City of Sumner

REVISED

ENVIRONMENTAL CHECKLIST

Purpose of checklist:

The State Environmental Policy Act (SEPA), chapter 43.21C RCW, requires all governmental agencies to consider the environmental impacts of a proposal before making decisions. An environmental impact statement (EIS) must be prepared for all proposals with probable significant adverse impacts on the quality of the environment. The purpose of this checklist is to provide information to help you and the agency identify impacts from your proposal (and to reduce or avoid impacts from the proposal, if it can be done) and to help the agency decide whether an EIS is required.

Instructions for applicants:

This environmental checklist asks you to describe some basic information about your proposal. Governmental agencies use this checklist to determine whether the environmental impacts of your proposal are significant, requiring preparation of an EIS. Answer the questions briefly, with the most precise information known, or give the best description you can.

You must answer each question accurately and carefully, to the best of your knowledge. In most cases, you should be able to answer the questions from your own observations or project plans without the need to hire experts. If you really do not know the answer, or if a question does not apply to your proposal, write "do not know" or "does not apply." Complete answers to the questions now may avoid unnecessary delays later.

Some questions ask about governmental regulations, such as zoning, shoreline, and landmark designations. Answer these questions if you can. If you have problems, the governmental agencies can assist you.

The checklist questions apply to all parts of your proposal, even if you plan to do them over a period of time or on different parcels of land. Attach any additional information that will help describe your proposal or its environmental effects. The agency to which you submit this checklist may ask you to explain your answers or provide additional information reasonably related to determining if there may be significant adverse impact.

Use of checklist for nonproject proposals:

Complete this checklist for nonproject proposals, even though questions may be answered "does not apply." in addition, complete the supplemental sheet for nonproject actions (part D).

For nonproject actions, the references in the checklist to the words "project," "applicant," and "property or site" should be read as "proposal," "proposer," and "affected geographic area," respectively.

A. Background

1. Name of proposed project, if applicable:

   CIP 15-04 410 Traffic Avenue Interchange

2. Name of applicant:

   City of Sumner: Doug Beagle, Public Works Project Manager

3. Address and phone number of applicant and contact person:

   1104 Maple Street, Suite 260

   Sumner, WA 98390

   (253) 299-5715

4. Date checklist prepared:

   January 12, 2017

5. Agency requesting checklist:

   City of Sumner

6. Proposed timing or schedule (including phasing, if applicable):

   Planning phase began in July 2016, design will begin January 2017, and construction will begin in July 2018. Project completion is estimated to occur in August 2019.

7. Do you have any plans for future additions, expansion, or further activity related to or connected with this proposal? If yes, explain.

   No

8. List any environmental information you know about that has been prepared, or will be prepared, directly related to this proposal.

   Categorical Exclusion Documentation Form

   Cultural Resources Report

   Biological Assessment

   Habitat Management Plan

9. Do you know whether applications are pending for governmental approvals of other proposals directly affecting the property covered by your proposal? If yes, explain.

   None are known to be pending

10. List any government approvals or permits that will be needed for your proposal, if known.

    NPDES Permit

    City of Sumner Permits (Grade and Fill, Critical Areas, etc.)

11. Give brief, complete description of your proposal, including the proposed uses and the size of the project and site. There are several questions later in this checklist that ask you to describe certain aspects of your proposal. You do not need to repeat those answers on this page. (Lead agencies may modify this form to include additional specific information on project description.)

    The City of Sumner is proposing to add general purpose lanes and non-motorized facilities on Traffic Avenue between the five lane, E. Main Street Bridge, over the Puyallup River and the five lane section of Traffic Avenue extending north towards downtown Sumner. The most significant section of work will include adding a lane in each direction to the existing two lanes bridge crossing over SR410. This would be done by building a separate parallel structure to carry new general purpose lanes and non-motorized facilities. The project will reconfigure intersections at each end of the existing SR410 overpass that connect to the SR 410 access ramps and Thompson Street. The south end of the project will connect to Puyallup's Riverwalk Trail, the Sumner Link Trail, and Pierce County's Foothills Trail system. Non-motorized facilities will be installed through the length of the project to provide an ADA accessible pathway connecting to the Sound Transit Sounder Rail Station.

12. Location of the proposal. Give sufficient information for a person to understand the precise location of your proposed project, including a street address, if any, and section, township, and range, if known. If a proposal would occur over a range of area, provide the range or boundaries of the site(s). Provide a legal description, site plan, vicinity map, and topographic map, if reasonably available. While you should submit any plans required by the agency, you are not required to duplicate maps or detailed plans submitted with any permit applications related to this checklist.

    The project is located at the SR 410 and Traffic Avenue interchange in southwest Sumner in the northwest quarter of Section 25 of Township 20E and Range 04E.

TO BE COMPLETED BY APPLICANT

EVALUATION FOR AGENCY USE ONLY

B. ENVIRONMENTAL ELEMENTS

1. Earth

a. General description of the site (circle one): Flat, rolling, hilly, steep slopes, mountainous, other

   The overall site is mainly flat but the embankments constructed for the Traffic Avenue Bridge are somewhat steep.

b. What is the steepest slope on the site (approximate percent slope)?

   33%

c. What general types of soils are found on the site (for example, clay, sand, gravel, peat, muck)? If you know the classification of agricultural soils, specify them and note any prime farmland.

According to soil survey data for Pierce County, soils in the vicinity consist of Puyallup fine sandy loam. This soil type is formed in mixed alluvium under hardwoods and conifers on natural levees in major river valleys. The project area is not within the vicinity of any agricultural resource lands or the 300-foot buffer of agricultural resource lands as identified on the City of Sumner Agricultural Resource Land Map.

d. Are there surface indications or history of unstable soils in the immediate vicinity? If so, describe.

There are no unstable soils in the immediate project vicinity. While the embankments on either side of Highway 410 are somewhat steep, the project area is not within a landslide or erosion hazard area according to the Sumner Landslide & Erosion Hazard Area map. It is within a seismic hazard area.

e. Describe the purpose, type, and approximate quantities of any filling or grading proposed. Indicate source of fill.

Excavation will occur for construction of bridge abutments and new roadway alignments. Fill will be imported to build up road base and backfill bridge structures. Approximate cubic yardage of fill and excavation has not yet been determined.

f. Could erosion occur as a result of clearing, construction, or use? If so, generally describe.

Short-term erosion may occur during construction as clearing, grubbing, and excavation.

g. About what percent of the site will be covered with impervious surfaces after project construction (for example, asphalt or buildings)?

Approximately 90% of the site will be covered with impervious surfaces after project construction.

h. Proposed measures to reduce or control erosion, or other impacts to the earth, if any:

Standard erosion control BMPs will be installed prior to construction and regularly inspected throughout. These BMPs include, but are not limited to: biodegradable erosion control blankets, temporary seeding, silt fence, straw bales, containment fences, stabilized construction entrances, and final revegetation of the disturbed areas. In addition, the project will follow the City of Sumner's municipal NPDES permit with the Department of Ecology as well as related City code.

Air

a. What types of emissions to the air would result from the proposal (i.e., dust, automobile, odors, industrial wood smoke) during construction and when the project is completed? If any, generally describe and give approximate quantities if known.

The project may result in short-term reductions in air quality due to increased emissions from construction equipment, vehicles, and dust during construction. The project will create new vehicular travel lanes which may result in long-term increases in vehicle emissions.

b. Are there any off–site sources of emissions or odor that may affect your proposal? If so, generally describe.

There are no off-site sources of emissions or odor that may effect this proposal.

c. Proposed measures to reduce or control emissions or other impacts to air, if any:

During construction, measures will be taken to limit the amount of idling time of construction equipment and vehicles. Dust will be minimized by spraying exposed soil with water, if necessary. Although the project is adding new vehicle travel lanes, the new lanes will reduce congestion on the project site which will reduce impacts to air quality.

3. **Water**

a. Surface:

1) Is there any surface water body on or in the immediate vicinity of the site (including year–round and seasonal streams, saltwater, lakes, ponds, wetlands)? If yes, describe type and provide names. If appropriate, state what stream or river it flows into.

The project is approximately 150 feet north of the Puyallup River. See the attached shoreline exhibit.

2) Will the project require any work over, in, or adjacent to (within 200 feet) the described waters? If yes, please describe and attach available plans.

A small amount of sidewalk construction will occur within 200 feet of the Puyallup River within areas of prior disturbance due to roadway shoulder construction.

3) Estimate the amount of fill and dredge material that would be placed in or removed from surface water or wetlands and indicate the area of the site that would be affected. Indicate the source of fill material.

No surface water or wetlands are affected by this project.

4) Will the proposal require surface water withdrawals or diversions? Give general description, purpose, and approximate quantities if known.

No

5) Does the proposal lie within a 100–year floodplain? If so, note location on the site plan.

The proposal is adjacent to the floodplain but will not impact it. A retaining wall will be used along the SR 410 eastbound ramps to avoid any fill within the 100-year floodplain of the Puyallup River. See the attached floodplain exhibit. .

6) Does the proposal involve any discharges of waste materials to surface waters? If so, describe the type of waste and anticipated volume of discharge.

No waste material will be discharged to surface waters.

b. Ground:

1) Will ground water be withdrawn, or will water be discharged to ground water? Give general description, purpose, and approximate quantities if known.

No groundwater will be withdrawn or discharged.

2) Describe waste material that will be discharged into the ground from septic tanks or other sources, if any (for example: Domestic sewage; industrial, containing the following chemicals… ; agricultural; etc.). Describe the general size of the system, the number of such systems, the number of houses to be served (if applicable), or the number of animals or humans the system(s) are expected to serve.

No waste material will be discharged into the ground.

c. Water runoff (including stormwater):

1) Describe the source of runoff (including storm water) and method of collection and disposal, if any (include quantities, if known). Where will this water flow? Will this water flow into other waters? If so, describe.

Modifications to the existing stormwater system will be made to account for the increase in impervious area resulting from the proposed project. Modifications will be made according 2012 Stormwater Manual with enhanced treatment and City of Sumner code and specifications.

2) Could waste materials enter ground or surface waters? If so, generally describe.

Waste materials are not anticipated to enter any waters.

d. Proposed measures to reduce or control surface, ground, and runoff water impacts, if any:

To reduce or avoid impacts to surface, ground, and runoff water impacts, the project will incorporate the following measures at the minimum:

-Implementation of an approved temporary erosion and sediment control (TESC) plan

-Erosion control BMPs (silt fence, straw wattle, straw mulch, plastic covering, seeding, check dams, inlet protection, etc.)

-Check equipment daily for leaks

-Preparation of spill prevention, pollution, and countermeasures (SPCC) plan for procedures and contacts to act upon in the event of a spill.

-Proper containment of any potentially hazardous substances

4. **Plants**

a. Check or circle types of vegetation found on the site:

deciduous tree: alder, maple, aspen, cottonwood, other
evergreen tree: fir, cedar, pine, other
shrubs
grass
pasture
crop or grain
wet soil plants: cattail, buttercup, bullrush, skunk cabbage, other
water plants: water lily, eelgrass, milfoil, other
other types of vegetation

b. What kind and amount of vegetation will be removed or altered?

Approximately 9 evergreen trees (fir) will be removed for the construction of the new bridge. Approximately 1.23 acres of grass and shrubs will be removed.

c. List threatened or endangered species known to be on or near the site.

No listed threatened or endangered species known to be on or near the site.

d. Proposed landscaping, use of native plants, or other measures to preserve or enhance vegetation on the site, if any:

Existing vegetation will be preserved to the maximum extent possible. Clearing limits will be marked with high visibility fence prior to construction. Unimproved disturbed areas will be seeded and replanted with native vegetation. Removed trees will be replaced at a ratio of at least 3:1.

5. **Animals**

a. Circle any birds and animals which have been observed on or near the site or are known to be on or near the site:

birds: hawk, heron, eagle, songbirds, other:
mammals: deer, bear, elk, beaver, other: skunk, opossum, squirrel,
fish: bass, salmon, trout, herring, shellfish, other:

b. List any threatened or endangered species known to be on or near the site.

No threatened or endangered species known to be on the site. Endangered Salmon species are known to be near the site.

c. Is the site part of a migration route? If so, explain.

No known migration routes on site.

d. Proposed measures to preserve or enhance wildlife, if any:

The BMP's listed above will avoid or minimize any impacts to habitat for wildlife. Trees removed during construction will be used as large woody debris in the White River or Salmon Creek.

6. **Energy and natural resources**

a. What kinds of energy (electric, natural gas, oil, wood stove, solar) will be used to meet the completed project's energy needs? Describe whether it will be used for heating, manufacturing, etc.

Electricity will meet the needs of the project.

b. Would your project affect the potential use of solar energy by adjacent properties? If so, generally describe.

The project will not affect potential use of solar energy.

c. What kinds of energy conservation features are included in the plans of this proposal? List other proposed measures to reduce or control energy impacts, if any:

No features or measures proposed.

7. **Environmental health**

a. Are there any environmental health hazards, including exposure to toxic chemicals, risk of fire and explosion, spill, or hazardous waste, that could occur as a result of this proposal? If so, describe.

No environmental health hazards are anticipated.

1) Describe special emergency services that might be required.

No special emergency services will be required.

2) Proposed measures to reduce or control environmental health hazards, if any:

The SPCC plan will outline all necessary information and procedures in the event of a spill. All waste materials will be fully contained and disposed of offsite in accordance with federal, state, and local laws.

b. **Noise**

1) What types of noise exist in the area which may affect your project (for example: traffic, equipment, operation, other)?

Traffic noise is the main source of noise in the project area. There is also noise from the BNSF railway adjacent to the project. Noise is not anticipated to affect the project.

2) What types and levels of noise would be created by or associated with the project on a short–term or a long–term basis (for example: traffic, construction, operation, other)? Indicate what hours noise would come from the site.

Construction activities will increase short-term levels of noise. All construction activities will occur during the City of Sumner's approved working hours. The project does add additional travel lanes so there may be an increased long-term noise impact.

3) Proposed measures to reduce or control noise impacts, if any:

All construction activities will occur during the City of Sumner's approved working hours. All noise levels that occur during the construction of the project and after will comply with the Sumner Municipal Code.

A noise study that quantifies and analyzes the project's potential noise impacts and mitigation measures will be completed as part of the NEPA process and in accordance with WSDOT protocols and standards.

8. **Land and Shoreline use**

a. What is the current use of the site and adjacent properties?

The site is currently used as a SR 410 crossing location as well as an interchange from SR 410 to Traffic Avenue. Adjacent properties include the City of Sumner's Waste Water Treatment Facility, BNSF Railroad, and general commercial and low density residential. ***The Traffic Avenue/East Main Street bridge over the Puyallup River is located adjacent to this project as well as the Sumner Link Trail and Puyallup Riverwalk Trail.***

b. Has the site been used for agriculture? If so, describe.

No

c. Describe any structures on the site.

*There is an existing 220 feet bridge crossing over SR 410. There is also the SR 410 and Traffic Avenue interchange.****There is an existing 450' bridge crossing the Puyallup River adjacent to the site.***

d. Will any structures be demolished? If so, what?

No structures on the site will be demolished.

e. What is the current zoning classification of the site?

Current zoning of the site is general commercial and low density residential.

f. What is the current comprehensive plan designation of the site?

General commercial and low density residential.

g. If applicable, what is the current shoreline master program designation of the site?

The project site is not in a shoreline master program designation area.

h. Has any part of the site been classified as an "environmentally sensitive" area? If so, specify.

No

i. Approximately how many people would reside or work in the completed project?

N/A

j. Approximately how many people would the completed project displace?

N/A

k. Proposed measures to avoid or reduce displacement impacts, if any:

N/A

l. Proposed measures to ensure the proposal is compatible with existing and projected land uses and plans, if any:

This proposal is compatible with existing and projected land uses and plans because it will provide improved connectivity between downtown Sumner, City of Puyallup and SR 410. The bridge will also be designed to provide a future link between the Sumner Link Trail and Puyallup's Riverwalk Trail. This project is also listed in the State Transportation Improvement Plan. The proposed construction is within existing right of way.

9. **Housing**

a. Approximately how many units would be provided, if any? Indicate whether high, middle, or low–income housing.

N/A

b. Approximately how many units, if any, would be eliminated? Indicate whether high, middle, or low–income housing.

N/A

c. Proposed measures to reduce or control housing impacts, if any:

N/A

10. **Aesthetics**

a. What is the tallest height of any proposed structure(s), not including antennas; what is the principal exterior building material(s) proposed?

The tallest height will be 25 feet tall light poles. The principle exterior material for the bridge is concrete.

b. What views in the immediate vicinity would be altered or obstructed?

No views will be altered or obstructed ***because the proposed bridge structure will be placed between the existing railroad bridge to the east and the existing overpass bridge to the west.***.

c. Proposed measures to reduce or control aesthetic impacts, if any:

Unimproved disturbed areas will be restored upon completion of the project.

11. **Light and glare**

a. What type of light or glare will the proposal produce? What time of day would it mainly occur?

The project will include standard WSDOT traffic lights along the bridge and interchange. This lighting will occur during nighttime hours.

b. Could light or glare from the finished project be a safety hazard or interfere with views?

No

c. What existing off–site sources of light or glare may affect your proposal?

None

d. Proposed measures to reduce or control light and glare impacts, if any:

None

12. **Recreation**

a. What designated and informal recreational opportunities are in the immediate vicinity?

The south end of the project will connect to Puyallup's Riverwalk Trail, the Sumner Link Trail, and Pierce County's Foothills Trail system. Non-motorized facilities will be installed through the length of the project to provide an ADA accessible pathway connecting to the Sound Transit Sounder Rail Station.

b. Would the proposed project displace any existing recreational uses? If so, describe.

No

c. Proposed measures to reduce or control impacts on recreation, including recreation opportunities to be provided by the project or applicant, if any:

The project will provide an ~~E~~e*nhanced connection to our* ***regional*** *Trail System* ***including the Foothills Trail to Orting, Puyallup Riverwalk Trail, and Sumner Link Trail.***

13. **Historic and cultural preservation**

a. Are there any places or objects listed on, or proposed for, national, state, or local preservation registers known to be on or next to the site? If so, generally describe.

No

c. Generally describe any landmarks or evidence of historic, archaeological, scientific, or cultural importance known to be on or next to the site.

None

b. Proposed measures to reduce or control impacts, if any:

~~*N/A*~~ ***In the event that archaeological materials are encountered during the development of the property, an archaeologist shall immediately be notified and work halted in the vicinity of the find until the materials can be inspected and assessed. At that time, the appropriate persons are to be notified of the exact nature and extent of the resource so that measures can be taken to secure them. In the event of inadvertently discovered human remains or indeterminate bones, pursuant to RCW 68.50.645, all work must stop immediately and law enforcement should be contacted. Any remains should be covered and secured against further disturbance, and communication established with local police, the DAHP, and any concerned tribal agencies.***

14. **Transportation**

a. Identify public streets and highways serving the site, and describe proposed access to the existing street system. Show on site plans, if any.

The site is served by Traffic Avenue and SR 410. The project will improve access to the existing street system by leaving the existing Traffic Avenue Bridge in place and building a new bridge next to it. Phased construction will allow for traffic to be maintained on Traffic Avenue and SR 410 interchange. ***The project also connects to East Main Street in the City of Puyallup via the Puyallup River Bridge.***

b. Is site currently served by public transit? If not, what is the approximate distance to the nearest transit stop?

Yes public transit routes exist on Traffic Avenue as well as the SR 410 interchange. ***The project will provide improved standards for non-motorized and motorized access to the Sound Transit commuter rail station located in Sumner approximately 1200 feet from the westbound off/on ramps.***

c. How many parking spaces would the completed project have? How many would the project eliminate?

N/A

d. Will the proposal require any new roads or streets, or improvements to existing roads or streets, not including driveways? If so, generally describe (indicate whether public or private).

Yes, the proposal will construct a new vehicular bridge next to the existing Traffic Avenue Bridge. With the new bridge, new travel lanes will be created on the existing bridge approaches. All improvements are public improvements. ***The project will also provide improved non-motorized access in the form of ADA compliant sidewalks and ramps and safer street crossings.***

e. Will the project use (or occur in the immediate vicinity of) water, rail, or air transportation? If so, generally describe.

The project will occur next to the BSNF railway ***that is used by the Sound Transit commuter rail train and approximately a total of 50 trains per day****.*

f. How many vehicular trips per day would be generated by the completed project? If known, indicate when peak volumes would occur.

*The proposal will not include a change in land use that will generate new trips. The proposal is meant to accommodate existing vehicular trips as well future growth in traffic volumes as population increases in the region. Peak volumes will occur during the normal commuter travel times which are in the early morning and evening hours.****The project will help relieve congestion caused during the peak hour, particularly the evening hours, for commuter traffic leaving the Sound Transit station.***

g. Proposed measures to reduce or control transportation impacts, if any:

Proposed measures to reduce or control transportation impacts will be either two roundabouts or two traffic signals, one at each intersection of the SR 410 interchange.
See the appendix to the Environmental Checklist containing the "SR 410/Traffic Avenue Overpass Improvements Transportation Technical Report"

15. **Public services**

a. Would the project result in an increased need for public services (for example: fire protection, police protection, health care, schools, other)? If so, generally describe.

Increased need for public services is not anticipated.

b. Proposed measures to reduce or control direct impacts on public services, if any.

None

16. **Utilities**

a. Circle utilities currently available at the site: ~~electricity~~, natural gas, ~~water~~, ~~refuse~~ service, ~~telephone~~, ~~sanitary sewer~~, ~~septic~~ system, other.

b. Describe the utilities that are proposed for the project, the utility providing the service, and the general construction activities on the site or in the immediate vicinity which might be needed.

Utilities proposed for the project are water, storm drainage, telecommunications, electrical, gas, and cable.

C. SIGNATURE

I, the undersigned, swear under the penalty of perjury that the above responses are made truthfully and to the best of my knowledge. I also understand that, should there be any willful misrepresentation or willful lack of full disclosure on my part, the agency may withdraw any determination of non-significance that it might issue in reliance upon this checklist.

