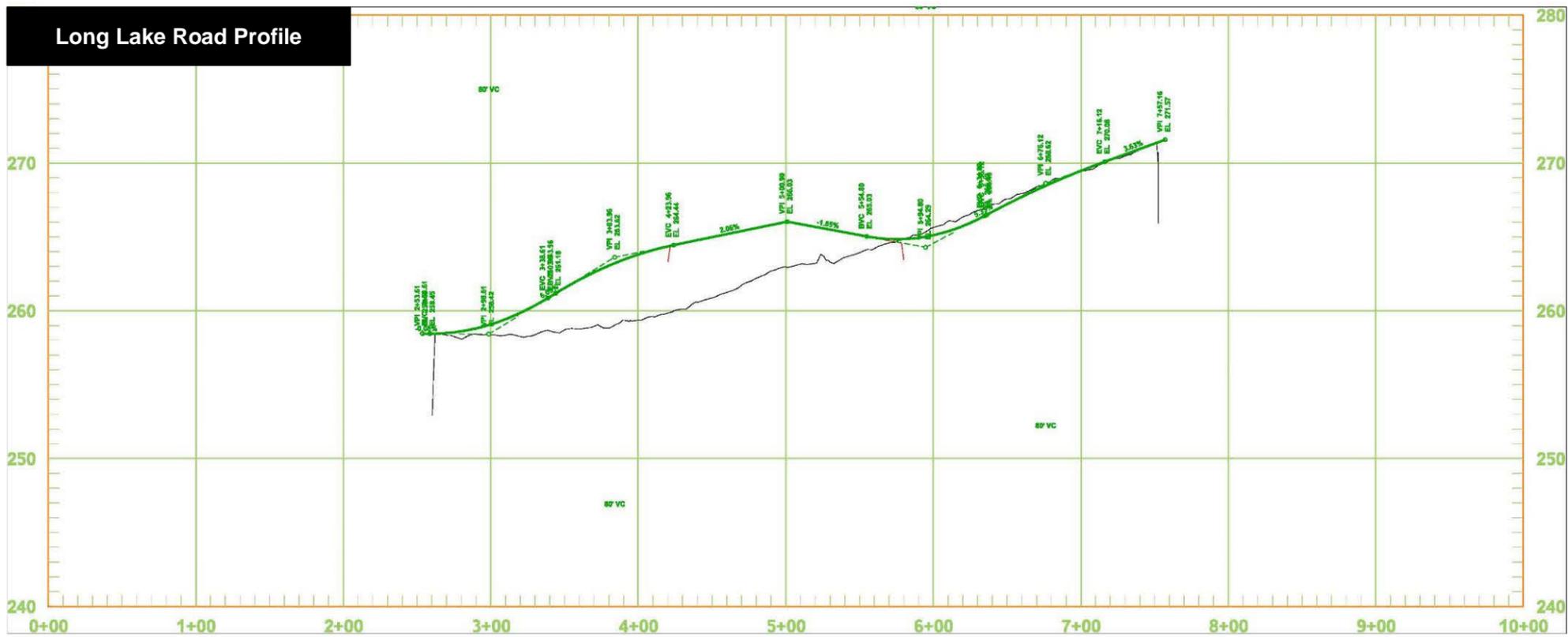
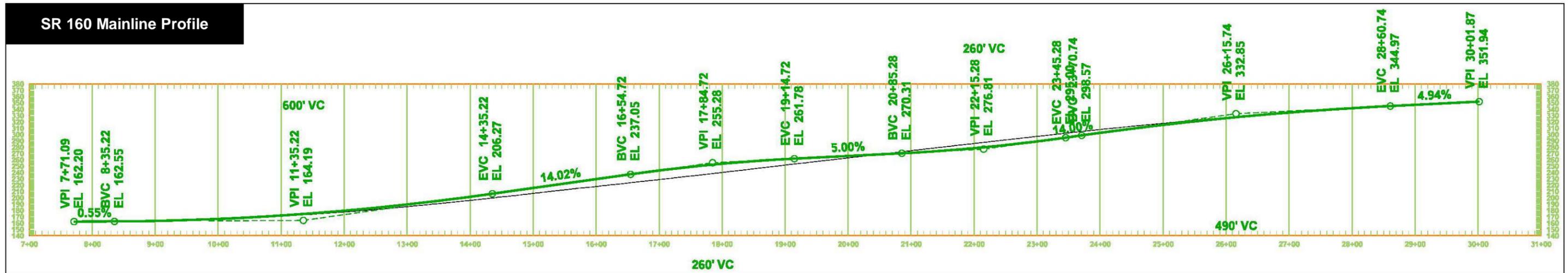
Engel said current demographics and forecasts don't support widening Highway 160 to four lanes.