Signature: Doug L Beagle

Name: Doug Beagle, Deputy Public Works Director

Date Submitted: 3-27-17

D. SUPPLEMENTAL SHEET FOR NONPROJECT ACTIONS

(do not use this sheet for project actions)

Because these questions are very general, it may be helpful to read them in conjunction with the list of the elements of the environment.

When answering these questions, be aware of the extent the proposal, or the types of activities likely to result from the proposal, would affect the item at a greater intensity or at a faster rate than if the proposal were not implemented. Respond briefly and in general terms.

1. How would the proposal be likely to increase discharge to water; emissions to air; production, storage, or release of toxic or hazardous substances; or production of noise?

~~Noise impacts are for the animals are proposed to be reduced by prohibiting roosters and having the kennels only allowed as an indoor use at this time.~~

N/A

Proposed measures to avoid or reduce such increases are: ***N/A***

2. How would the proposal be likely to affect plants, animals, fish, or marine life?

N/A

Proposed measures to protect or conserve plants, animals, fish, or marine life are:

N/A

3. How would the proposal be likely to deplete energy or natural resources? **N/A**

   N/A

   Proposed measures to protect or conserve energy and natural resources are: **N/A**

4. How would the proposal be likely to use or affect environmentally sensitive areas or areas designated (or eligible or under study) for governmental protection; such as parks, wilderness, wild and scenic rivers, threatened or endangered species habitat, historic or cultural sites, wetlands, floodplains, or prime farmlands? ***N/A***

   Proposed measures to protect such resources or to avoid or reduce impacts are: ***N/A***

5. How would the proposal be likely to affect land and shoreline use, including whether it would allow or encourage land or shoreline uses incompatible with existing plans?

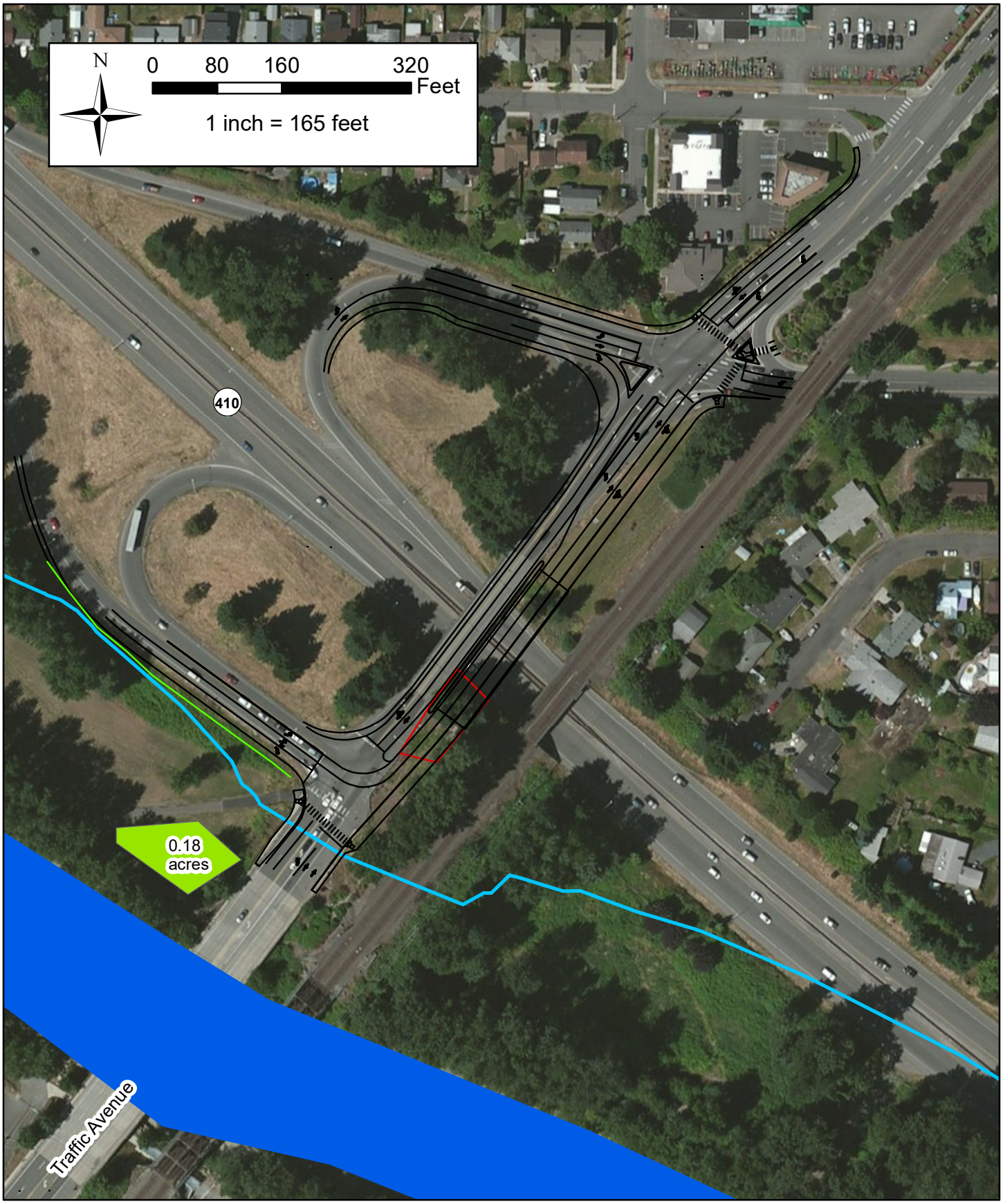
   Proposed measures to avoid or reduce shoreline and land use impacts are: ***N/A***

6. How would the proposal be likely to increase demands on transportation or public services and utilities? ***N/A***

   Proposed measures to reduce or respond to such demand(s) are: ***N/A***

7. Identify, if possible, whether the proposal may conflict with local, state, or federal laws or requirements for the protection of the environment. ***N/A***

[Statutory Authority: RCW 43.21C.110. 84–05–020 (Order DE 83–39), § 197–11–960, filed 2/10/84, effective 4/4/84.]



Approximate Wall Location
Planting Area
Tree Removal Area
Shoreline Jurisdiction
Approx OHW

Figure 1: Shoreline

SR 410 Traffic Avenue Interchange

City of Sumner

January 12, 2017

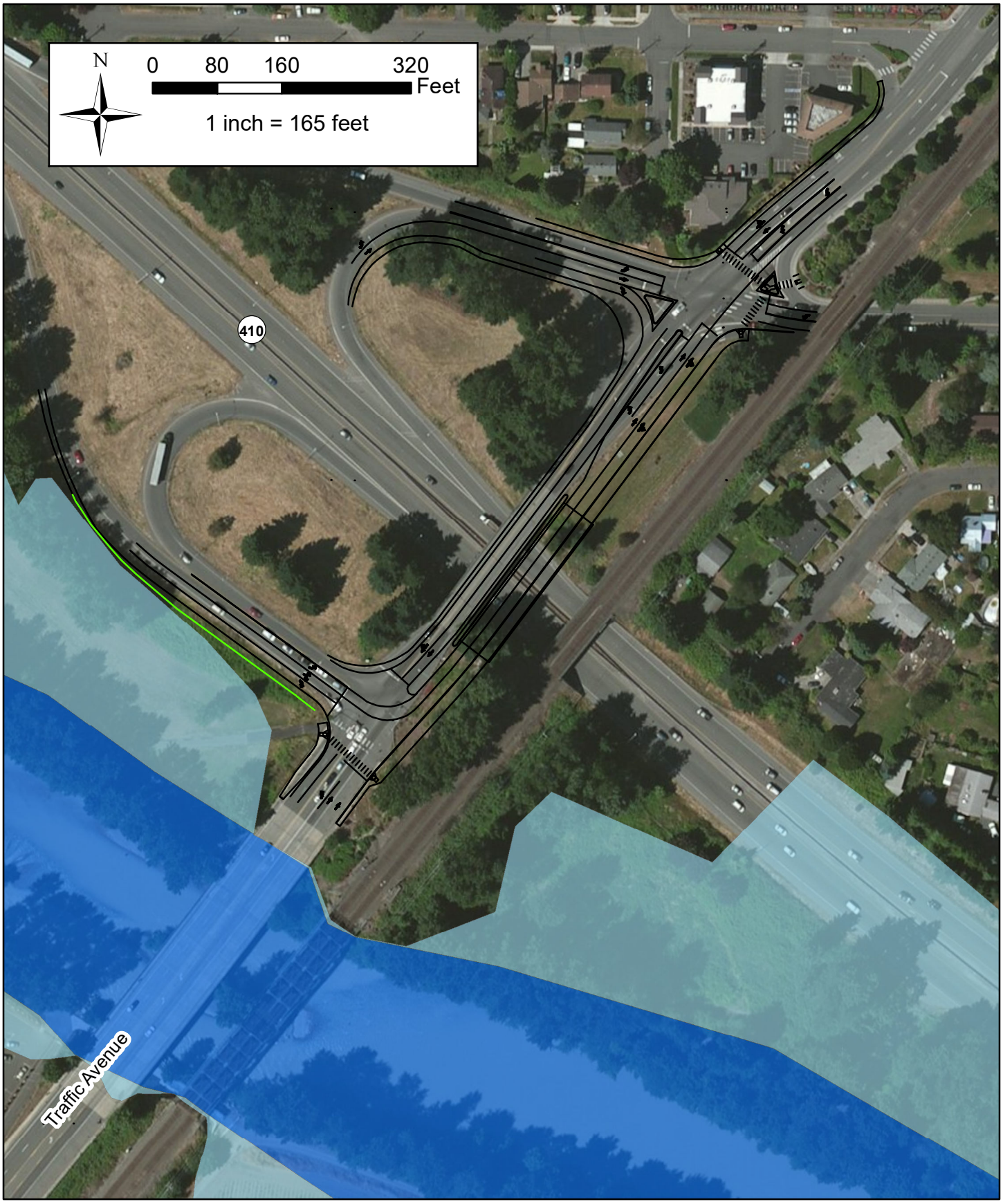


Figure 2: Puyallup River Floodplain

SR 410 Traffic Avenue Interchange

City of Sumner

January 12, 2017

Approximate Wall Location

100-year Floodplain

Floodway

APPENDIX

SR 410/Traffic Avenue Overpass Improvements Transportation Technical Report

Prepared for
City of Sumner

March 2017

Prepared by
Parametrix

SR 410/Traffic Avenue Overpass Improvements Transportation Technical Report

Prepared for

City of Sumner
1104 Maple Street, Suite 260
Sumner, WA 98390

Prepared by

Parametrix
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www.parametrix.com

March 2017 | 214-1527-080

CITATION

Parametrix. 2017. SR 410/Traffic Avenue Overpass Improvements Transportation Technical Report. Prepared by Parametrix, Puyallup, WA. March 2017.

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ACRONYMS AND ABBREVIATIONS

HCM	Highway Capacity Manual
LOS	level of service
MAISA	Multi-Agency Interdisciplinary and Stakeholder Advisory
MP	milepost
mph	miles per hour
sec	seconds
sec/veh	seconds per vehicle
Sound Transit	Central Puget Sound Regional Transit Authority
SR	State Route
vph	vehicles per hour
WSDOT	Washington State Department of Transportation

1. INTRODUCTION

The City of Sumner is proposing roadway and intersection control improvements at the State Route (SR) 410/Traffic Avenue ramp terminal intersections. The SR 410/Traffic Avenue overpass is a key element of the transportation system in east Pierce County. In addition, the Central Puget Sound Regional Transit Authority (Sound Transit) is expanding its South Line Sounder rail service and is proposing to improve access to Sumner Station, located northwest of the overpass on Traffic Avenue, for pedestrians, bicyclists, transit users, and automobiles. The Traffic Avenue overpass is a bottleneck for motorized travel and a gap in the system for nonmotorized travel. **Figure 1-1** shows the vicinity of the proposed project.

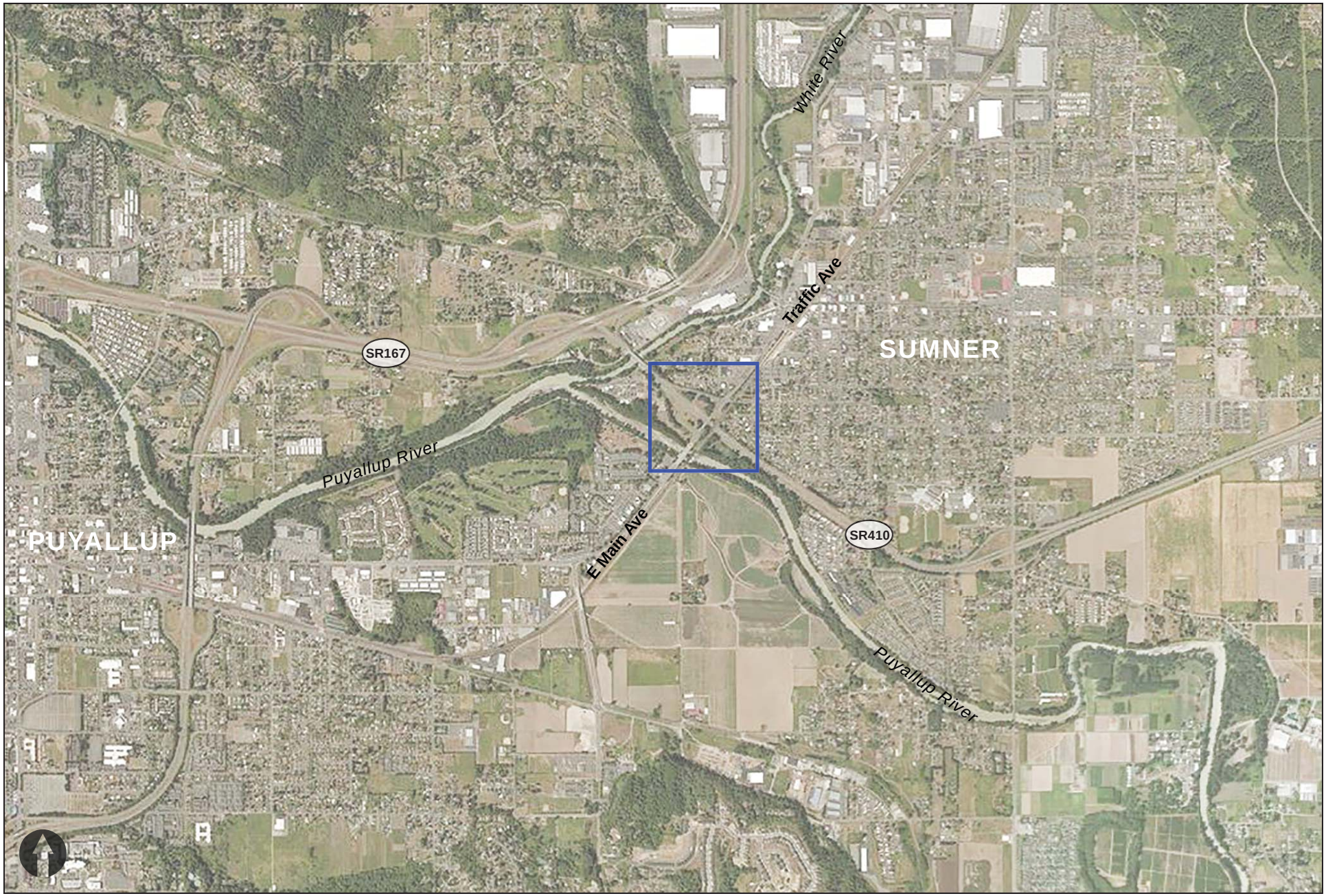
Today, congestion at the SR 410/Traffic Avenue ramp terminal intersections causes substantial delays and queues for motorists travelling between Sumner and Puyallup. Traffic queues in excess of a ½ mile are common for northbound traffic on Traffic Avenue approaching the interchange during the AM peak commute period, and southbound traffic on Traffic Avenue approaching the interchange during the PM peak commute period. Additionally, traffic queues on the SR 410 eastbound off-ramp occasionally back up and affect mainline traffic along SR 410.

Sound Transit is expanding its South Line Sounder rail service to include two new round-trip trains by September 2017, for a total of 13 daily round trips. Sound Transit forecasts ridership to increase steadily over the next 20 years, and is in the process of constructing access improvements. Sound Transit has voter-approved funding to improve access for all travel modes to Sumner Station, including additional parking capacity, congestion management, and pedestrian and bicycle improvements. As part of identifying the Sumner Station access improvements for all modes, Sound Transit completed an in-depth traffic operations analysis of the SR 410/Traffic Avenue ramp terminal intersections and nearby study area intersections. The analysis showed that additional Sumner Station traffic will further increase delays at the SR 410/Traffic Avenue ramp terminal intersections, and that Sound Transit buses and Sounder riders would have challenging, unpredictable access to Sumner Station. Therefore, Sound Transit has agreed to be a funding partner with the City of Sumner on potential improvements to the SR 410/Traffic Avenue ramp terminal intersections.

The City of Sumner, Washington State Department of Transportation (WSDOT), and Sound Transit have formed a Multi-Agency Interdisciplinary and Stakeholder Advisory (MAISA) team to identify the most practical solution at the interchange. The MAISA team has developed the following Project Need Statement:

> *The SR 410/Traffic Avenue interchange is a key element of the transportation system in east Pierce County. The overpass is a bottleneck for motorized travel and a gap in the system for nonmotorized travel. Improvements are needed to:*
>
> 1. *Relieve the bottleneck for freight, transit, and automobile travel.*
> 2. *Complete the missing link between the nonmotorized facilities north and south of the interchange.*

The purpose of this report is to present the technical transportation analysis conducted for improvements at the SR 410/Traffic Avenue ramp terminal intersections. This report describes existing and future traffic conditions at the SR 410/Traffic Avenue ramp terminal intersections, freeway operations along SR 410 near the SR 410/Traffic Avenue ramp terminal, and a safety analysis.



Study Area

Figure 1-1
Vicinity Map

SR 410 Traffic Avenue

In addition to this Chapter 1, Introduction, the technical report comprises the following chapters:

- Chapter 2, Methodology and Assumptions, discusses the methodology and assumptions used in performing the traffic operations analysis.
- Chapter 3, Existing Conditions, discusses current transportation conditions.
- Chapter 4, Design Year 2035, describes future transportation conditions.
- Chapter 5, Conclusion, provides a succinct closing statement.

2. METHODOLOGY AND ASSUMPTIONS

The methodology and assumptions used to analyze the traffic operations analysis have been summarized in the SR 410/Traffic Avenue Interchange Improvements Methodology and Assumptions Document (see **Appendix A**). The traffic operations analysis evaluated impacts and developed proposals to mitigate the impacts. The methodology and assumptions document provides the following information:

- Introduction
- Data Needs and Sources
- Study Area
- Analysis Years
- Time Period
- Traffic Volumes
- Intersection Operations Analysis
- SR 410 Operations Analysis
- Analysis Tools
  - Synchro
  - SIDRA
  - VISSIM
  - HCS
- Safety Analysis

3. EXISTING CONDITIONS

The study area includes the following two existing intersections at the SR 410/Traffic Avenue ramp terminal (**Figure 3-1**), which are evaluated:

- East Main Avenue and SR 410 Eastbound Ramps
- Traffic Avenue/Thompson Street/SR 410 Westbound Ramps

The following section describes the roadways, transit routes, study intersection traffic volumes, and collision history.

3.1 Roadway Descriptions

3.1.1 SR 410

SR 410 is a four-lane highway with a speed limit of 55 miles per hour (mph). The western terminus is SR 167, which continues east through Sumner, Bonney Lake, Buckley, and Enumclaw. The SR 410 Traffic Avenue ramp terminal intersections frequently experience heavy congestion during peak travel periods.

3.1.2 Traffic Avenue/Main Avenue

North of the SR 410 interchange, Traffic Avenue is a five-lane principal arterial with two lanes in each direction and a landscaped center median with turn lanes at some intersections. The speed limit is 25 mph. At the Traffic Avenue/Fryar Avenue and Main Street/Bridge Street intersection, this principal arterial continues east on Bridge Street.

The Traffic Avenue overpass across SR 410 is only one lane in each direction and the speed limit is 25 mph.

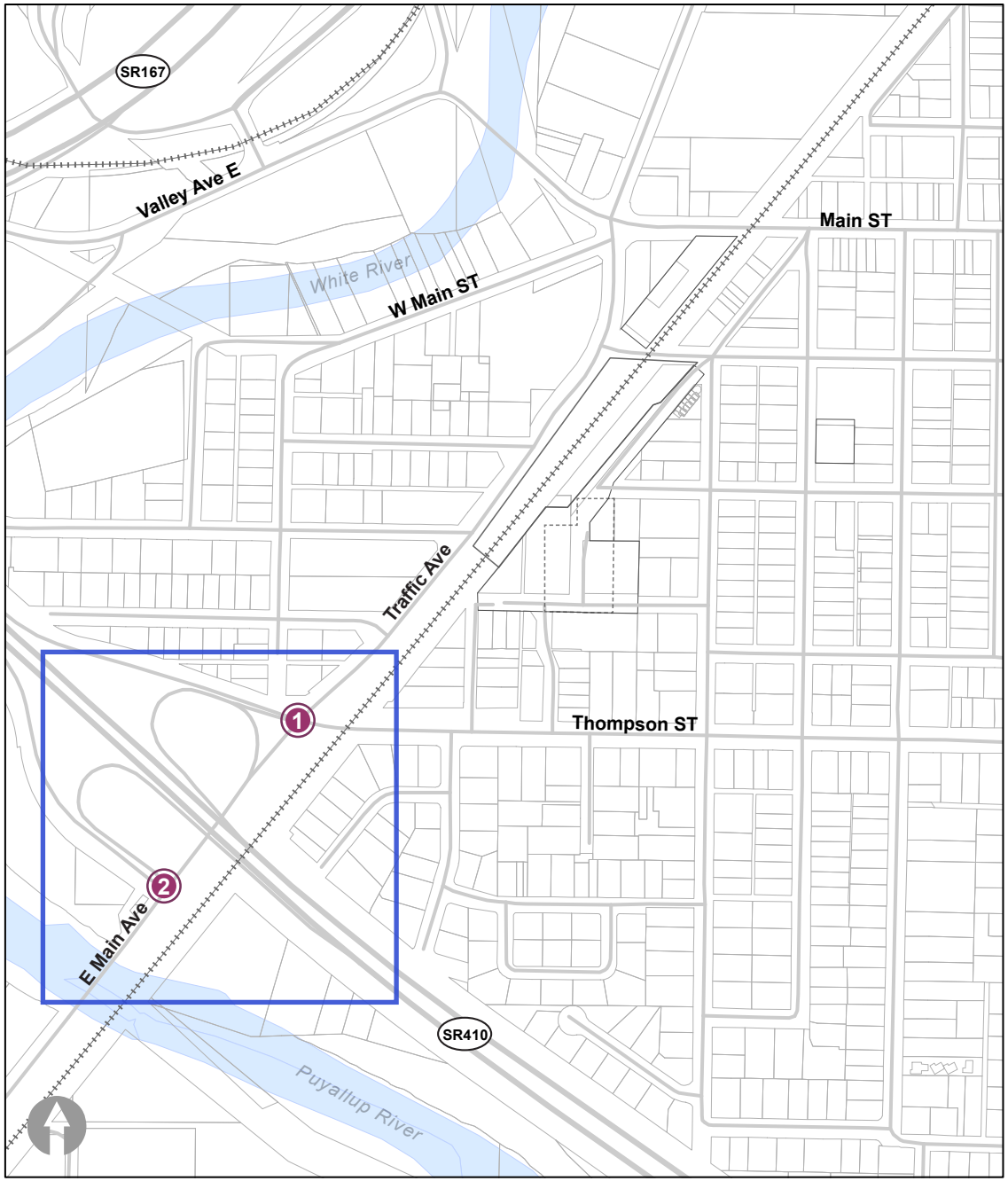
South of the SR 410 interchange, Traffic Avenue becomes East Main Avenue, which continues west into Puyallup, and is classified as a Minor Arterial. East Main Avenue has five lanes, with two lanes in each direction and a center two-way left-turn lane. The speed limit is 35 mph.

3.1.3 Thompson Street

Thompson Street is classified as a Major Collector. It is a two-lane roadway with a center turn lane west of Station Lane, and a speed limit of 25 mph.

3.2 Nonmotorized Facilities

Traffic Avenue north of SR 410 and East Main Street south of SR 410 have sidewalks on both sides of the street; however, nonmotorized facilities at the study area intersections and across the SR 410 overpass at Traffic Avenue are limited and discourage nonmotorized users.



Study Area

Study Intersections

Figure 3-1
Study Area

SR 410 Traffic Avenue

3.3 Transit

Public transportation options are available within the study area. **Table 3-1** lists the routes and describes the transit service in the study area during the commute periods.

Table 3-1. Transit Service within Study Area

Service Provider and Route		Frequency	Station Served/Route Notes
Sound Transit			
578	Between Puyallup and Seattle	30 minutes throughout the day with service not available during the 3-hour AM and PM peak periods	Serves Sumner Station. No southbound service is provided during the evening commute.
596	Between Sumner and Bonney Lake	20 to 30 minutes during the AM and PM peak periods	Serves Sumner Station. Buses coincide with Sounder trains.
Sounder Trains	Between Lakewood and Seattle	20 to 30 minutes during the 3-hour AM and PM peak periods	Serves Sumner Station.

3.4 Existing Traffic Volumes

Intersection turn movement counts were collected on Tuesday, September 13, 2016. That day was chosen to replicate normal conditions because school was in session for both Puyallup and Sumner School Districts and the Washington State Fair was closed. The turn movement counts were conducted at the study intersections of SR 410/Traffic Avenue ramp terminal intersections, from 4:30 to 9:30 am, and 2:00 to 7:00 pm. The turning movement counts collected the total number of vehicles, heavy vehicles, pedestrians, and bicycles. Traffic count data are provided in **Appendix B**. The existing 2016 AM and PM peak hour traffic volumes at the study intersections are shown in **Figure 3-2**.

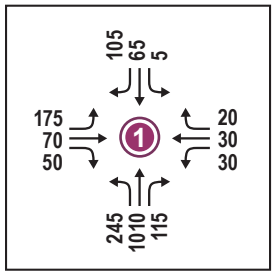
3.5 Existing Intersection Operations

3.5.1 Phased Analysis

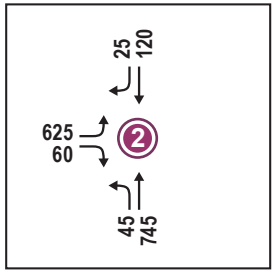
The traffic operations analysis was completed in two phases:

1. Phase 1 analyzed the ramp terminal intersections using Synchro and/or SIDRA. It focused on the relative benefits and drawbacks of the various options during the AM and PM peak hours. Key metrics used to screen the alternatives were delay, level of service (LOS), and volume-to-capacity ratios. Phase 1 was completed to identify the Preferred Alternative, which would mitigate existing and future transportation impacts. The Phase 1 analysis is documented in the Intersection Control Analysis (**Appendix C**).
2. Phase 2 analyzed the ramp terminal intersections using VISSIM. It focused on the impacts of the Preferred Alternative compared to the No Build Alternative in year 2035. The VISSIM analysis included the 3-hour AM and PM peak periods to demonstrate the benefits to the transportation system during the shoulder peak periods. Key metrics used to determine the transportation impacts of the Preferred Alternative were travel times, queue lengths, and unserved vehicles.

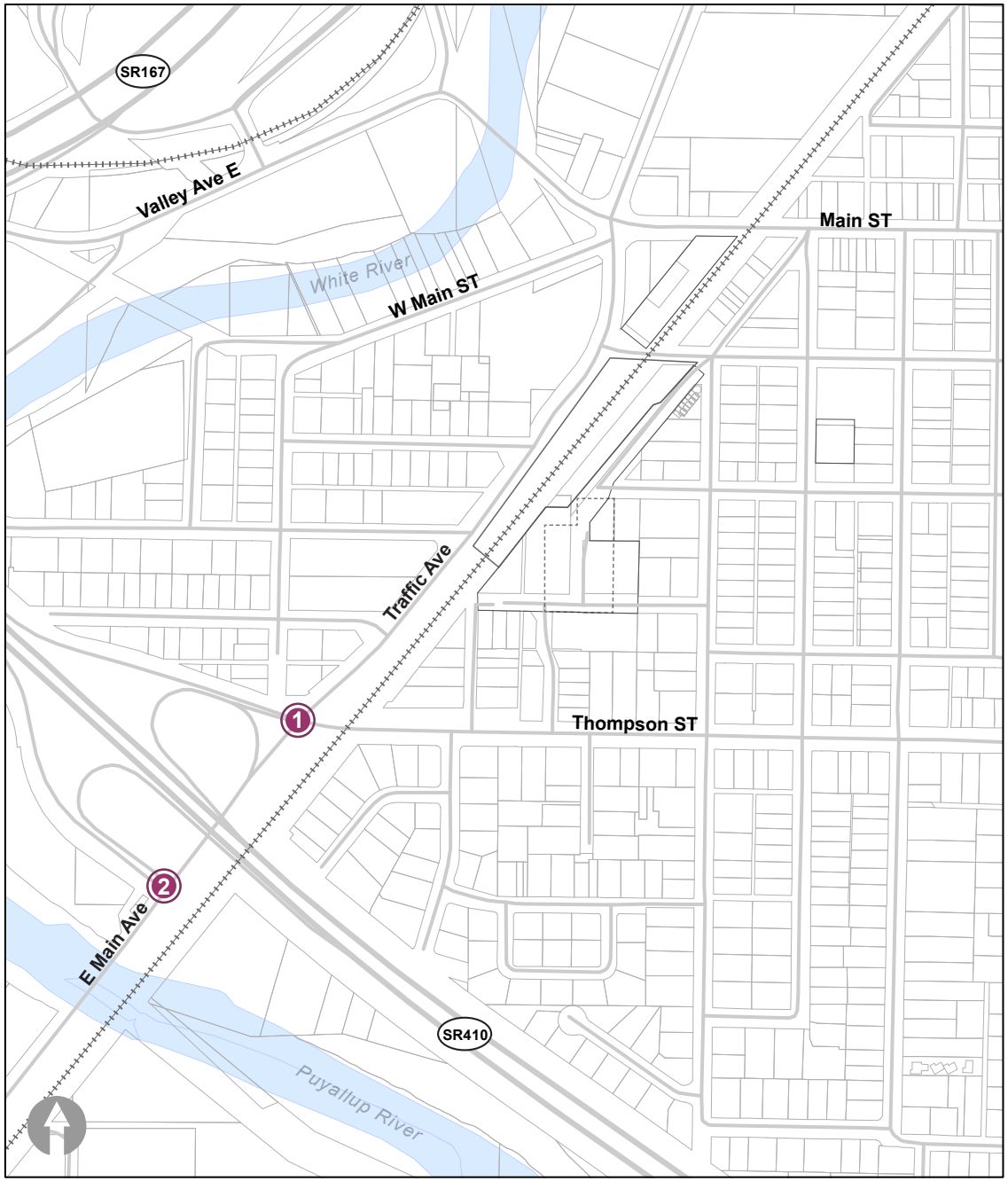
2016 AM Existing



Traffic Ave / Thompson ST
SR 410 Westbound Ramps

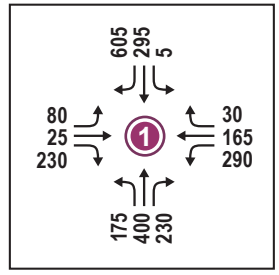


Traffic Ave
SR 410 Eastbound Ramps

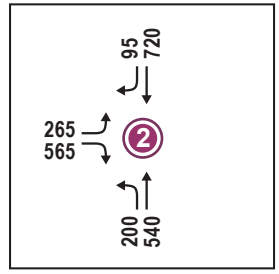


Intersection Turn Movement

2016 PM Existing



Traffic Ave / Thompson ST
SR 410 Westbound Ramps



Traffic Ave
SR 410 Eastbound Ramps

Figure 3-2
Existing Conditions 2016
Peak Hour Traffic Volumes

SR 410 Traffic Avenue

3.5.2 Intersection Analysis Tools

VISSIM (version 7) was used to analyze the study intersections after the Preferred Alternative had been selected as part of the Intersection Control Analysis (see **Appendix C**). VISSIM is a microscopic, time-step oriented, and behavior-based simulation software for modeling multimodal traffic flow. Traffic flow is simulated using individual vehicles that respond to other vehicles on the network, and network elements such as traffic signals and stop signs. The VISSIM model was calibrated to match existing 2016 conditions in the field during the AM and PM peak periods.

3.5.3 Intersection Operations

The AM and PM peak hour traffic operations for the existing 2016 condition are summarized for the study area intersections in **Figures 3-3** through **3-6**.

Figures 3-3 and **3-4** show the northbound and southbound travel times along Traffic Avenue/East Main Avenue from Bridge Street in Sumner to Shaw Road in Puyallup during the AM and PM peak periods, respectively. During the AM peak period, the southbound traffic flows are free-flow with a travel time of 3 minutes throughout the peak period. During the AM peak period, the northbound travel times are affected by peak period congestion at the East Main Avenue/SR 410 Eastbound Ramps intersection, resulting in travel times ranging from 3 to 7 minutes (see **Figure 3-3**). During the PM peak period, the northbound traffic flows are relatively free-flow with a travel time ranging between 3 and 4 minutes. During the PM peak period, the southbound travel times are affected by peak period congestion at the Traffic Avenue/Thompson Street/SR 410 Westbound Ramps intersection, resulting in travel times that range from 3 minutes to a peak of 17 minutes (see **Figure 3-4**).

Figures 3-5 and **3-6** summarize the 95 percentile queue lengths approaching the study area intersections during the AM and PM peak periods, respectively. As shown in **Figure 3-5,** AM peak period queuing problems occur at the East Main Avenue/SR 410 Eastbound Ramps intersection. The queuing is problematic on the SR 410 Eastbound off-ramp with queuing sometimes backing up to the SR 410 Eastbound off-ramp gore point, and northbound on East Main Avenue with queuing backing up all the way to Shaw Road during the peak period. As shown in **Figure 3-6,** PM peak period queuing problems occur at both study area intersections. At the East Main Avenue/SR 410 Eastbound Ramps intersection, the queuing is problematic on the SR 410 Eastbound off-ramp with queuing sometimes backing up to the SR 410 Eastbound off-ramp gore point. At the Traffic Avenue/Thompson Street/SR 410 Westbound Ramps intersection, the southbound queuing backs up all the way to Bridge Street during the peak period.