<http://www.kitsapsun.com/story/news/local/2017/10/12/roundabout-proposed-dangerous-hwy-160-inte...> 10/13/2017

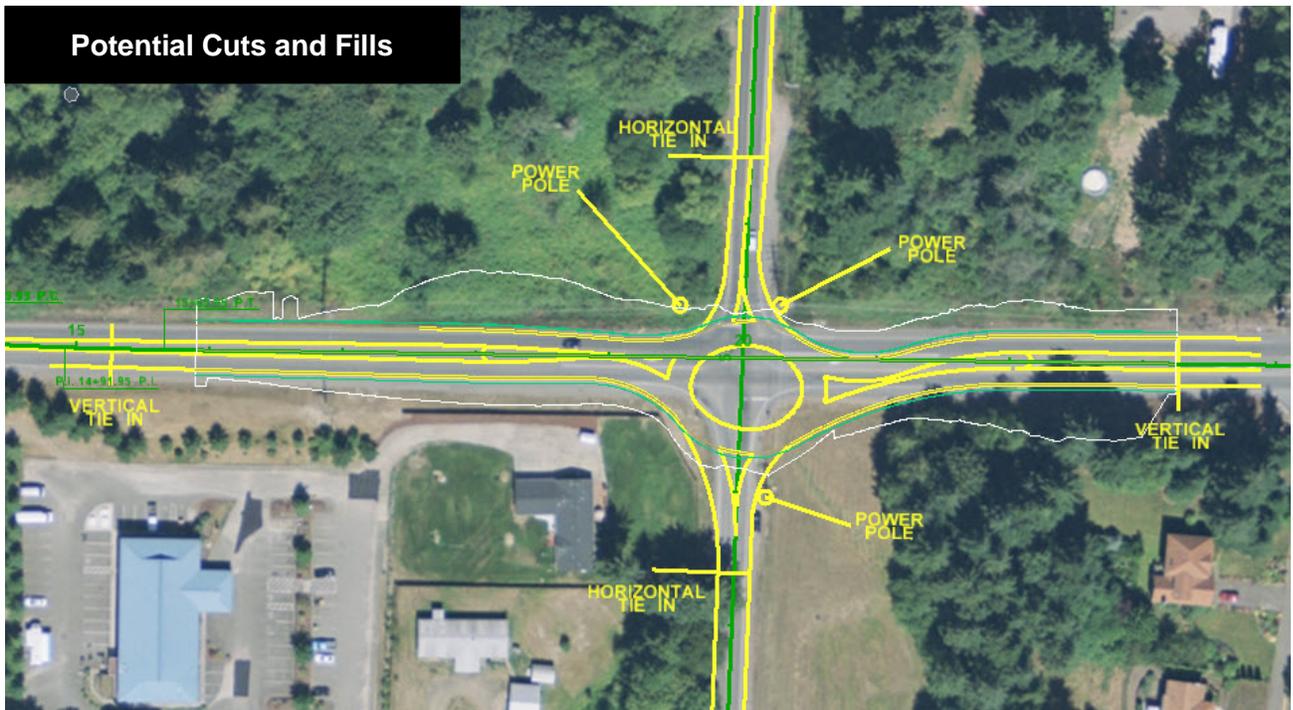
Recommended Alternative Profiles and Scoping Work