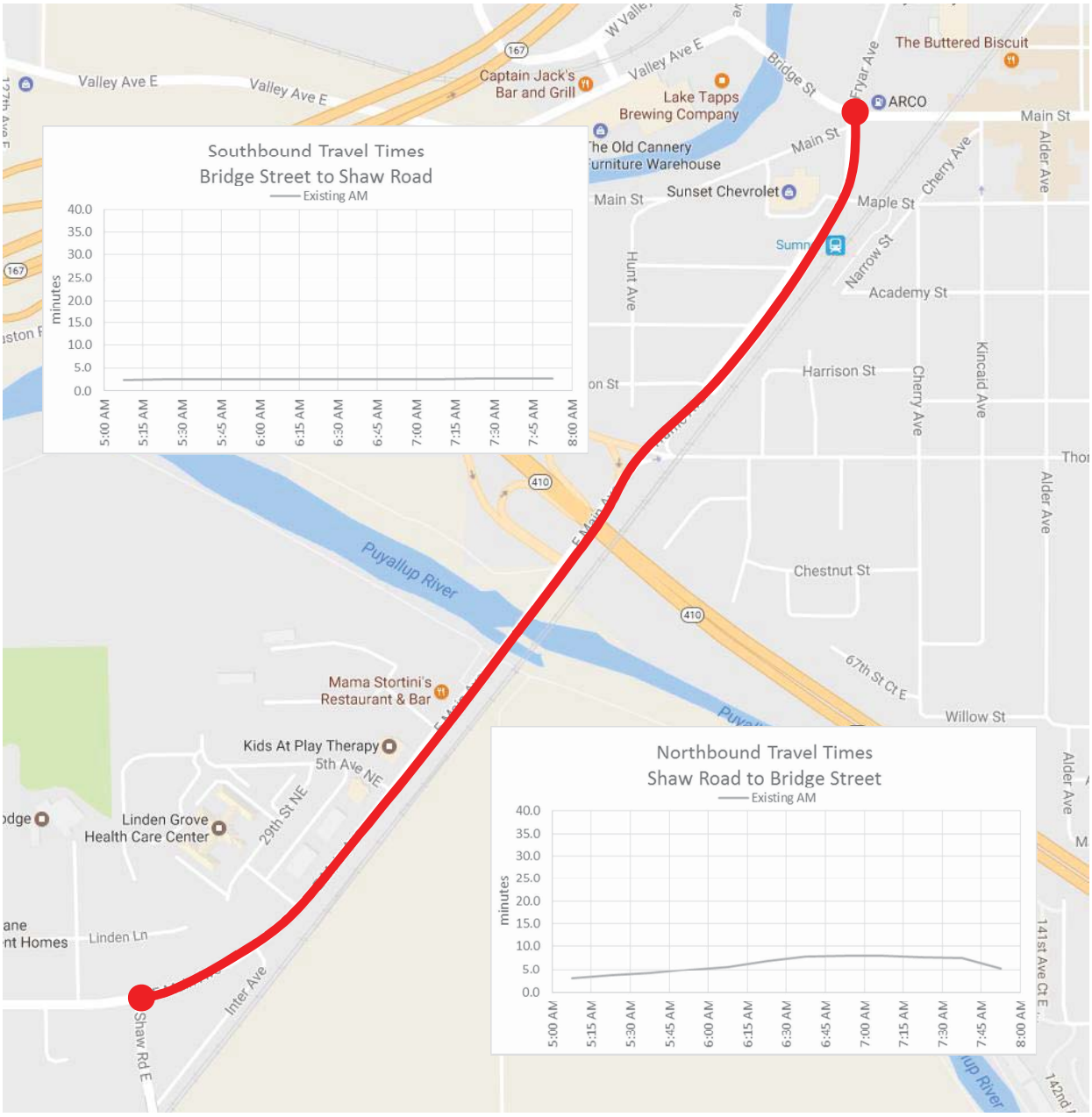


Figure 3-3
Travel Times between Bridge Street and Shaw Road AM Peak Period

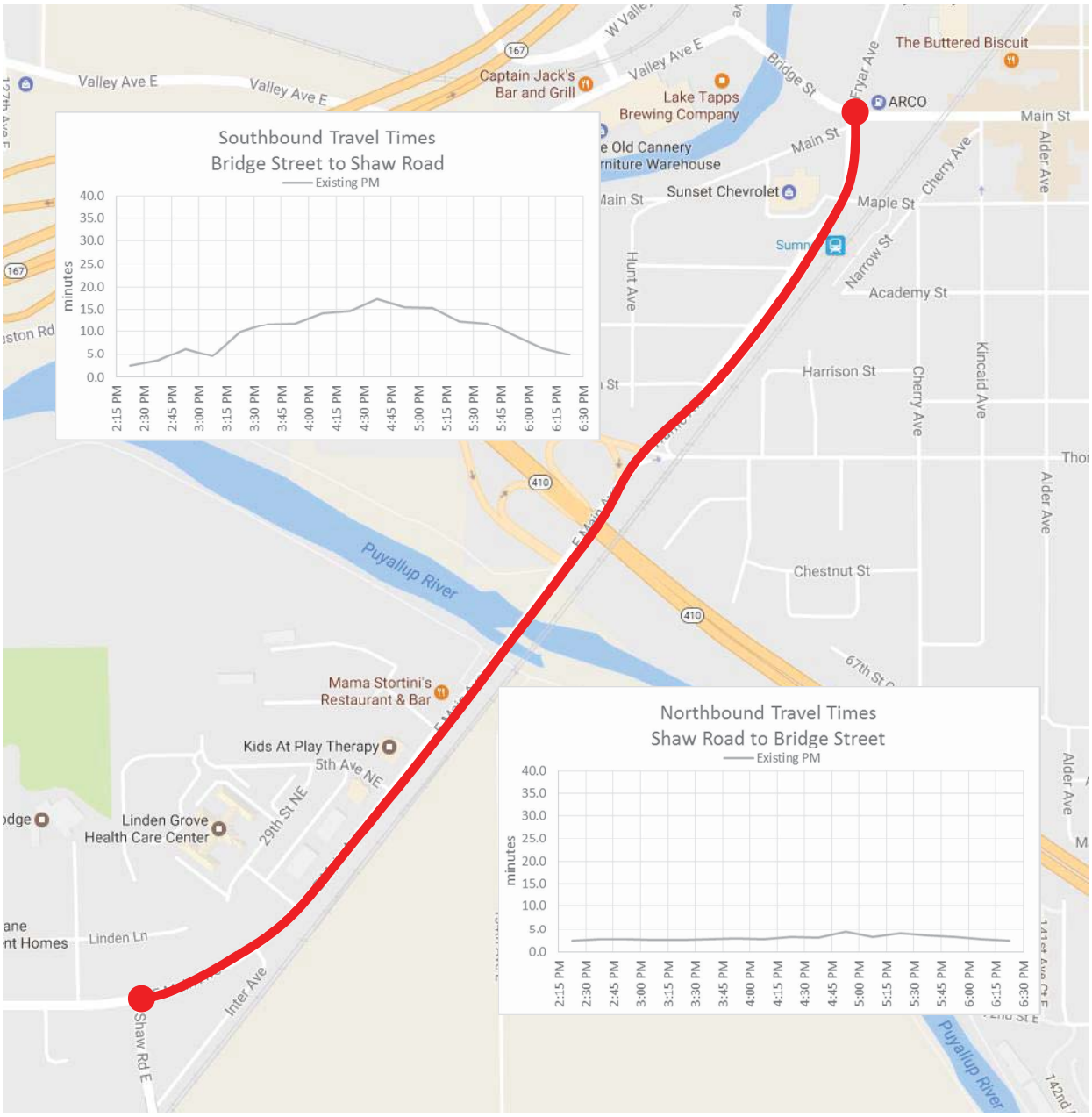


Figure 3-4
Travel Times between Bridge Street and Shaw Road PM Peak Period

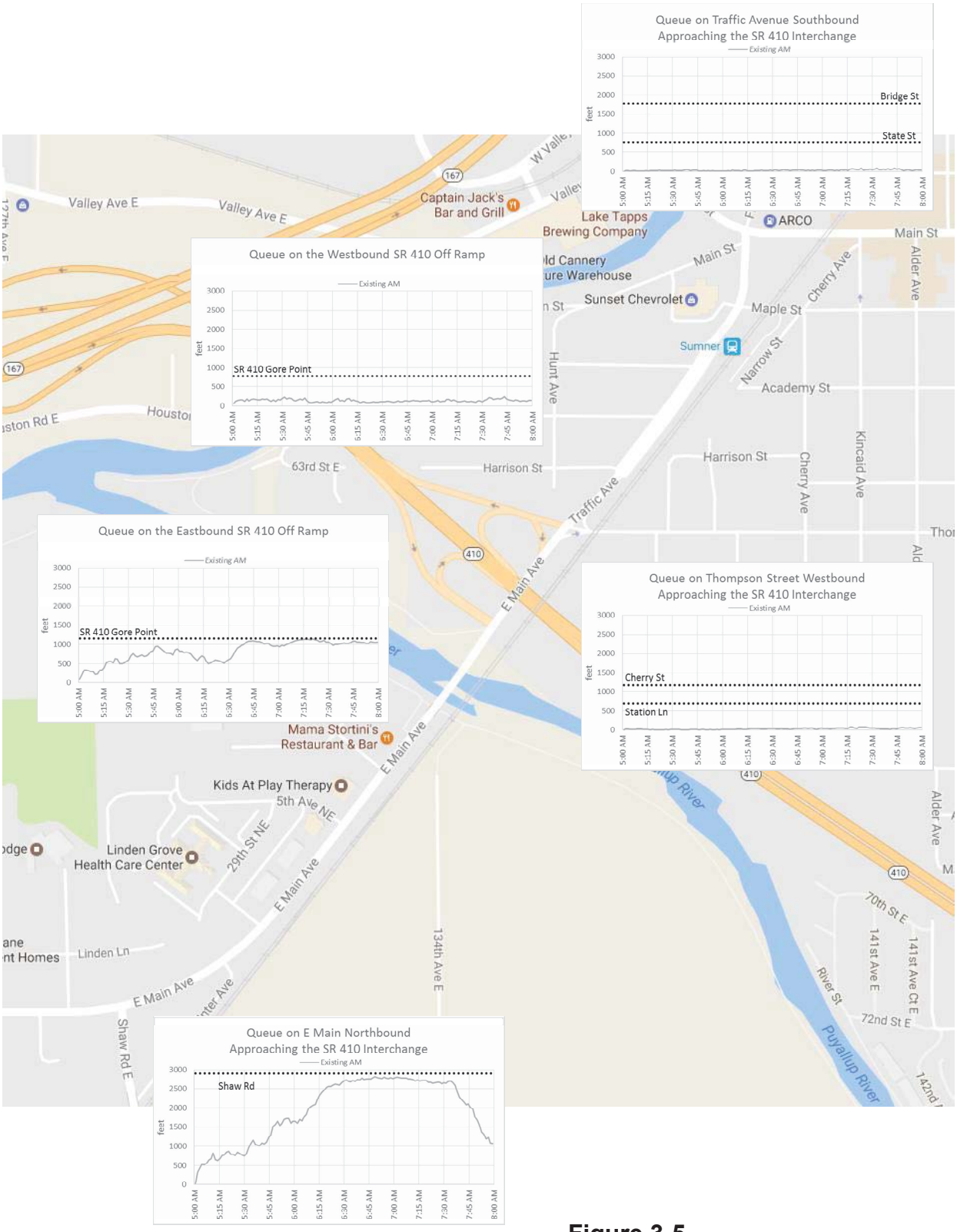


Figure 3-5
Queue Lengths Approaching the SR 410 Interchange AM Peak Period

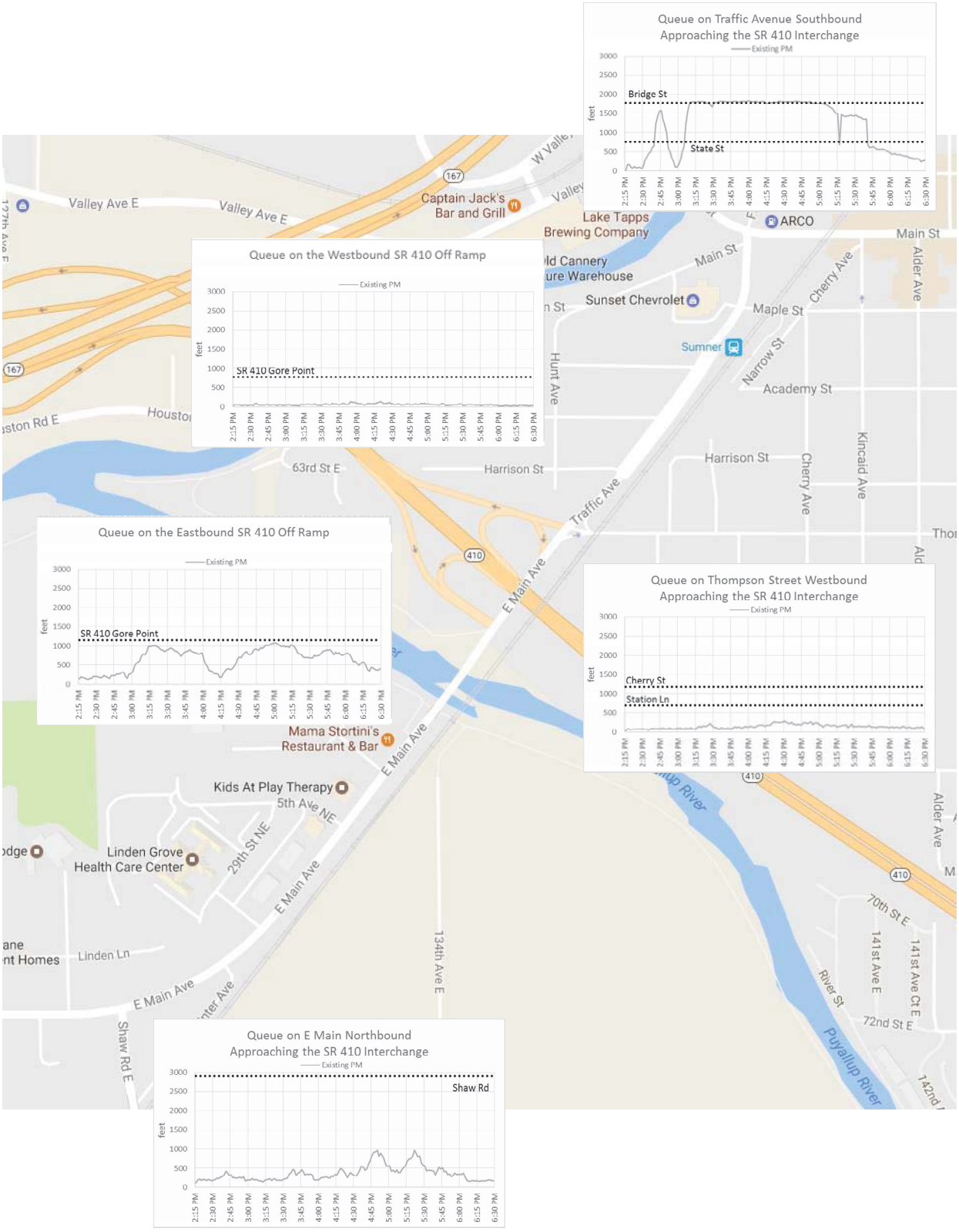


Figure 3-6
Queue Lengths Approaching the SR 410 Interchange PM Peak Period

3.6 Freeway Operations

Freeway operations were analyzed along SR 410 between the SR 167 ramps and the Traffic Avenue interchange. The analysis of freeway operations was undertaken in conformance with the procedures in the 2010 Highway Capacity Manual (HCM). Highway Capacity Software 2010 (version 6.70) was used for the analysis. The freeway LOS was determined by the density of vehicles (i.e., vehicles per lane per mile) per individual segment. The following freeway segments were analyzed (both directions):

- ***Weave Section*** between the SR 167 ramps and Traffic Avenue ramps
- ***Basic Section*** between the SR 167 on-ramps and off-ramps
- ***Diverge*** (westbound direction) and ***Merge*** (eastbound direction) sections east of the Traffic Avenue ramps

The 2016 traffic volumes are summarized in **Table 3-2** and **Table 3-3**.

Table 3-2. 2016 SR 410 Westbound Traffic Volumes (vph)

Westbound ←		Southbound SR 167 Off-ramp	Northbound SR 167 Off-ramp	SR 410 Mainline	Traffic Avenue On-ramp	SR 410 Mainline	Traffic Avenue Off-ramp	SR 410 Mainline
AM Peak Hour	**2016 Existing**	1,955	1,075	3,030	380	2,650	295	2,945
PM Peak Hour	**2016 Existing**	1,750	815	2,565	945	1,620	335	1,955

vph = vehicles per hour

Table 3-3. 2016 SR 410 Eastbound Traffic Volumes (vph)

Eastbound →		SR 167 Northbound On-ramp	SR 167 Southbound On-ramp	SR 410 Mainline	Traffic Avenue Off-Ramp	SR 410 Mainline	Traffic Avenue On-ramp	SR 410 Mainline
AM Peak Hour	**2016 Existing**	1,350	625	1,975	685	1,290	70	1,360
PM Peak Hour	**2016 Existing**	2,085	1,385	3,470	830	2,640	295	2,935

vph = vehicles per hour

As shown in **Tables 3-4** and **3-5**, all freeway sections operate at LOS D or better during the AM and PM peak hours.

Table 3-4. 2016 LOS and Density (vehicles/mile/lane)

Westbound ←		Weave Section between Traffic Avenue and SR 167 Ramps	Basic Section between Traffic Avenue Ramps	Diverge to Traffic Avenue Off-ramp
AM Peak Hour	**2016 Existing**	C / 23	C / 20	D / 30
PM Peak Hour	**2016 Existing**	B / 20	B / 12	C / 21

Table 3-5. 2016 LOS and Density (vehicles/mile/lane)

Eastbound →		Weave Section between SR 167 and Traffic Avenue Ramps	Basic Section between Traffic Avenue Ramps	Merge from Traffic Avenue On-ramp
AM Peak Hour	**2016 Existing**	B / 14	A / 10	B / 11
PM Peak Hour	**2016 Existing**	C / 28	C / 20	C / 24

3.7 Collision History

The collision history was reviewed for the SR 410/Traffic Avenue ramp terminal intersections, SR 410 mainline near the study area, and Traffic Avenue on- and off-ramps. Collision data were collected from WSDOT for the previous 5 years (2011 to 2015). Historical collision data were reviewed to identify if any of the study area intersections, SR 410 mainline, or Traffic Avenue on- and off-ramps have safety concerns.

Table 3-6 summarizes collisions by severity. As shown, most of the collisions at the study intersections, along SR 410 near the Traffic Avenue interchange, or on the SR 410 Traffic Avenue ramps resulted in property damage only (142 out of 206 total collisions). The remaining 64 collisions resulted in an injury or was unknown. There were no fatalities during the 5-year period.

Table 3-6. Summary of Collision Data by Severity (January 2013 to September 2016)

Location	Collision Severity				
	Fatality	Injuries	Property Damage Only	Unknown	Total
Traffic Avenue Westbound Ramp Terminal Intersection	0	9	20	0	29
Traffic Avenue between Ramps	0	3	3	0	6
Traffic Avenue Eastbound Ramp Terminal Intersection	0	10	9	0	19
Total	**0**	**22**	**32**	**0**	**54**
SR 410 Mainline Freeway (Milepost [MP] 8.84 to MP 10.81)	0	36	85	1	122
SR 410 Eastbound Off-ramp	0	2	9	0	11
SR 410 Eastbound On-ramp	0	0	9	0	9
SR 410 Westbound Off-ramp	0	2	6	1	9
SR 410 Westbound On-ramp	0	0	1	0	1
Total	**0**	**40**	**110**	**2**	**152**

Source: WSDOT Transportation Data and GIS Office

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.

In addition to summarizing the collision data by severity, the 62 injury collisions were summarized by type in **Table 3-7**. For the SR 410/Traffic Avenue ramp terminal intersections, the majority of the injury collisions were rear end and turning (opposite direction). Rear-end collisions often occur in congested locations and turning (opposite direction) often occur when vehicles try to turn in front of oncoming traffic even if the gap does not provide sufficient space to make a left or right turn. The main collision type on the overpass between the ramp terminal intersections is also rear-end collisions caused by congestion at the adjacent intersections. As for the SR 410 mainline and ramp injury collisions, the main collision types are fixed object, rear end, sideswipe, and vehicle overturned/over embankment/ditch.

Table 3-7. Summary of Collision Data by Type (January 2013 to September 2016)

Location	Collision Type									
	Entering at Angle	Fixed Object	Other	Parking	Pedestrian/ Cyclist Involved	Rear End	Sideswipe	Turning (Opposite Direction)	Vehicle Overturned/ Over Embankment /Ditch	Total
Traffic Avenue Ramp Terminal Intersections and between Ramps										
Traffic Avenue Westbound Ramp Terminal Intersection	2	2	0	0	1	3	0	1	0	**9**
Traffic Avenue between Ramps	0	0	0	1	0	2	0	0	0	**3**
Traffic Avenue Eastbound Ramp Terminal Intersection	1	0	0	0	1	3	0	5	0	**10**
Total	**3**	**2**	**0**	**1**	**2**	**8**	**0**	**6**	**0**	**22**
SR 410 Mainline and Traffic Avenue Ramps										
SR 410 Mainline Freeway	0	6	1	1	0	19	7	0	2	**36**
SR 410 Eastbound Off-ramp	0	0	0	0	0	0	0	0	2	**2**
SR 410 Eastbound On-ramp	0	0	0	0	0	0	0	0	0	**0**
SR 410 Westbound Off-ramp	0	0	0	0	0	2	0	0	0	**2**
SR 410 Westbound On-ramp	0	0	0	0	0	0	0	0	0	**0**
Total	0	6	1	1	0	21	7	0	4	**40**

Source: WSDOT Transportation Data and GIS Office

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.

4. DESIGN YEAR 2035

4.1 Traffic Volumes

Design year 2035 traffic volumes are based on existing 2016 volumes plus background growth rates from WSDOT, and Sumner Station Sounder traffic volume forecasts, including the addition of a 623-space parking garage at Sumner Station.

4.1.1 Background Growth

WSDOT calculated background growth rates using the Pierce County travel demand model being used for the SR 162 Sumner to Orting Corridor Planning Study, which includes the Tehaleh master-planned community south of Bonney Lake and other developments occurring in the vicinity. Using the Pierce County travel demand model, WSDOT calculated annual straightline growth rates of 1.73 percent per year during the AM peak period and 1.46 percent per year during the PM peak period. These annual straightline growth rates were calculated from the Pierce County travel demand model link volumes along SR 410 near the Traffic Avenue interchange and the Traffic Avenue ramps. These growth rates were applied to the existing year 2016 count data to develop the future year 2035 background volumes.

4.1.2 Sumner Station Growth

As described in **Section 1 (Introduction)**, Sound Transit is expanding its South Line Sounder rail service and forecasts Sounder ridership to increase steadily over the next 20 years. Sound Transit has voter-approved funding to improve access for all travel modes to Sumner Station, including additional parking capacity, congestion management, and pedestrian and bicycle improvements. Two elements of the project will directly increase vehicle traffic through the interchange:

- A 623-space parking garage, which will result in a net increase of 505 parking spaces
- Traffic control measures that will force traffic exiting the garage to turn right on Thompson Street and travel west toward the interchange

Table 4-1 shows the additional peak hour (1 hour) traffic volumes from the Sound Transit Sumner Station.

Table 4-1. Additional Sumner Station Traffic Volumes in Year 2035 (Added to Background Volumes)

Period	Peak Hour (1 hour)
AM	206
PM	279

Source: Sumner Station Access Improvements Transportation Technical Report, March 2016

4.1.3 Design 2035 Traffic Volumes

Design year 2035 traffic volumes were calculated by adding 19 years of background growth to the Sound Transit Sumner Station traffic growth and to the existing 2016 traffic volumes. The resulting year 2035 AM and PM peak hour volumes are shown in **Figure 4-1**.

4.2 No Build Alternative

The No Build Alternative assumes the lane geometry, two-lane overpass, and signalized traffic control that exist today would remain into the future. See **Figure 4-2** for an illustration of the No Build Alternative.

4.3 Build Alternative

The Build Alternative includes traffic signals and a new parallel bridge to the east resulting in a five-lane cross section along Traffic Avenue on the overpass. The Build Alternative includes traffic signals versus roundabouts based on the analysis completed for the Intersection Control Analysis (see **Appendix C**). See **Figure 4-3** for an illustration of the Build Alternative.

4.4 Design Year Traffic Operations

The AM and PM peak hour traffic operations for the 2035 No Build and Build Alternatives are summarized for the study area intersections in **Figures 4-4** through **4-7**. The 2016 existing traffic operations are also included in **Figures 4-4** through **4-7** for reference.

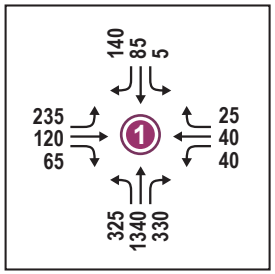
Figures 4-4 and **4-5** show the northbound and southbound travel times along Traffic Avenue/East Main Avenue from Bridge Street in Sumner to Shaw Road in Puyallup during the AM and PM peak periods, respectively.

During the AM peak period, the southbound traffic flows are free-flow with a travel time of 3 minutes throughout the peak period in both the No Build Alternative and Build Alternative. Northbound travel times are affected by peak period congestion at the East Main Avenue/SR 410 Eastbound Ramps intersection in the No Build Alternative, resulting in travel times ranging from 5 to 15 minutes (see **Figure 4-4**). Northbound travel times are free-flow with the Build Alternative.

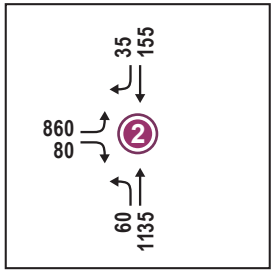
During the PM peak period, the northbound travel times are affected by peak period congestion at the East Main Avenue/SR 410 Eastbound Ramps intersection in the No Build Alternative, resulting in travel times that peak at over 35 minutes. Northbound travel times are free-flow with the Build Alternative. Southbound travel times are affected by peak period congestion at the Traffic Avenue/Thompson Street/SR 410 Westbound Ramps intersection in the No Build Alternative, resulting in travel times as high as 20 minutes (see **Figure 4-5**). Southbound travel times are close to free-flow with the Build Alternative.

Figures 4-6 and **4-7** summarize the 95 percentile queue lengths approaching the study area intersections during the AM and PM peak periods, respectively. Also shown are the number of unserved vehicles at the end of the peak period VISSIM model run. The number of unserved vehicles represents the number of vehicles waiting beyond the limits of the VISSIM model at the end of the peak analysis period.

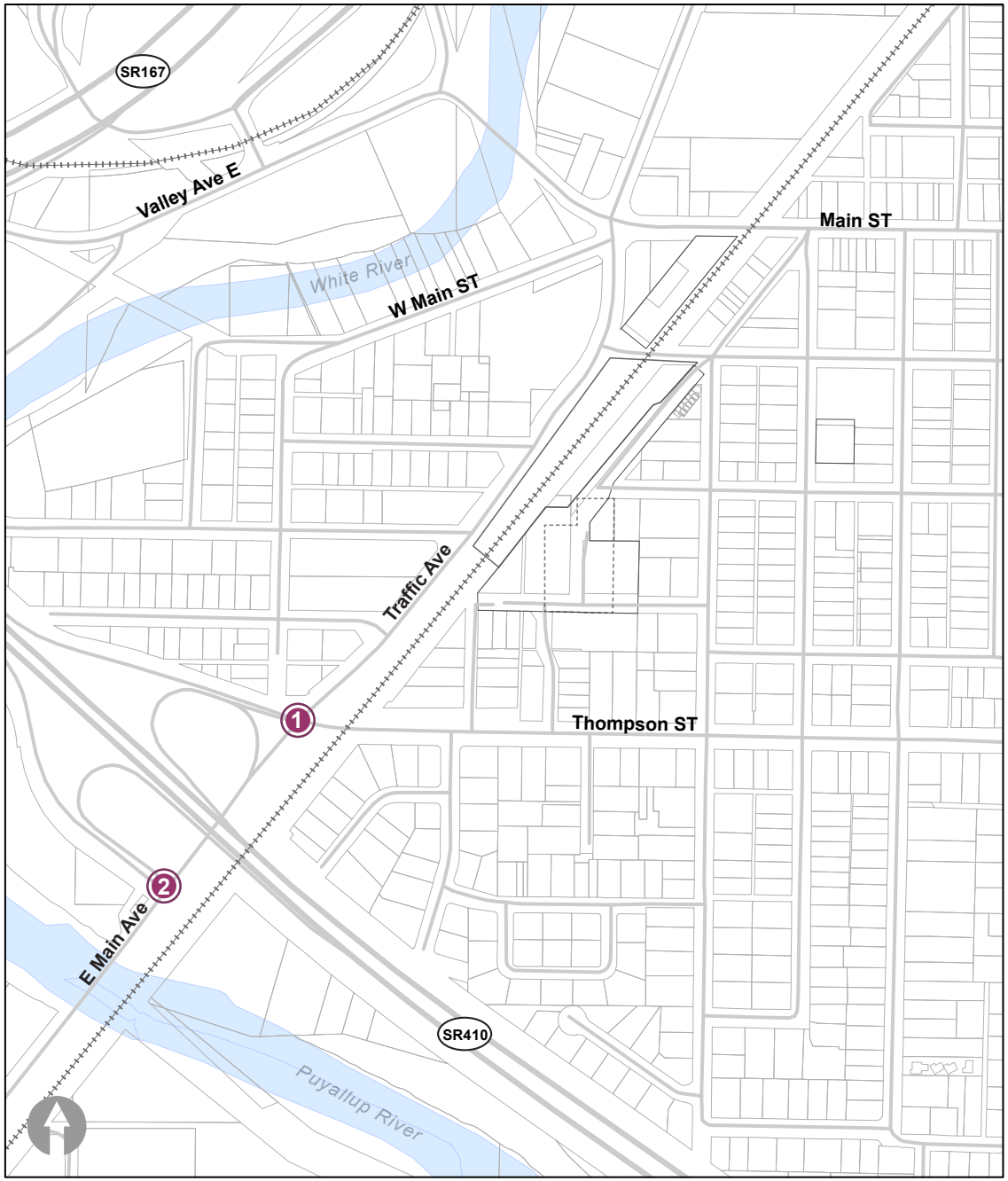
2035 AM



Traffic Ave / Thompson ST
SR 410 Westbound Ramps

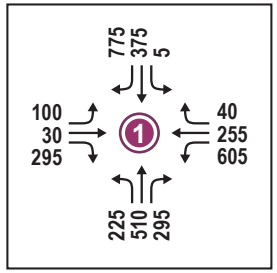


Traffic Ave
SR 410 Eastbound Ramps

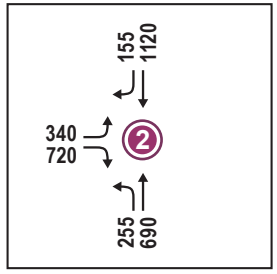


Intersection Turn Movement

2035 PM



Traffic Ave / Thompson ST
SR 410 Westbound Ramps



Traffic Ave
SR 410 Eastbound Ramps

Figure 4-1
Design Year 2035
Peak Hour Traffic Volumes

SR 410 Traffic Avenue

Parametrix

N

0 150

SCALE IN FEET

Figure 4-2
No Build Alternative

SR 410 Traffic Ave

Parametrix REVISED 2-23-17

N

0 150

SCALE IN FEET

LEGEND:

- STRIPING
- EDGE OF PAVEMENT
- PROPOSED NON-MOTORIZED ROUTE
- EXISTING NON-MOTORIZED ROUTE
- EXISTING BRIDGE TO REMAIN
- NEW BRIDGE

PROPOSED:

- FOUR 12' GENERAL PURPOSE LANES
- 14' SHARED USE PATH
- 120' LEFT TURN LANE TO WESTBOUND ON-RAMP

Figure 4-3
Traffic Signal Alternative

SR 410 Traffic Avenue

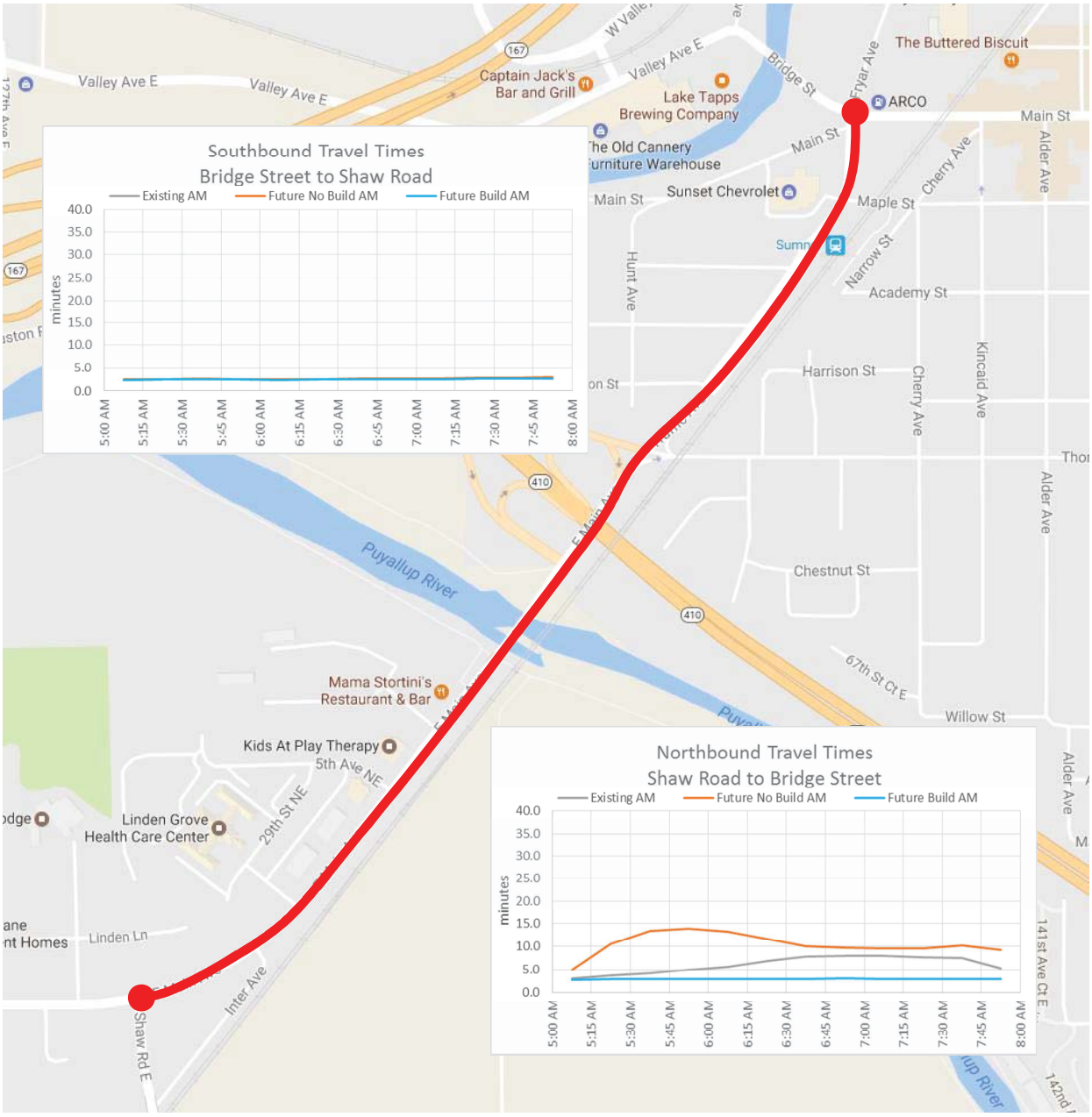


Figure 4-4
Travel Times between Bridge Street and Shaw Road AM Peak Period

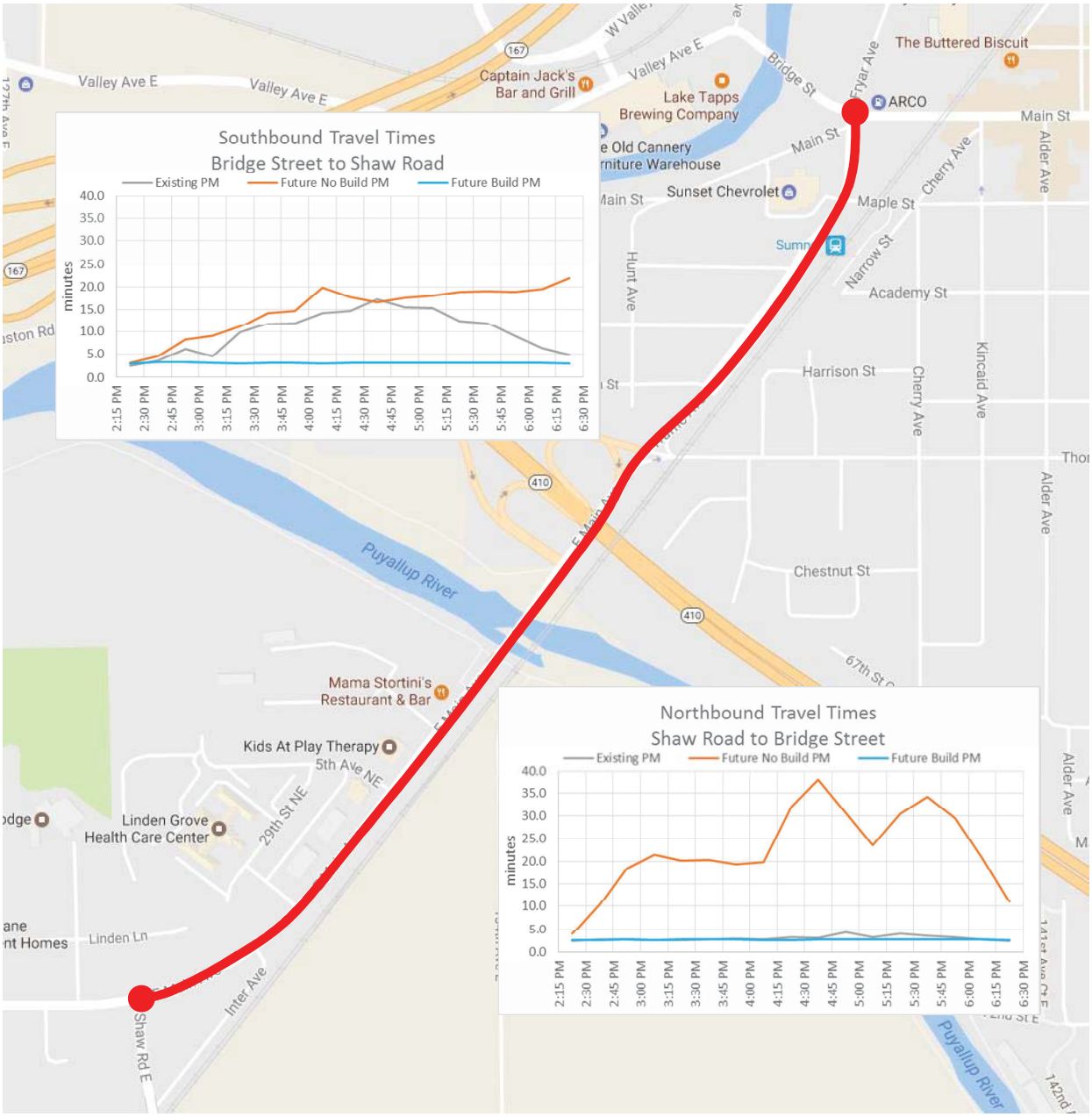


Figure 4-5
Travel Times between Bridge Street and Shaw Road PM Peak Period

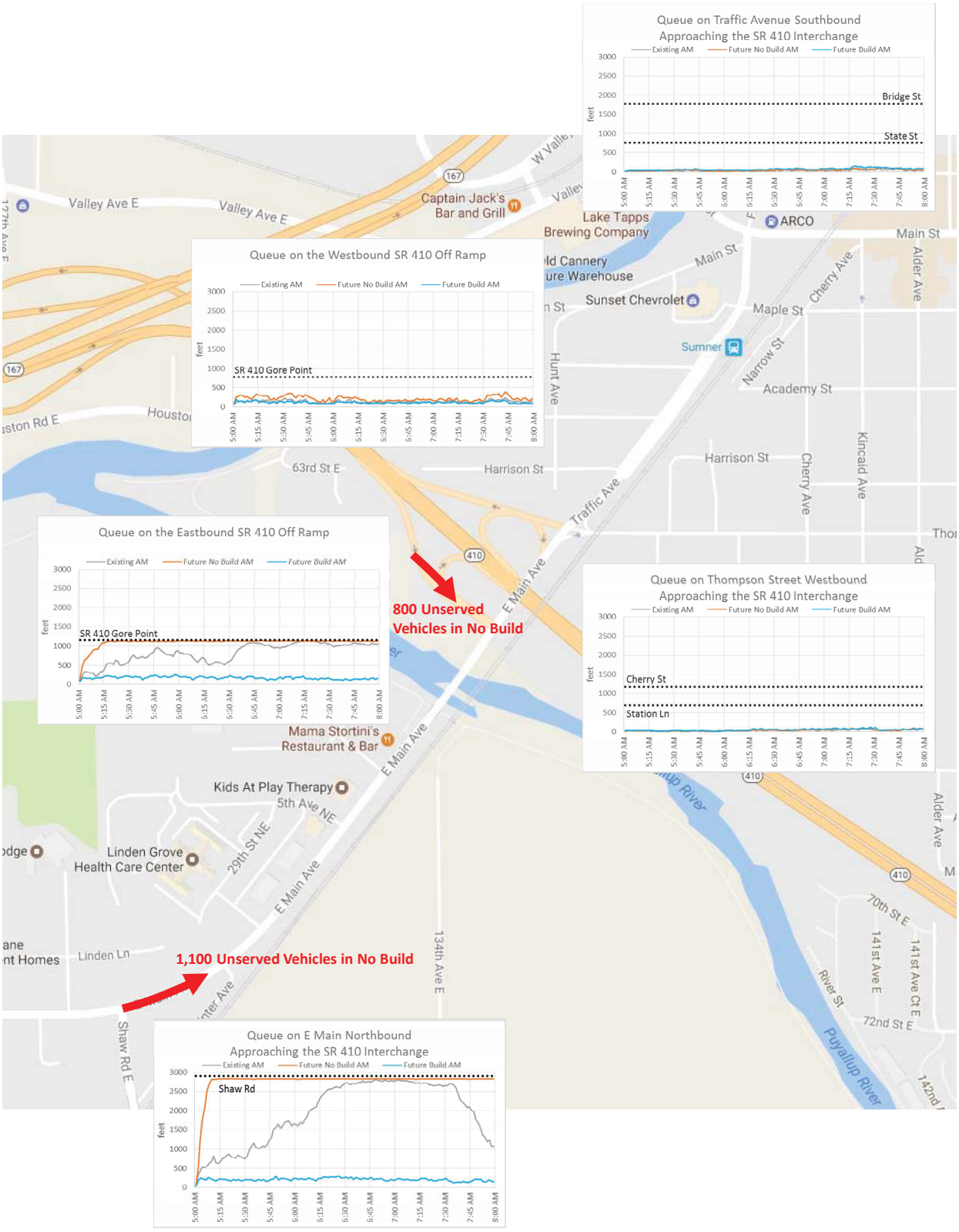


Figure 4-6
Queue Lengths Approaching the SR 410 Interchange AM Peak Period

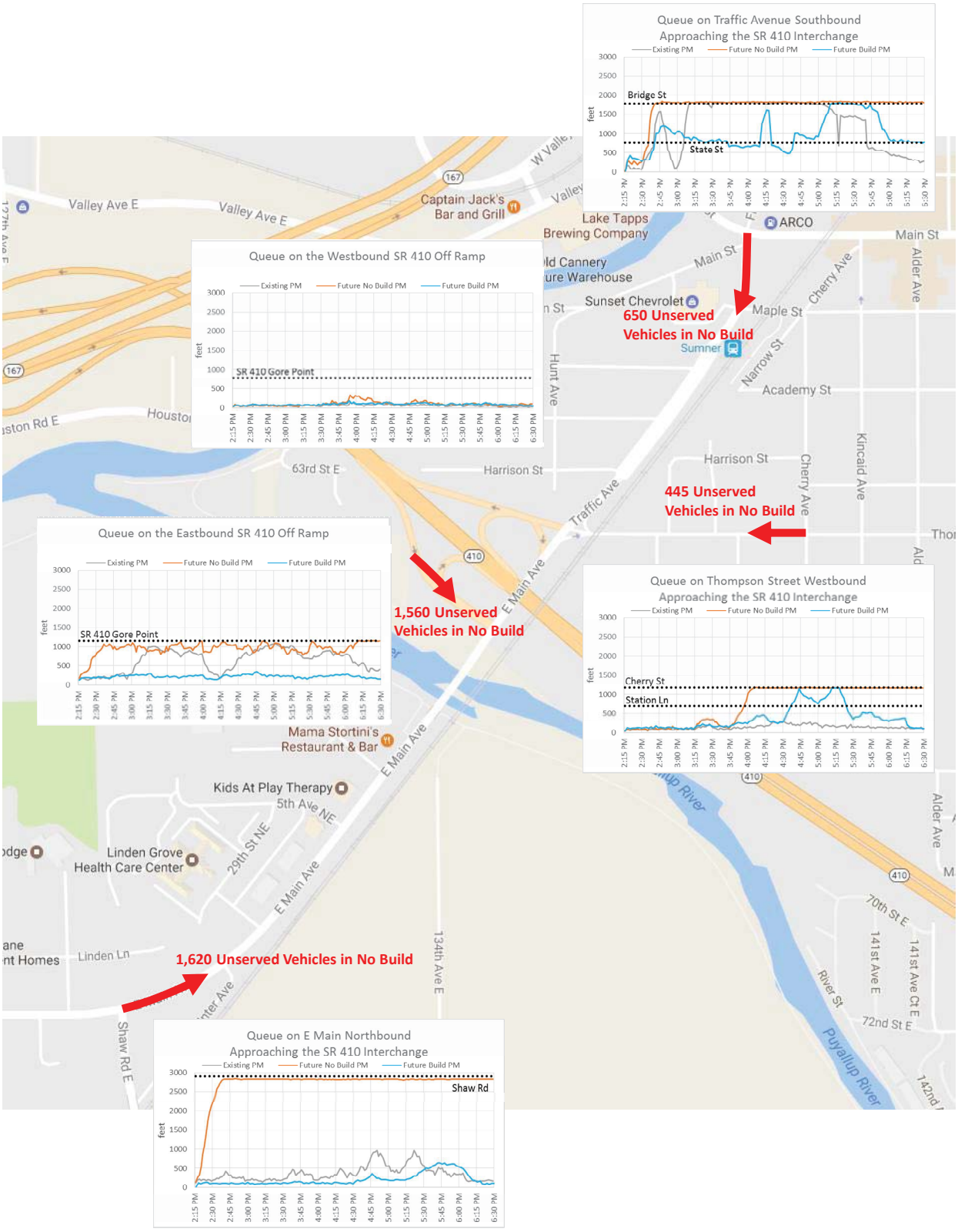


Figure 4-7
Queue Lengths Approaching the SR 410 Interchange PM Peak Period

As shown in **Figure 4-6,** AM peak period queuing problems occur at the East Main Avenue/SR 410 Eastbound Ramps intersection with the No Build Alternative. The queue on the eastbound off-ramp extends onto mainline SR 410 for the entire peak period, and 800 vehicles remain unserved at the end of the model run. The queue on northbound East Main Avenue backs up all the way to Shaw Road for the duration of the peak period with 1,100 vehicles left unserved at the end of the model run. With the Build Alternative, queues are stable during the AM peak period and do not cause any substantial blocking problems.

As shown in **Figure 4-7,** PM peak period queuing problems occur at both study area intersections with the No Build Alternative. Queues extend to the limits of the VISSIM model at four of the five locations, with over 4,275 vehicles left unserved at the end of the model run at all locations. With the Build Alternative, queues are typically stable during the PM peak period. Queues on southbound Traffic Avenue approaching the Traffic Avenue/Thompson Street/SR 410 Westbound Ramps intersection occasionally spill back past State Street, and extend to Bridge Street, but there are no unserved vehicles. Queues on Thompson Street spill back to Cherry Street from 4:45 to 5:15 pm as a result of heavy traffic flow from the Sounder Station, but the queue dissipates shortly after.

Also shown in **Figure 4-7,** the queues on northbound East Main Avenue with the Build Alternative extends up to 500 feet south of the East Main Avenue/SR 410 Eastbound Ramps intersection. This queue is a result of vehicles spilling out of the northbound left-turn pocket at the Traffic Avenue/Thompson Street/SR 410 Westbound Ramps intersection. These vehicles queue in the left northbound travel lane, but the Build Alternative provides two northbound travel lanes; therefore, through vehicles are able to bypass the queue from the left-turn lane when it spills out of the pocket.

Although there is some congestion and queuing in the Build Alternative during the PM peak period, including the northbound left-turn queue spilling out of the pocket at the Traffic Avenue/Thompson Street/SR 410 Westbound Ramps intersection, the system operates at an acceptable rate. The Build Alternative meets the Project Need Statement, and eliminates the bottleneck at the SR 410 and Traffic Avenue interchange.

4.5 Freeway Operations

Future year 2035 freeway operations were analyzed in the same fashion as 2016 freeway operations. Future year 2035 freeway volumes were developed as described in **Section 4.1**. Note that the 2035 freeway volumes would be the same for the No Build and Build Alternatives. Future year 2035 traffic volumes are summarized in **Tables 4-2** and **4-3**.

Table 4-2. 2035 SR 410 Westbound Traffic Volumes (vph)

Westbound ←		Southbound SR 167 Off-ramp	Northbound SR 167 Off-ramp	SR 410 Mainline	Traffic Avenue On-ramp	SR 410 Mainline	Traffic Avenue Off-ramp	SR 410 Mainline
AM Peak Hour	**2016 Existing**	2,595	1,430	4,025	505	3,520	390	3,910
PM Peak Hour	**2016 Existing**	2,235	1,040	3,275	1,205	2,070	430	2,500

Table 4-3. 2035 SR 410 Eastbound Traffic Volumes (vph)

Eastbound →		SR 167 Northbound On-ramp	SR 167 Southbound On-ramp	SR 410 Mainline	Traffic Avenue Off-Ramp	SR 410 Mainline	Traffic Avenue On-ramp	SR 410 Mainline
AM Peak Hour	**2016 Existing**	1,795	830	2,625	910	1,715	95	1,810
PM Peak Hour	**2016 Existing**	2,665	1,770	4,435	1,060	3,375	375	3,750

Similar to 2016 conditions, the following freeway segments were analyzed (both directions) in 2035:

- ***Weave Section*** between the SR 167 ramps and Traffic Avenue ramps
- ***Basic Section*** between the SR 167 on- and off-ramps
- ***Diverge*** (westbound direction) and ***Merge*** (eastbound direction) sections east of the Traffic Avenue ramps

As shown in **Tables 4-4** and **4-5**, all freeway sections operate at LOS D or better during the AM and PM peak hours with the following two exceptions:

- 2035 AM Peak Hour—the westbound diverge section to the Traffic Avenue (loop) off-ramp operates at LOS E
- 2035 PM Peak Hour—the eastbound weave section between the SR 167 ramps and the Traffic Avenue off-ramp operates at LOS E

Both sections that operate at LOS E have a density of 39 vehicles/mile/lane. The threshold for LOS D is 35 vehicles/mile/lane.