Appendix D – Recommended Alternative Profiles and Scoping Work

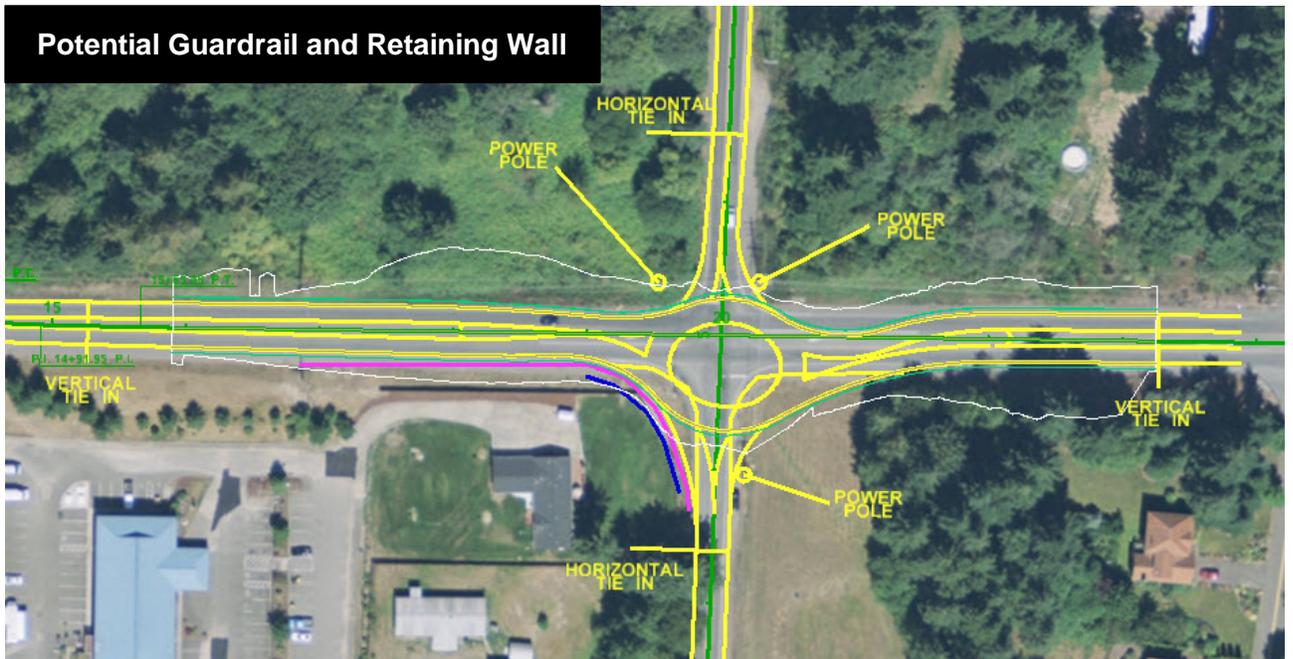
SR 160 / Long Lake Road Roundabout



Potential Cuts and Fills



Potential Guardrail and Retaining Wall



ESTIMATE

 PROJECT: **SR 160 and Long Lake - Scoping Estimate**

 Calculated for SR 160
 Same as SR 28 RB in Wenatchee

 DESIGNED BY: **LRS**
 CHECKED BY:

 AS OF DATE: **8/8/2017**

| ITEM NO. | ITEM | STANDARD ITEM No. | UNITS | UNIT PRICE | QUANTITY | AMOUNT |
|---------------------------------|---|-------------------|-------|---------------|-----------|-----------------------|
| PREPARATION | | | | | | |
| 1 | MOBILIZATION | 0001 | L.S. | 9.00% | 1.00 | \$59,448.89 |
| 2 | CLEARING AND GRUBBING | 0025 | ACRE | \$3,000.00 | 0.62 | \$1,860.00 |
| GRADING | | | | | | |
| 3 | ROADWAY EXCAVATION INCL. HAUL | 0310 | C.Y. | \$40.00 | 2,676.00 | \$107,040.00 |
| 4 | COMMON BORROW INCL. HAUL | 0405 | C.Y. | \$15.00 | 6,120.00 | \$91,800.00 |
| DRAINAGE | | | | | | |
| 5 | DRAINAGE ALLOCATION | | L.S. | 10% | 1.00 | \$55,045.27 |
| SURFACING | | | | | | |
| 6 | CRUSHED SURFACING BASE COURSE | 5100 | TON | \$40.00 | 407.00 | \$16,280.00 |
| CEMENT CONCRETE PAVEMENT | | | | | | |
| 7 | PIGMENTED CEMENT CONCRETE PAVEMENT | | C.Y. | \$390.00 | 92.00 | \$35,880.00 |
| HOT MIX ASPHALT | | | | | | |
| 8 | HMA CL. 1/2" PG 64-28 | 5767 | TON | \$90.00 | 340.00 | \$30,600.00 |
| 9 | JOB MIX COMPLIANCE PRICE ADJUSTMENT | 5830 | EST. | \$918.00 | 1.00 | \$918.00 |
| 10 | COMPACTION PRICE ADJUSTMENT | 5835 | EST. | \$612.00 | 1.00 | \$612.00 |
| TRAFFIC | | | | | | |
| 11 | ROUNDBOUT SPLITTER ISLAND NOSING CURB | 6698 | EACH | \$500.00 | 4.00 | \$2,000.00 |
| 12 | ROUNDBOUT CEMENT CONCRETE CURB AND GUTTER | 6699 | L.F. | \$39.00 | 882.00 | \$34,398.00 |
| 13 | ROUNDBOUT CENTRAL ISLAND CEMENT CONCRETE CURB | 6708 | L.F. | \$35.00 | 230.00 | \$8,050.00 |
| 14 | BEAM GUARDRAIL ANCHOR TYPE 10 | 6766 | EACH | \$1,000.00 | 6.00 | \$6,000.00 |
| 15 | GUARDRAIL | | L.F. | \$65.00 | 655.00 | \$42,575.00 |
| 16 | PAINT LINE | 6806 | L.F. | \$1.50 | 4,386.00 | \$6,579.00 |
| 17 | PLASTIC TRAFFIC ARROW | 6833 | EACH | \$300.00 | 8.00 | \$2,400.00 |
| 18 | PLASTIC YIELD LINE SYMBOL | 9238 | EACH | \$70.00 | 16.00 | \$1,120.00 |
| 19 | PERMANENT SIGNING | 6890 | LS | \$1.00 | 21,340.70 | \$21,340.70 |
| 20 | ILLUMINATION SYSTEM NO. 1 | 6904 | LS | \$1.00 | 91,000.00 | \$91,000.00 |
| 21 | TRAFFIC CONTROL | | L.S. | 10% | 1.00 | \$55,045.27 |
| OTHER ITEMS | | | | | | |
| 22 | ROADSIDE CLEANUP | 7480 | EST. | \$1.00 | 10,000.00 | \$10,000.00 |
| 23 | SPCC PLAN | 7736 | L.S. | \$1.00 | 5,000.00 | \$5,000.00 |
| 24 | LANDSCAPING | NON-STD | L.S. | \$1.00 | 35,000.00 | \$35,000.00 |
| 25 | STD PLAN RETAINING WALL | | L.F. | \$90.00 | 840.00 | \$75,600.00 |
| | MISCELLANEOUS ITEM ALLOWANCE | | | 20.00% | | \$136,998.43 |
| | CONSTRUCTION TOTAL | | | | | \$932,590.56 |
| | SALES TAX | | | 8.40% | | \$78,337.61 |
| | SUB TOTAL | | | | | \$1,010,928.16 |
| | CONSTRUCTION ENGINEERING (CE) | | | 18% | | \$181,967.07 |
| | CONTINGENCIES | | | 4% | | \$40,437.13 |
| | CN | | | | | \$1,233,332.36 |
| | PE | | | 18% | | \$221,999.82 |
| | PROJECT TOTAL | | | | | \$1,455,332.19 |

Possible items included in Misc

 Removal of structures and obstructions
 Storm sewer items
 Erosion control
 ROW
 Utility relocate