Table 4-4. 2035 Westbound LOS and Density (vehicles/mile/lane)

Westbound ←		Weave Section between Traffic Avenue and SR 167 Ramps	Basic Section between Traffic Avenue Ramps	Diverge to Traffic Avenue Off-ramp
AM Peak Hour	**2035**	D / 34	D / 29	E / 39
PM Peak Hour	**2035**	C / 27	B / 16	C / 26

Table 4-5. 2035 Eastbound LOS and Density (vehicles/mile/lane)

Eastbound →		Weave Section between SR 167 and Traffic Avenue Ramps	Basic Section between Traffic Avenue Ramps	Merge from Traffic Avenue On-ramp
AM Peak Hour	**2035**	B / 19	B / 13	B / 15
PM Peak Hour	**2035**	E / 39	D / 27	D / 31

4.6 Nonmotorized Facilities

The study intersections do not experience a large volume of bicycle and pedestrian traffic. During the traffic count data collection, minimal pedestrian or bicyclist activity was observed through the study intersections. Regardless of the existing usage, the new overcrossing and intersections will have pedestrian and bicycle facilities. A 14-foot shared use path will be provided on the new overpass. The Build Alternative would provide typical pedestrian and bicycle facilities through the traffic signals as shown in **Figure 4-3**. It would include sufficient time during the signal phases for pedestrians to cross the intersection.

4.7 Collision Frequency

Although the traffic volumes at the study area intersections are forecast to be similar between the 2035 No Build Alternative and Build Alternative, the amount of collisions is expected to decrease in the Build Alternative compared to the No Build Alternative because of the reduced congestion, as discussed above.

5. CONCLUSION

The purpose of the SR 410/Traffic Avenue ramp terminal intersection improvements is to relieve the bottleneck for freight, transit, and automobile travel, and to complete the missing link between the nonmotorized facilities north and south of the overpass. The Build Alternative includes traffic signals and a new parallel bridge to the east, resulting in a four-lane cross section on the overpass, plus left turn lanes at the two intersections. As shown throughout this technical report, the Build Alternative meets all of the applicable standards.

Appendix A

Methodology and Assumptions

SR 410/Traffic Avenue Interchange Improvements

Methodology and Assumptions

Introduction

This technical memorandum describes the methods and assumptions that will be used in the traffic operations analysis for the SR 410/Traffic Avenue Interchange Improvement project. The analysis will evaluate impacts and develop proposals to mitigate the impacts. The following sections describe the data need and sources, study area, analysis years, time periods, traffic volumes, traffic operations analysis, analysis tools, and safety analysis. These methods and assumptions are being provided for review and comment by participating agencies through the MAISA team.

Data Needs and Sources

A variety of data will be collected to analyze how the proposed alternatives effect the transportation system. These data sets will include the following:

- Collect existing year 2016 5-hour AM and 5-hour PM peak period turn movement counts, including bicycle and pedestrian volumes, at study intersections.
- Review year 2014 PM peak period turn movement counts, including bicycle and pedestrian volumes from the Sumner Station Access Improvement Project for comparison with new 2016 peak period counts.
- Review year 2014 24-hour tube count data from the Puyallup and Sumner Station Access Improvement Projects for comparison with new 2016 peak period counts.
- Collect recent SR 410 mainline and ramp volume data at the SR 410/Traffic Avenue interchange from WSDOT.
- Review existing year 2016 transit routes and schedules from Sound Transit.
- Collect the physical characteristics of the existing street system, including functional use, lane geometry, traffic signal timing and phasing patterns, and other parameters necessary to conduct traffic operations analysis.
- Collect collision data for the most recent 3-year period from WSDOT for the study area including the study intersections and the SR 410 mainline, ramps, merge, diverge, and weaving areas near the Traffic Avenue interchange.
- Obtain future year 2035 PSRC forecast growth rates within the study area.
- Obtain future year 2035 forecast growth rates for the study area from WSDOT.
- Review historical SR 410 growth rates in the study area.
- Review future year 2035 estimates of traffic related to the Sounder Train from the Puyallup/Sumner Station Access Improvement Projects.
- Obtain future transit routes and schedules from Sound Transit.

Study Area

The transportation analysis will focus on locations affected by the SR 410/Traffic Avenue Interchange Improvement alternatives. The following two intersections will be studied:

- E Main Avenue and SR 410 Eastbound Ramps
- Traffic Avenue/E Main Avenue and Thompson St/SR 410 Westbound Ramps

The Sumner Station Access Improvements Transportation Technical Report completed in March 2016 analyzed a larger study area so impacts caused by Sumner Sound Station parking expansion intersections along Traffic Avenue as well as near the Sumner Sounder Station are summarized in that report.

In addition to the ramp terminal intersections, SR 410 freeway operations near the Traffic Avenue Interchange will be completed. The SR 410 freeway operations analysis will include freeway merge, diverge, and weaving operations between Traffic Avenue and adjacent upstream and downstream interchanges.

Analysis Years

The transportation analysis will focus on the following time periods:

- Existing Year – 2016
- Design Year – 2035

Time Period

Both the AM and PM peak periods will be analyzed due to the different travel patterns during each peak period.

Traffic Volumes

Existing year 2016 AM and PM peak turn movement volumes at the study intersections will be based on counts collected in September 2016. The existing year SR 410 mainline and ramp volumes will be based on existing volumes provided by WSDOT balanced with the ramp terminal intersections volumes.

Future year 2035 traffic volumes will be based on existing volumes plus background growth rates from WSDOT, and Sumner Station Sounder traffic volume forecasts including the addition of a 623-space parking garage at Sumner Station. WSDOT calculated background growth rates using the Pierce County travel demand model being used for the SR 162 project which includes the Tehaleh master-planned community south of Bonney Lake and other developments occurring in the vicinity. Using the Pierce County travel demand model, WSDOT calculated annual straightline growth rates of 1.73% per year during the AM peak period and 1.46% per year during the PM peak period. These annual straightline growth rates were calculated from the Pierce County travel demand model link volumes along SR 410 near the Traffic Avenue interchange and the Traffic Avenue ramps. These annual straightline growth rates will be applied to the existing year 2016 count data to develop the future year 2035 background volumes.

In addition to the background volume growth using the WSDOT straightline growth rates, the future year 2035 volumes will include additional traffic related to the Sound Transit Sumner Station

improvements including parking expansion. **Table 1** shows the additional peak hour (one hour) volumes from the Sumner Station Access Improvement Project that will be added to the future year 2035 background volumes.

Table 1. Additional Sumner Station Traffic Volumes in Year 2035 (Added to Background Volumes)

Period	Peak Hour (1 hour)
AM	206
PM	279

Source: Sumner Station Access Improvements Transportation Technical Report, March 2016

Intersection Operations Analysis

The traffic operations analysis will proceed in two phases.

1. Phase 1 - Ramp Terminal Intersection Control Analysis. This phase will analyze signal and roundabout options at the ramp terminal intersections using Synchro and SIDRA, and identify a Preferred Alternative.
2. Phase 2 - Intersection Operations Analysis. This phase will analyze the ramp terminal intersections for 2016 existing year, 2035 No Build, and 2035 Preferred Alternative using VISSIM.

The phase one analysis will focus on the relative benefits and drawbacks of the various options during the AM and PM peak hours. Key metrics that will be used to screen the alternatives are delay and level of service (LOS), volume-to-capacity ratios, and queue lengths.

The phase two analysis will focus on the impacts of the Preferred Alternative compared to No Build conditions in year 2035. The 2035 analysis will include the three-hour AM and PM peak periods to demonstrate the benefits to the transportation system during the shoulder peak periods. Key metrics that will be used in the phase two analysis to determine impacts of the Preferred Alternative are travel times, volume throughput, queue lengths, and duration of congestion.

SR 410 Freeway Operations Analysis

SR 410 freeway operations analysis will include freeway merge, diverge, and weaving operations between Traffic Avenue and adjacent upstream and downstream interchanges. The SR 410 freeway operations analysis will be completed 2016 existing year, 2035 No Build, and 2035 Preferred Alternative. It will be completed using HCS for both the AM and PM peak hours and the key metrics will be density and LOS.

Analysis Tools

Synchro

Synchro (version 9.1) will be used to analyze the signalized intersection alternatives during the screening analysis (Phase 1), and develop optimized signal timing plans for signalized intersections. Synchro is a macroscopic analysis and optimization software application that supports the Highway Capacity Manual's methodology (2000 & 2010 methods) for signalized intersections, and creates optimized signal timing plans for intersections and corridors.

SIDRA

SIDRA (version 6.1) will be used to analyze roundabout intersection alternatives during the screening analysis (Phase 1). SIDRA is an analytical traffic evaluation software application that uses lane-by-lane and vehicle path models to provide estimates of capacity. Roundabouts will be analyzed consistent with WSDOT's SIDRA Policy and Settings[1].

VISSIM

VISSIM (version 7) will be used to analyze the three study intersections after the Preferred Alternative has been selected in Phase 2. VISSIM is a microscopic, time-step oriented, and behavior-based simulation software for modeling multimodal traffic flow. Traffic flow is simulated using individual vehicles that respond to other vehicles on the network, and network elements such as traffic signals and stop signs.

The VISSIM model will be calibrated to match existing 2016 conditions in the field during the AM and PM peak periods. The metrics will be aggregated for each hour.

- Travel times on Traffic Avenue will be calibrated to within 10 percent or one minute of field travel times, whichever is greater.
- Throughput volumes will be calibrated as follows:
    - A GEH[2] less than 3 for all state facility segments, entry and exit locations, and on and off ramps
    - A GEH less than 5 at all local intersections
    - The sum of all segment flows within five percent of field traffic flows
- Queues in the model will be calibrated to be visually consistent with queues in the field

Highway Capacity Software (HCS) 2010

The SR 410 freeway operations analysis will be completed using HCS 2010 (version 6.70). HCS 2010 is a traffic analysis software that implements the procedures defined in the 2010 Highway Capacity Manual.

Safety analysis

The safety analysis will be used to assess crashes currently occurring within the project limits in terms of the following:

- Type
- Frequency
- Severity
- Cause

Crash data from the latest 3 years will be compiled and summarized to identify current safety deficiencies. Unique crash patterns (e.g., high frequency of a specific pattern) will be noted. The crash data will be collected for the two study intersections and the roadways within the study area including SR 410 near the Traffic Avenue Interchange.

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[1] http://www.wsdot.wa.gov/design/traffic/analysis/

[2] WSDOT VISSIM Protocol 6.2.4.1 Throughput Volumes (http://www.wsdot.wa.gov/NR/rdonlyres/378BEAC9-FE26-4EDA-AA1F-B3A55F9C532F/0/VissimProtocol.pdf#page=67&zoom=auto,-24,582)

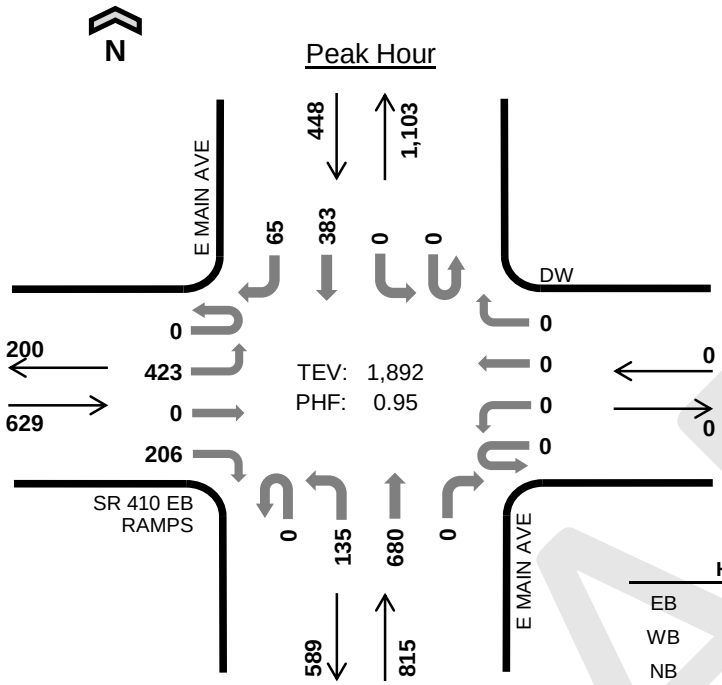
Future year 2035 safety performance for the No Build and Preferred Alternative will be completed using the Highway Safety Manual. The safety analysis will document the design elements that contribute to the predicted safety performance.

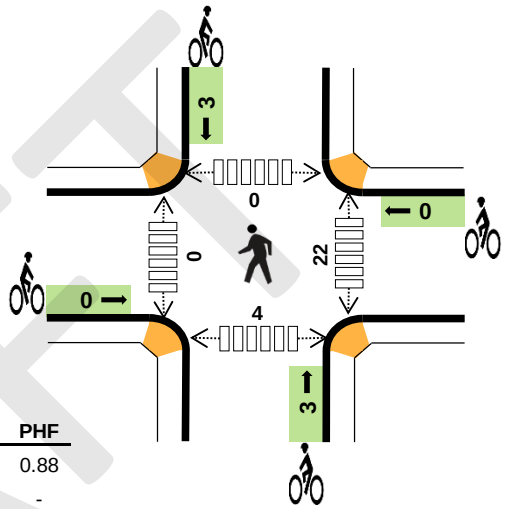
Appendix B

Traffic Count Data

E MAIN AVE
SR 410 EB RAMPS

Date: Tue, Sep 13, 2016
Count Period: 4:30 AM to 9:30 AM
Peak Hour: 7:30 AM to 8:30 AM





	HV %:	PHF
EB	6.2%	0.88
WB	-	-
NB	0.9%	0.94
SB	2.7%	0.95
TOTAL	3.1%	0.95

Five-Hour Count Summaries

Interval Start	SR 410 EB RAMPS				DW				E MAIN AVE				E MAIN AVE				15-min Total	Rolling One Hour
	Eastbound				Westbound				Northbound				Southbound					
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
7:30 AM	0	89	0	50	0	0	0	0	0	41	175	0	0	0	91	17	463	0
7:45 AM	0	117	0	62	0	0	0	0	0	22	181	0	0	0	101	14	497	0
8:00 AM	0	105	0	47	0	0	0	0	0	41	175	0	0	0	95	12	475	0
8:15 AM	0	112	0	47	0	0	0	0	0	31	149	0	0	0	96	22	457	1,892
Peak Hour	0	423	0	206	0	0	0	0	0	135	680	0	0	0	383	65	1,892	0

Note: For all three-hour count summary, see next page.

Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
7:30 AM	6	0	4	2	*12*	0	0	0	2	*2*	10	0	0	3	*13*
7:45 AM	6	0	0	4	*10*	0	0	3	1	*4*	1	0	0	0	*1*
8:00 AM	14	0	2	3	*19*	0	0	0	0	*0*	6	0	0	0	*6*
8:15 AM	13	0	1	3	*17*	0	0	0	0	*0*	5	0	0	1	*6*
Peak Hour	39	0	7	12	*58*	0	0	3	3	*6*	22	0	0	4	*26*

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Five-Hour Count Summaries

Interval Start	SR 410 EB RAMPS				DW				E MAIN AVE				E MAIN AVE				15-min Total	Rolling One Hour
	Eastbound				Westbound				Northbound				Southbound					
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
4:30 AM	0	98	0	15	0	0	0	0	0	4	158	0	0	0	16	3	294	0
4:45 AM	0	107	0	9	0	0	0	0	0	2	184	0	0	0	16	3	321	0
5:00 AM	0	132	0	10	0	1	0	0	1	5	169	0	0	0	17	10	345	0
5:15 AM	0	156	0	9	0	0	0	0	0	13	167	0	0	0	19	5	369	1,329
5:30 AM	0	144	0	11	0	0	0	0	0	13	183	0	0	0	36	7	394	1,429
5:45 AM	0	158	0	28	0	0	0	0	0	10	145	0	0	0	40	7	388	1,496
6:00 AM	0	139	0	13	0	0	0	0	0	8	169	0	0	0	25	8	362	1,513
6:15 AM	0	122	0	38	0	0	0	0	0	12	175	0	0	0	33	17	397	1,541
6:30 AM	0	138	0	39	0	0	0	0	0	28	188	0	0	0	44	13	450	1,597
6:45 AM	0	100	0	33	0	0	0	0	0	29	188	0	0	0	55	16	421	1,630
7:00 AM	0	136	0	35	0	0	0	0	0	29	173	0	0	0	78	12	463	1,731
7:15 AM	0	109	0	36	0	0	0	0	0	18	151	0	0	0	88	20	422	1,756
7:30 AM	**0**	**89**	**0**	**50**	**0**	**0**	**0**	**0**	**0**	**41**	**175**	**0**	**0**	**0**	**91**	**17**	**463**	1,769
7:45 AM	**0**	**117**	**0**	**62**	**0**	**0**	**0**	**0**	**0**	**22**	**181**	**0**	**0**	**0**	**101**	**14**	**497**	1,845
8:00 AM	**0**	**105**	**0**	**47**	**0**	**0**	**0**	**0**	**0**	**41**	**175**	**0**	**0**	**0**	**95**	**12**	**475**	1,857
8:15 AM	**0**	**112**	**0**	**47**	**0**	**0**	**0**	**0**	**0**	**31**	**149**	**0**	**0**	**0**	**96**	**22**	**457**	**1,892**
8:30 AM	0	93	0	53	0	0	0	0	0	36	150	0	0	0	90	18	440	1,869
8:45 AM	0	89	0	47	0	0	0	0	0	37	171	0	0	0	101	17	462	1,834
9:00 AM	0	73	0	32	0	0	0	0	0	27	155	0	0	0	104	18	409	1,768
9:15 AM	0	63	0	49	0	0	0	0	0	21	144	0	0	0	88	14	379	1,690
Count Total	0	2,280	0	663	0	1	0	0	1	427	3,350	0	0	0	1,233	253	8,208	0
Peak Hour	**0**	**423**	**0**	**206**	**0**	**0**	**0**	**0**	**0**	**135**	**680**	**0**	**0**	**0**	**383**	**65**	**1,892**	**0**

Note: Five-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
4:30 AM	3	0	1	0	*4*	0	1	0	0	*1*	0	0	0	0	*0*
4:45 AM	4	0	1	1	*6*	0	0	1	1	*2*	0	0	0	0	*0*
5:00 AM	3	0	2	2	*7*	0	0	0	0	*0*	1	0	0	0	*1*
5:15 AM	3	0	3	0	*6*	0	0	0	0	*0*	0	0	0	0	*0*
5:30 AM	4	0	2	1	*7*	0	1	5	0	*6*	1	0	0	0	*1*
5:45 AM	4	0	0	1	*5*	0	1	1	0	*2*	1	0	0	1	*2*
6:00 AM	7	0	3	4	*14*	0	0	2	0	*2*	1	0	0	0	*1*
6:15 AM	5	0	5	0	*10*	0	0	2	0	*2*	8	0	0	2	*10*
6:30 AM	7	0	4	1	*12*	0	0	2	0	*2*	4	0	0	1	*5*
6:45 AM	11	0	4	2	*17*	0	0	0	0	*0*	3	0	1	1	*5*
7:00 AM	10	0	4	0	*14*	0	0	1	0	*1*	5	0	0	1	*6*
7:15 AM	9	0	3	3	*15*	0	0	0	2	*2*	1	0	0	0	*1*
7:30 AM	**6**	**0**	**4**	**2**	***12***	**0**	**0**	**0**	**2**	***2***	**10**	**0**	**0**	**3**	*13*
7:45 AM	**6**	**0**	**0**	**4**	***10***	**0**	**0**	**3**	**1**	***4***	**1**	**0**	**0**	**0**	*1*
8:00 AM	**14**	**0**	**2**	**3**	***19***	**0**	**0**	**0**	**0**	***0***	**6**	**0**	**0**	**0**	*6*
8:15 AM	**13**	**0**	**1**	**3**	***17***	**0**	**0**	**0**	**0**	***0***	**5**	**0**	**0**	**1**	***6***
8:30 AM	13	0	3	4	*20*	0	0	0	1	*1*	1	0	0	0	*1*
8:45 AM	11	0	4	4	*19*	0	0	0	0	*0*	0	0	0	0	*0*
9:00 AM	17	0	4	1	*22*	0	0	0	1	*1*	0	0	0	0	*0*
9:15 AM	9	0	4	3	*16*	0	0	0	0	*0*	2	0	0	1	*3*
Count Total	159	0	54	39	*252*	0	3	17	8	*28*	50	0	1	11	*62*
Peak Hour	**39**	**0**	**7**	**12**	***58***	**0**	**0**	**3**	**3**	***6***	**22**	**0**	**0**	**4**	***26***

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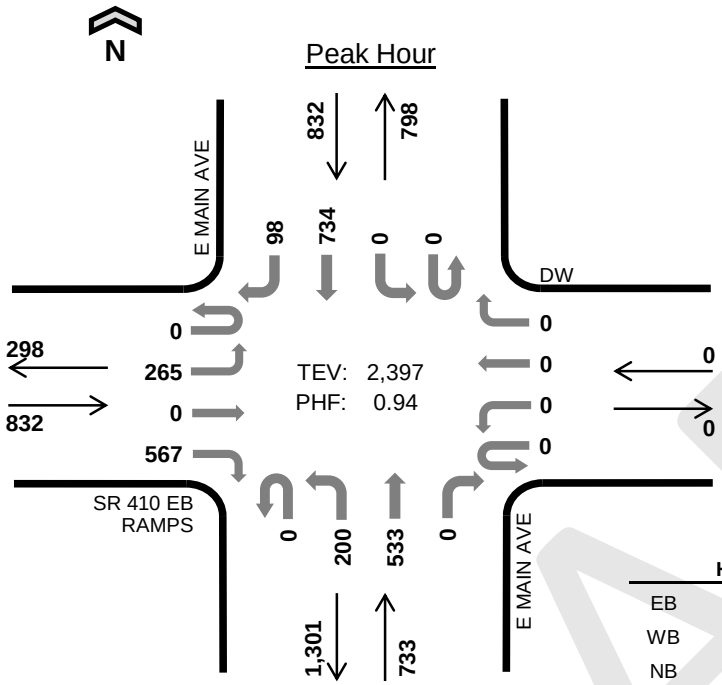
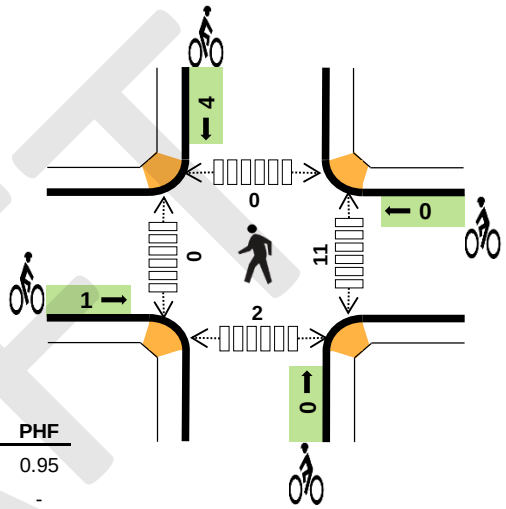
Mark Skaggs: (425) 250-0777 mark.skaggs@idaxdata.com

E MAIN AVE
SR 410 EB RAMPS

Date: Tue, Sep 13, 2016
Count Period: 2:00 PM to 7:00 PM
Peak Hour: 4:15 PM to 5:15 PM





	HV %:	PHF
EB	1.7%	0.95
WB	-	-
NB	0.5%	0.90
SB	0.8%	0.97
TOTAL	1.0%	0.94

Five-Hour Count Summaries

Interval Start	SR 410 EB RAMPS				DW				E MAIN AVE				E MAIN AVE				15-min Total	Rolling One Hour
	Eastbound				Westbound				Northbound				Southbound					
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
4:15 PM	0	64	0	145	0	0	0	0	0	43	123	0	0	0	182	27	584	0
4:30 PM	0	74	0	145	0	0	0	0	0	52	151	0	0	0	189	26	637	0
4:45 PM	0	62	0	144	0	0	0	0	0	51	134	0	0	0	178	22	591	0
5:00 PM	0	65	0	133	0	0	0	0	0	54	125	0	0	0	185	23	585	2,397
Peak Hour	0	265	0	567	0	0	0	0	0	200	533	0	0	0	734	98	2,397	0

Note: For all three-hour count summary, see next page.

Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
4:15 PM	3	0	2	3	*8*	0	0	0	0	*0*	2	0	0	0	*2*
4:30 PM	3	0	1	1	*5*	1	0	0	1	*2*	1	0	0	0	*1*
4:45 PM	5	0	1	3	*9*	0	0	0	1	*1*	6	0	0	1	*7*
5:00 PM	3	0	0	0	*3*	0	0	0	2	*2*	2	0	0	1	*3*
Peak Hour	14	0	4	7	*25*	1	0	0	4	*5*	11	0	0	2	*13*

DRAFT

Mark Skaggs: (425) 250-0777 mark.skaggs@idaxdata.com

Five-Hour Count Summaries

Interval Start	SR 410 EB RAMPS				DW				E MAIN AVE				E MAIN AVE				15-min Total	Rolling One Hour
	Eastbound				Westbound				Northbound				Southbound					
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
2:00 PM	0	81	0	101	0	0	0	0	0	29	137	0	0	0	144	36	528	0
2:15 PM	0	80	0	93	0	0	0	0	0	34	152	0	0	0	151	32	542	0
2:30 PM	0	74	0	109	0	0	0	0	1	34	139	0	0	0	183	36	576	0
2:45 PM	0	81	0	133	0	0	0	0	0	42	143	0	0	0	170	31	600	2,246
3:00 PM	0	86	0	155	0	0	0	0	0	40	139	0	0	0	161	32	613	2,331
3:15 PM	0	74	0	126	0	0	0	0	0	36	150	0	0	0	171	24	581	2,370
3:30 PM	0	62	0	140	0	0	0	0	0	51	146	0	0	0	163	35	597	2,391
3:45 PM	0	68	0	130	0	0	0	0	0	49	123	0	0	0	181	29	580	2,371
4:00 PM	0	48	0	99	0	0	0	0	0	48	127	0	0	0	186	24	532	2,290
4:15 PM	**0**	**64**	**0**	**145**	**0**	**0**	**0**	**0**	**0**	**43**	**123**	**0**	**0**	**0**	**182**	**27**	**584**	2,293
4:30 PM	**0**	**74**	**0**	**145**	**0**	**0**	**0**	**0**	**0**	**52**	**151**	**0**	**0**	**0**	**189**	**26**	**637**	2,333
4:45 PM	**0**	**62**	**0**	**144**	**0**	**0**	**0**	**0**	**0**	**51**	**134**	**0**	**0**	**0**	**178**	**22**	**591**	2,344
5:00 PM	**0**	**65**	**0**	**133**	**0**	**0**	**0**	**0**	**0**	**54**	**125**	**0**	**0**	**0**	**185**	**23**	**585**	**2,397**
5:15 PM	0	43	0	131	0	0	0	0	0	50	144	0	0	0	175	28	571	2,384
5:30 PM	0	52	0	140	0	0	0	0	0	37	134	0	0	0	182	24	569	2,316
5:45 PM	0	64	1	139	0	0	0	0	0	40	112	0	0	0	184	26	566	2,291
6:00 PM	0	60	0	132	0	0	0	0	0	37	121	0	0	0	168	31	549	2,255
6:15 PM	0	46	0	121	0	0	0	0	0	34	122	0	0	0	192	18	533	2,217
6:30 PM	0	31	0	103	0	0	0	0	0	28	94	0	0	0	192	32	480	2,128
6:45 PM	0	34	0	97	0	0	0	0	0	37	104	0	0	0	131	31	434	1,996
Count Total	0	1,249	1	2,516	0	0	0	0	1	826	2,620	0	0	0	3,468	567	11,248	0
Peak Hour	**0**	**265**	**0**	**567**	**0**	**0**	**0**	**0**	**0**	**200**	**533**	**0**	**0**	**0**	**734**	**98**	**2,397**	**0**

Note: Five-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

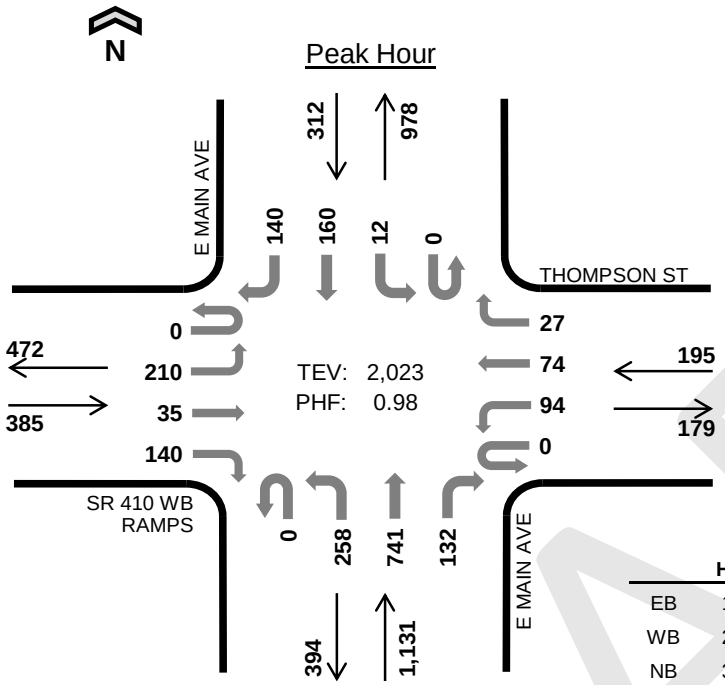
Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
2:00 PM	11	0	3	6	*20*	0	0	1	0	*1*	0	0	0	1	*1*
2:15 PM	8	0	0	1	*9*	0	0	1	2	*3*	1	0	0	1	*2*
2:30 PM	6	0	2	3	*11*	0	0	0	1	*1*	0	0	0	0	*0*
2:45 PM	7	0	1	3	*11*	0	0	1	1	*2*	2	0	0	0	*2*
3:00 PM	7	0	1	6	*14*	0	0	1	0	*1*	1	0	0	1	*2*
3:15 PM	3	0	3	3	*9*	0	0	3	1	*4*	1	0	0	0	*1*
3:30 PM	5	0	4	4	*13*	0	1	1	1	*3*	2	1	0	4	*7*
3:45 PM	11	0	0	2	*13*	0	0	0	1	*1*	2	0	0	2	*4*
4:00 PM	3	0	2	4	*9*	0	0	1	0	*1*	1	0	0	0	*1*
4:15 PM	**3**	**0**	**2**	**3**	***8***	**0**	**0**	**0**	**0**	***0***	**2**	**0**	**0**	**0**	*2*
4:30 PM	**3**	**0**	**1**	**1**	***5***	**1**	**0**	**0**	**1**	***2***	**1**	**0**	**0**	**0**	*1*
4:45 PM	**5**	**0**	**1**	**3**	***9***	**0**	**0**	**0**	**1**	***1***	**6**	**0**	**0**	**1**	*7*
5:00 PM	**3**	**0**	**0**	**0**	***3***	**0**	**0**	**0**	**2**	***2***	**2**	**0**	**0**	**1**	***3***
5:15 PM	2	0	1	1	*4*	0	0	2	1	*3*	15	0	0	6	*21*
5:30 PM	3	0	2	2	*7*	0	0	0	3	*3*	7	0	0	0	*7*
5:45 PM	3	0	1	2	*6*	0	0	0	1	*1*	7	0	0	3	*10*
6:00 PM	3	0	1	1	*5*	0	0	0	2	*2*	4	0	0	1	*5*
6:15 PM	5	0	0	1	*6*	0	0	0	0	*0*	0	0	0	0	*0*
6:30 PM	1	0	1	1	*3*	0	0	0	1	*1*	6	0	0	3	*9*
6:45 PM	1	0	0	0	*1*	0	0	0	2	*2*	1	0	0	0	*1*
Count Total	93	0	26	47	*166*	1	1	11	21	*34*	61	1	0	24	*86*
Peak Hour	**14**	**0**	**4**	**7**	***25***	**1**	**0**	**0**	**4**	***5***	**11**	**0**	**0**	**2**	***13***

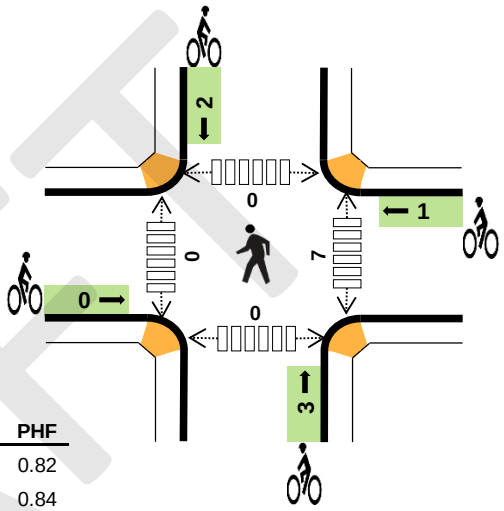
DRAFT

Mark Skaggs: (425) 250-0777 mark.skaggs@idaxdata.com

E MAIN AVE
SR 410 WB RAMPS

Date: Tue, Sep 13, 2016
Count Period: 4:30 AM to 9:30 AM
Peak Hour: 7:00 AM to 8:00 AM





	HV %:	PHF
EB	1.6%	0.82
WB	2.6%	0.84
NB	3.3%	0.92
SB	7.7%	0.74
TOTAL	3.6%	0.98

Five-Hour Count Summaries

Interval Start	SR 410 WB RAMPS				THOMPSON ST				E MAIN AVE				E MAIN AVE				15-min Total	Rolling One Hour
	Eastbound				Westbound				Northbound				Southbound					
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
7:00 AM	0	39	19	27	0	25	23	8	0	73	186	47	0	4	26	32	509	0
7:15 AM	0	50	3	27	0	28	21	9	0	72	171	30	0	4	55	46	516	0
7:30 AM	0	67	12	38	0	13	18	6	0	52	186	22	0	2	45	28	489	0
7:45 AM	0	54	1	48	0	28	12	4	0	61	198	33	0	2	34	34	509	2,023
Peak Hour	0	210	35	140	0	94	74	27	0	258	741	132	0	12	160	140	2,023	0

Note: For all three-hour count summary, see next page.

Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
7:00 AM	2	0	13	4	*19*	0	0	1	0	*1*	3	0	0	0	*3*
7:15 AM	0	3	11	7	*21*	0	0	0	1	*1*	2	0	0	0	*2*
7:30 AM	3	0	10	9	*22*	0	1	0	1	*2*	0	0	0	0	*0*
7:45 AM	1	2	3	4	*10*	0	0	2	0	*2*	2	0	0	0	*2*
Peak Hour	6	5	37	24	*72*	0	1	3	2	*6*	7	0	0	0	*7*

DRAFT

Five-Hour Count Summaries

Interval Start	SR 410 WB RAMPS				THOMPSON ST				E MAIN AVE				E MAIN AVE				15-min Total	Rolling One Hour
	Eastbound				Westbound				Northbound				Southbound					
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
4:30 AM	0	19	10	5	0	1	6	0	0	94	139	16	0	0	12	21	323	0
4:45 AM	0	40	32	6	0	0	19	2	0	73	181	26	0	0	9	14	402	0
5:00 AM	0	38	36	8	0	9	10	3	0	70	184	27	0	0	13	16	414	0
5:15 AM	0	50	16	5	0	5	7	2	0	53	253	19	0	1	11	25	447	1,586
5:30 AM	0	45	24	9	0	6	8	5	0	44	238	21	0	0	21	35	456	1,719
5:45 AM	0	34	7	22	0	6	6	8	0	67	231	20	0	0	17	19	437	1,754
6:00 AM	1	46	23	8	0	10	10	6	0	61	192	46	0	0	10	25	438	1,778
6:15 AM	0	29	12	12	0	16	20	8	0	57	210	33	0	0	19	26	442	1,773
6:30 AM	0	45	11	10	0	13	15	6	0	54	217	41	0	1	30	23	466	1,783
6:45 AM	0	45	14	15	0	21	20	3	0	38	192	55	0	6	29	31	469	1,815
7:00 AM	**0**	**39**	**19**	**27**	**0**	**25**	**23**	**8**	**0**	**73**	**186**	**47**	**0**	**4**	**26**	**32**	**509**	1,886
7:15 AM	**0**	**50**	**3**	**27**	**0**	**28**	**21**	**9**	**0**	**72**	**171**	**30**	**0**	**4**	**55**	**46**	**516**	1,960
7:30 AM	**0**	**67**	**12**	**38**	**0**	**13**	**18**	**6**	**0**	**52**	**186**	**22**	**0**	**2**	**45**	**28**	**489**	1,983
7:45 AM	**0**	**54**	**1**	**48**	**0**	**28**	**12**	**4**	**0**	**61**	**198**	**33**	**0**	**2**	**34**	**34**	**509**	**2,023**
8:00 AM	0	20	5	44	0	16	11	3	0	62	192	37	0	5	46	38	479	1,993
8:15 AM	0	27	5	52	0	22	10	9	0	68	156	31	0	4	48	40	472	1,949
8:30 AM	0	30	2	37	0	20	8	2	0	64	161	25	0	2	53	37	441	1,901
8:45 AM	0	21	2	56	0	9	14	3	0	72	157	39	0	2	50	53	478	1,870
9:00 AM	0	20	3	51	0	17	16	3	0	66	119	29	0	2	46	45	417	1,808
9:15 AM	0	28	0	33	0	16	15	5	0	75	115	18	0	3	59	52	419	1,755
Count Total	1	747	237	513	0	281	269	95	0	1,276	3,678	615	0	38	633	640	9,023	0
Peak Hour	**0**	**210**	**35**	**140**	**0**	**94**	**74**	**27**	**0**	**258**	**741**	**132**	**0**	**12**	**160**	**140**	**2,023**	**0**

Note: Five-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

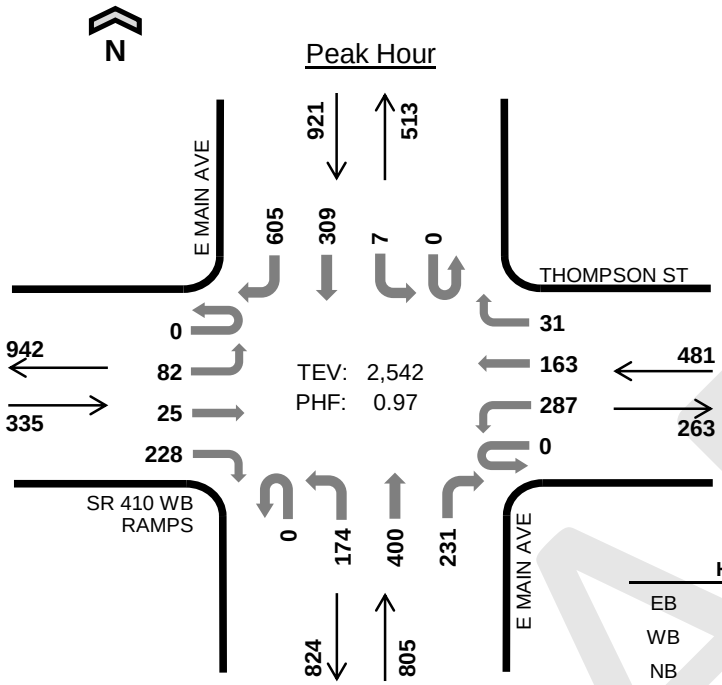
Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
4:30 AM	0	0	4	4	*8*	0	0	1	0	*1*	0	0	0	0	*0*
4:45 AM	0	0	4	6	*10*	0	0	0	0	*0*	2	0	0	0	*2*
5:00 AM	1	1	7	2	*11*	0	0	0	0	*0*	2	0	0	0	*2*
5:15 AM	2	0	12	6	*20*	0	0	0	0	*0*	0	0	0	0	*0*
5:30 AM	2	1	5	6	*14*	0	0	3	0	*3*	1	0	0	0	*1*
5:45 AM	0	0	6	1	*7*	0	0	1	0	*1*	1	0	0	0	*1*
6:00 AM	1	2	7	4	*14*	0	0	0	0	*0*	3	0	0	1	*4*
6:15 AM	2	0	9	4	*15*	0	0	2	0	*2*	3	0	0	0	*3*
6:30 AM	0	1	9	7	*17*	0	0	1	0	*1*	1	0	0	0	*1*
6:45 AM	2	1	12	6	*21*	0	0	0	0	*0*	6	0	0	0	*6*
7:00 AM	**2**	**0**	**13**	**4**	***19***	**0**	**0**	**1**	**0**	***1***	**3**	**0**	**0**	**0**	*3*
7:15 AM	**0**	**3**	**11**	**7**	***21***	**0**	**0**	**0**	**1**	***1***	**2**	**0**	**0**	**0**	*2*
7:30 AM	**3**	**0**	**10**	**9**	***22***	**0**	**1**	**0**	**1**	***2***	**0**	**0**	**0**	**0**	*0*
7:45 AM	**1**	**2**	**3**	**4**	***10***	**0**	**0**	**2**	**0**	***2***	**2**	**0**	**0**	**0**	***2***
8:00 AM	1	0	13	8	*22*	0	0	0	1	*1*	0	0	0	0	*0*
8:15 AM	3	2	12	9	*26*	0	0	0	0	*0*	4	0	0	0	*4*
8:30 AM	0	2	13	8	*23*	0	1	0	0	*1*	0	0	0	0	*0*
8:45 AM	2	1	16	10	*29*	0	0	0	0	*0*	0	0	0	0	*0*
9:00 AM	1	0	18	8	*27*	0	0	0	1	*1*	0	0	0	0	*0*
9:15 AM	1	2	12	12	*27*	0	0	0	0	*0*	1	0	0	0	*1*
Count Total	24	18	196	125	*363*	0	2	11	4	*17*	31	0	0	1	*32*
Peak Hour	**6**	**5**	**37**	**24**	***72***	**0**	**1**	**3**	**2**	***6***	**7**	**0**	**0**	**0**	***7***

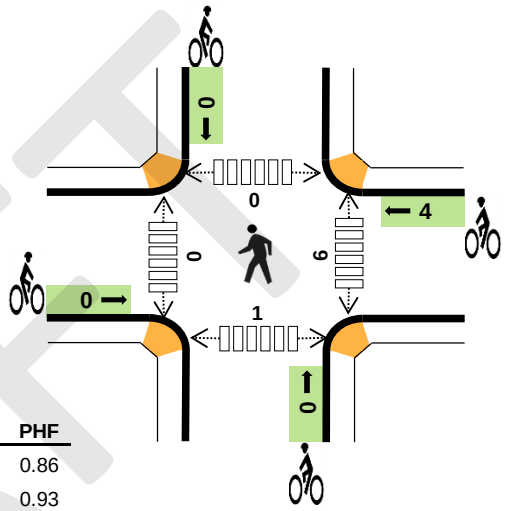
DRAFT

Mark Skaggs: (425) 250-0777 mark.skaggs@idaxdata.com

E MAIN AVE
SR 410 WB RAMPS

Date: Tue, Sep 13, 2016
Count Period: 2:00 PM to 7:00 PM
Peak Hour: 4:15 PM to 5:15 PM





	HV %:	PHF
EB	3.9%	0.86
WB	2.1%	0.93
NB	2.0%	0.85
SB	2.6%	0.91
TOTAL	2.5%	0.97

Five-Hour Count Summaries

Interval Start	SR 410 WB RAMPS				THOMPSON ST				E MAIN AVE				E MAIN AVE				15-min Total	Rolling One Hour
	Eastbound				Westbound				Northbound				Southbound					
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
4:15 PM	0	29	5	63	0	76	38	12	0	31	98	58	0	0	73	151	634	0
4:30 PM	0	21	4	55	0	74	35	7	0	63	106	68	0	0	84	135	652	0
4:45 PM	0	22	9	56	0	70	34	6	0	35	102	46	0	2	83	141	606	0
5:00 PM	0	10	7	54	0	67	56	6	0	45	94	59	0	5	69	178	650	2,542
Peak Hour	**0**	**82**	**25**	**228**	**0**	**287**	**163**	**31**	**0**	**174**	**400**	**231**	**0**	**7**	**309**	**605**	**2,542**	**0**

Note: For all three-hour count summary, see next page.

Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
4:15 PM	5	2	5	7	*19*	0	0	0	0	*0*	2	0	0	0	*2*
4:30 PM	0	4	2	1	*7*	0	1	0	0	*1*	0	0	0	0	*0*
4:45 PM	5	3	8	6	*22*	0	1	0	0	*1*	2	0	0	1	*3*
5:00 PM	3	1	1	10	*15*	0	2	0	0	*2*	2	0	0	0	*2*
Peak Hour	**13**	**10**	**16**	**24**	***63***	**0**	**4**	**0**	**0**	***4***	**6**	**0**	**0**	**1**	***7***

DRAFT

Five-Hour Count Summaries

Interval Start	SR 410 WB RAMPS				THOMPSON ST				E MAIN AVE				E MAIN AVE				15-min Total	Rolling One Hour
	Eastbound				Westbound				Northbound				Southbound					
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
2:00 PM	0	12	0	32	0	25	19	3	0	43	122	45	0	7	123	110	541	0
2:15 PM	0	17	2	28	0	34	21	7	0	61	126	44	0	4	113	105	562	0
2:30 PM	0	22	3	32	0	41	24	4	0	44	120	47	0	5	143	133	618	0
2:45 PM	0	18	3	40	0	42	23	2	0	46	124	46	0	9	120	143	616	2,337
3:00 PM	0	21	2	44	0	43	13	4	0	41	136	40	0	3	95	132	574	2,370
3:15 PM	0	24	3	51	0	67	29	3	0	34	132	49	0	5	72	131	600	2,408
3:30 PM	0	22	5	56	0	46	31	7	0	55	112	53	0	3	92	136	618	2,408
3:45 PM	0	18	5	61	0	63	32	8	0	37	100	57	0	2	86	128	597	2,389
4:00 PM	0	22	7	61	0	73	42	7	0	44	76	43	0	0	92	167	634	2,449
4:15 PM	**0**	**29**	**5**	**63**	**0**	**76**	**38**	**12**	**0**	**31**	**98**	**58**	**0**	**0**	**73**	**151**	**634**	2,483
4:30 PM	**0**	**21**	**4**	**55**	**0**	**74**	**35**	**7**	**0**	**63**	**106**	**68**	**0**	**0**	**84**	**135**	**652**	2,517
4:45 PM	**0**	**22**	**9**	**56**	**0**	**70**	**34**	**6**	**0**	**35**	**102**	**46**	**0**	**2**	**83**	**141**	**606**	2,526
5:00 PM	**0**	**10**	**7**	**54**	**0**	**67**	**56**	**6**	**0**	**45**	**94**	**59**	**0**	**5**	**69**	**178**	**650**	**2,542**
5:15 PM	0	13	4	52	0	77	46	2	0	55	95	49	0	4	73	127	597	2,505
5:30 PM	0	9	8	53	0	69	30	8	0	46	79	51	0	1	90	147	591	2,444
5:45 PM	0	20	4	52	0	63	23	7	0	40	85	54	0	2	99	125	574	2,412
6:00 PM	0	5	3	46	0	61	31	3	0	37	89	40	0	2	94	103	514	2,276
6:15 PM	0	8	7	52	0	56	24	0	0	35	82	61	0	3	89	83	500	2,179
6:30 PM	0	15	6	54	0	56	26	6	0	32	58	35	0	5	117	60	470	2,058
6:45 PM	0	7	1	34	0	25	18	2	0	44	62	39	0	4	118	53	407	1,891
Count Total	0	335	88	976	0	1,128	595	104	0	868	1,998	984	0	66	1,925	2,488	11,555	0
Peak Hour	**0**	**82**	**25**	**228**	**0**	**287**	**163**	**31**	**0**	**174**	**400**	**231**	**0**	**7**	**309**	**605**	**2,542**	**0**

Note: Five-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
2:00 PM	0	1	12	16	*29*	0	0	1	0	*1*	0	0	0	0	*0*
2:15 PM	3	1	9	12	*25*	0	1	1	2	*4*	1	0	0	0	*1*
2:30 PM	6	0	10	8	*24*	0	1	0	0	*1*	1	0	0	0	*1*
2:45 PM	1	3	10	11	*25*	0	0	1	1	*2*	0	1	0	0	*1*
3:00 PM	1	1	7	12	*21*	0	0	0	0	*0*	2	0	0	0	*2*
3:15 PM	1	4	7	7	*19*	0	0	4	2	*6*	0	0	0	0	*0*
3:30 PM	2	2	7	7	*18*	0	0	0	0	*0*	2	0	0	2	*4*
3:45 PM	9	1	10	5	*25*	0	1	0	0	*1*	2	0	0	2	*4*
4:00 PM	0	2	5	7	*14*	0	0	1	0	*1*	0	0	0	0	*0*
4:15 PM	**5**	**2**	**5**	**7**	***19***	**0**	**0**	**0**	**0**	***0***	**2**	**0**	**0**	**0**	*2*
4:30 PM	**0**	**4**	**2**	**1**	***7***	**0**	**1**	**0**	**0**	***1***	**0**	**0**	**0**	**0**	*0*
4:45 PM	**5**	**3**	**8**	**6**	***22***	**0**	**1**	**0**	**0**	***1***	**2**	**0**	**0**	**1**	*3*
5:00 PM	**3**	**1**	**1**	**10**	***15***	**0**	**2**	**0**	**0**	***2***	**2**	**0**	**0**	**0**	***2***
5:15 PM	2	1	2	5	*10*	0	0	2	1	*3*	6	0	0	3	*9*
5:30 PM	1	0	3	5	*9*	0	2	0	1	*3*	6	0	0	3	*9*
5:45 PM	1	2	4	7	*14*	0	0	0	1	*1*	2	0	0	0	*2*
6:00 PM	1	1	3	4	*9*	0	1	0	1	*2*	4	0	0	0	*4*
6:15 PM	1	1	4	4	*10*	0	0	0	0	*0*	0	0	0	0	*0*
6:30 PM	1	1	0	3	*5*	0	0	0	1	*1*	2	0	0	0	*2*
6:45 PM	1	1	2	1	*5*	0	2	0	0	*2*	0	0	0	0	*0*
Count Total	44	32	111	138	*325*	0	12	10	10	*32*	34	1	0	11	*46*
Peak Hour	**13**	**10**	**16**	**24**	***63***	**0**	**4**	**0**	**0**	***4***	**6**	**0**	**0**	**1**	***7***

DRAFT

Appendix C

Intersection Control Analysis

SR 410/Traffic Avenue Overpass Improvements
Intersection Control Analysis

Prepared for
City of Sumner

March 2017

Prepared by
Parametrix

SR 410/Traffic Avenue Overpass Improvements Intersection Control Analysis

Prepared for

City of Sumner
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Sumner WA 98390

Prepared by

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March 2017 | 214-1527-080

CITATION

Parametrix. 2017. SR 410/Traffic Avenue Overpass Improvements
Intersection Control Analysis.
Prepared by Parametrix, Puyallup, WA. March 2017.

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ACRONYMS AND ABBREVIATIONS

ICA	intersection control analysis
LOS	level of service
MAISA	Multi-Agency Interdisciplinary and Stakeholder Advisory
MOE	Measure of Effectiveness
MP	milepost
mph	miles per hour
SEPA	State Environmental Policy Act
Sound Transit	Central Puget Sound Regional Transit Authority
SR	State Route
v/c	volume-to-capacity
vph	vehicles per hour
WSDOT	Washington State Department of Transportation

1. INTRODUCTION

The City of Sumner is proposing roadway and intersection control improvements at the State Route (SR) 410/Traffic Avenue ramp terminal intersections. The SR 410/Traffic Avenue overpass is a key element of the transportation system in east Pierce County. In addition, the Central Puget Sound Regional Transit Authority (Sound Transit) is expanding its South Line Sounder rail service and is proposing to improve access to Sumner Station, located northwest of the overpass on Traffic Avenue, for pedestrians, bicyclists, transit users, and automobiles. The Traffic Avenue overpass is a bottleneck for motorized travel and a gap in the system for non-motorized travel. **Figure 1-1** shows the vicinity of the proposed project.

Today, congestion at the SR 410/Traffic Avenue ramp terminal intersections causes substantial delays and queues for motorists travelling between Sumner and Puyallup. Traffic queues in excess of a 1/2 mile are common for northbound traffic on Traffic Avenue approaching the interchange during the AM peak commute period and southbound traffic on Traffic Avenue approaching the interchange during the PM peak commute period. Additionally, traffic queues on the SR 410 eastbound off-ramp occasionally backs up and impacts mainline traffic along SR 410.

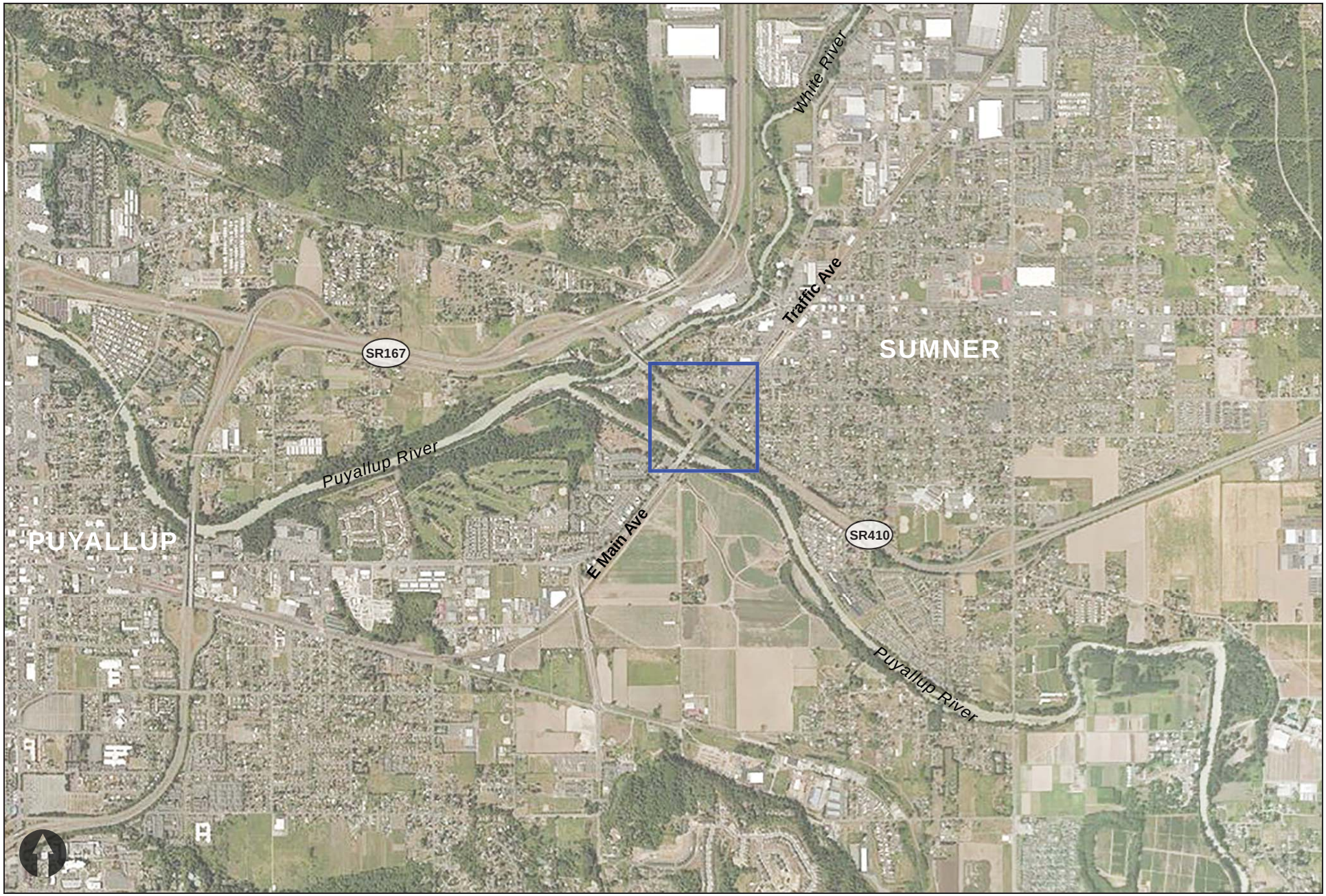
Sound Transit is expanding its South Line Sounder rail service to include two new round-trip trains by September 2017, for a total of 13 daily round trips. Sound Transit forecasts ridership to increase steadily over the next 20 years, and is in the process of constructing access improvements. Sound Transit has voter-approved funding to improve access for all travel modes to Sumner Station, including additional parking capacity, congestion management, and pedestrian and bicycle improvements. As part of identifying the Sumner Station access improvements for all modes, Sound Transit completed an in-depth traffic operations analysis at the SR 410/Traffic Avenue ramp terminal intersections and nearby study area intersections. The analysis showed that additional Sumner Station traffic will further increase delays at the SR 410/Traffic Avenue ramp terminal intersections, and that Sound Transit buses and Sounder riders would have challenging, unpredictable access to Sumner Station. Therefore, Sound Transit has agreed to be a funding partner with the City of Sumner on potential improvements to the SR 410/Traffic Avenue ramp terminal intersections.

The City of Sumner, Washington State Department of Transportation (WSDOT), and Sound Transit have formed a Multi-Agency Interdisciplinary and Stakeholder Advisory (MAISA) team to identify the most practical solution at the interchange. The MAISA team has developed the following Project Need Statement:

The SR 410/Traffic Avenue interchange is a key element of the transportation system in east Pierce County. The overpass is a bottleneck for motorized travel and a gap in the system for nonmotorized travel. Improvements are needed to:

1. *Relieve the bottleneck for freight, transit, and automobile travel.*
2. *Complete the missing link between the nonmotorized facilities north and south of the interchange.*

The purpose of this report is to present the intersection control analysis (ICA) for improvements at the SR 410/Traffic Avenue ramp terminal intersections. This ICA provides a preliminary traffic analysis and describes existing and future traffic conditions at the SR 410/Traffic Avenue ramp terminal intersections. This ICA also reviews the existing and forecast traffic operation and evaluates, at a schematic level, two preliminary alternative intersection controls that may be considered at the SR 410/Traffic Avenue ramp terminal intersections: signals or roundabouts.



Study Area

Figure 1-1
Vicinity Map

SR 410 Traffic Avenue

2. EXISTING CONDITIONS

The study area includes the following two existing intersections at the SR 410/Traffic Avenue ramp terminal (**Figure 2-1**), which will be studied:

- East Main Avenue and SR 410 Eastbound Ramps
- Traffic Avenue/Thompson Street/SR 410 Westbound Ramps

The following section describes the roadways, transit routes, study intersection traffic volumes, and collision history.

2.1 Roadway Descriptions

2.1.1 SR 410

SR 410 is a four-lane highway with a speed limit of 55 miles per hour (mph). The western terminus is SR 167, and it continues east through Sumner, Bonney Lake, Buckley, and Enumclaw. The SR 410 Traffic Avenue ramp terminal intersections frequently experience heavy congestion during peak travel periods.

2.1.2 Traffic Avenue/Main Avenue

North of the SR 410 interchange, Traffic Avenue is a five-lane principal arterial with two lanes in each direction and a landscaped center median with turn lanes at some intersections. The speed limit is 25 mph. At the Traffic Avenue/Fryar Avenue and Main Street/Bridge Street intersection, the principal arterial classification continues east on Bridge Street.

The Traffic Avenue overpass across SR 410 is only one lane in each direction and the speed limit is 25 mph.

South of the SR 410 interchange, Traffic Avenue becomes East Main Avenue, which continues west into Puyallup, and is classified as a Minor Arterial. East Main Avenue has five lanes, with two lanes in each direction and a center two-way left-turn lane. The speed limit is 35 mph.

2.1.3 Thompson Street

Thompson Street is classified as a Major Collector. It is a two-lane roadway with a center turn lane west of Station Lane, and a speed limit of 25 mph.

2.2 Non-motorized Facilities

Traffic Avenue north of SR 410 and East Main Street south of SR 410 have sidewalks on both sides of the street; however, non-motorized facilities at the study area intersections and across the SR 410 overpass at Traffic Avenue are limited and discourage non-motorized users.

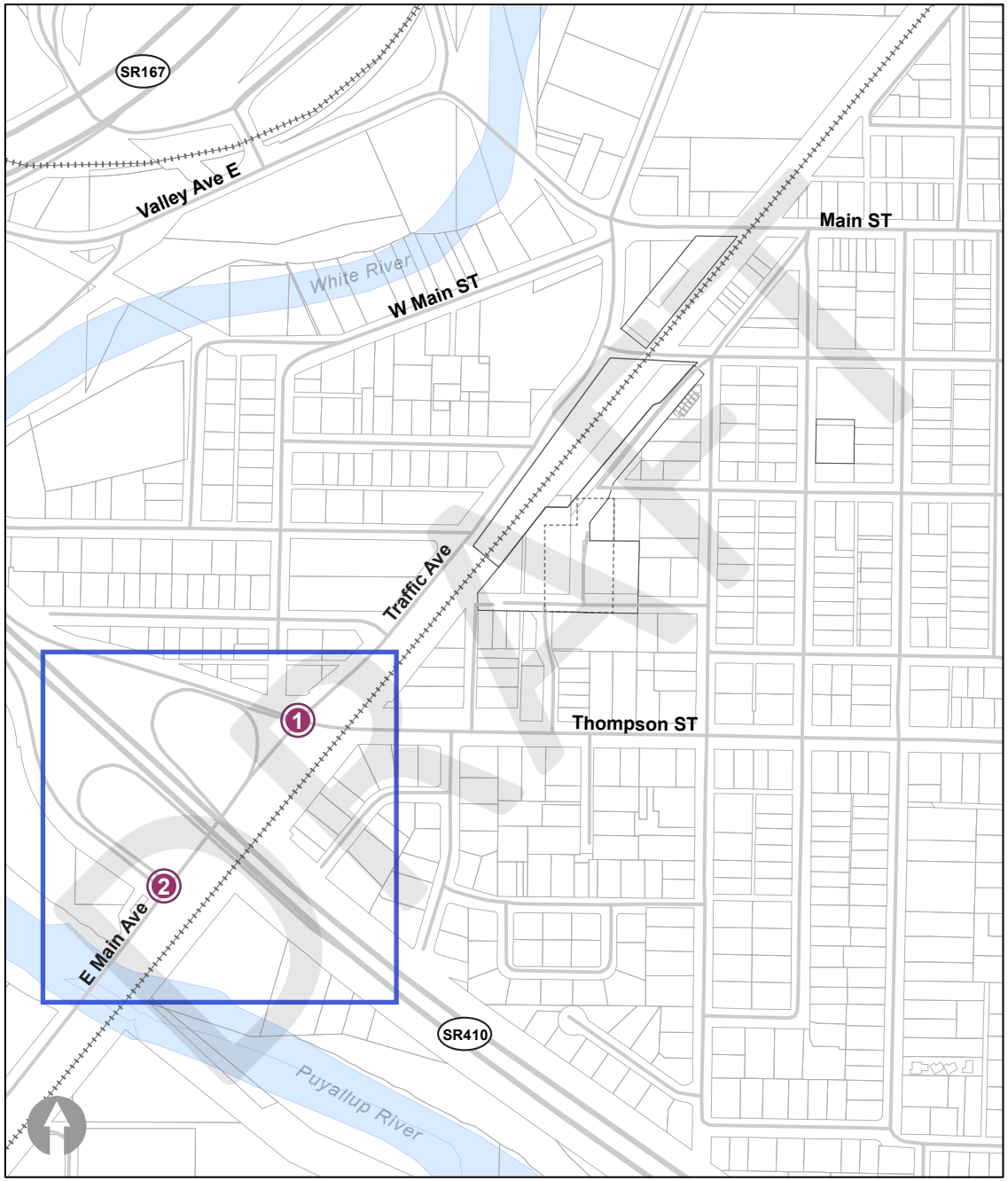


Figure 2-1
Study Area

SR 410 Traffic Avenue

2.3 Transit

Public transportation options are available within the study area. **Table 2-1** lists the routes and describes the transit service in the study area during the commuter periods.

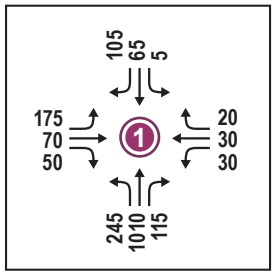
Table 2-1. Transit Service within Study Area

Service Provider and Route		Frequency	Station Served/Route Notes
Sound Transit			
578	Between Puyallup and Seattle	30 minutes throughout the day with service not available during the 3-hour AM and PM peak periods	Serves Sumner Station. No southbound service is provided during the evening commute.
596	Between Sumner and Bonney Lake	20 to 30 minutes during the AM and PM peak periods	Serves Sumner Station. Buses coincide with Sounder trains.
Sounder Trains	Between Lakewood and Seattle	20 to 30 minutes during the 3-hour AM and PM peak periods	Serves Sumner Station.

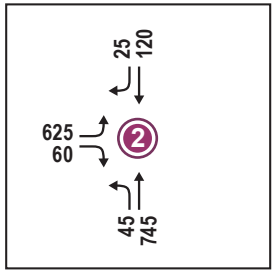
2.4 Existing Traffic Volumes

Intersection turn movement counts were collected on Tuesday, September 13, 2016. That day was chosen to replicate normal conditions because school was in session for both Puyallup and Sumner School Districts and the Washington State Fair was closed. The turn movement counts were conducted at the study intersections of SR 410/Traffic Avenue ramp terminal intersections, from 4:30 to 9:30 am, and 2:00 to 7:00 pm. The turning movement counts collected total number of vehicles, heavy vehicles, pedestrians, and bicycles. Traffic count data are provided in **Appendix A**. The existing 2016 AM and PM peak hour traffic volumes at the study intersections are shown in **Figure 2-2**.

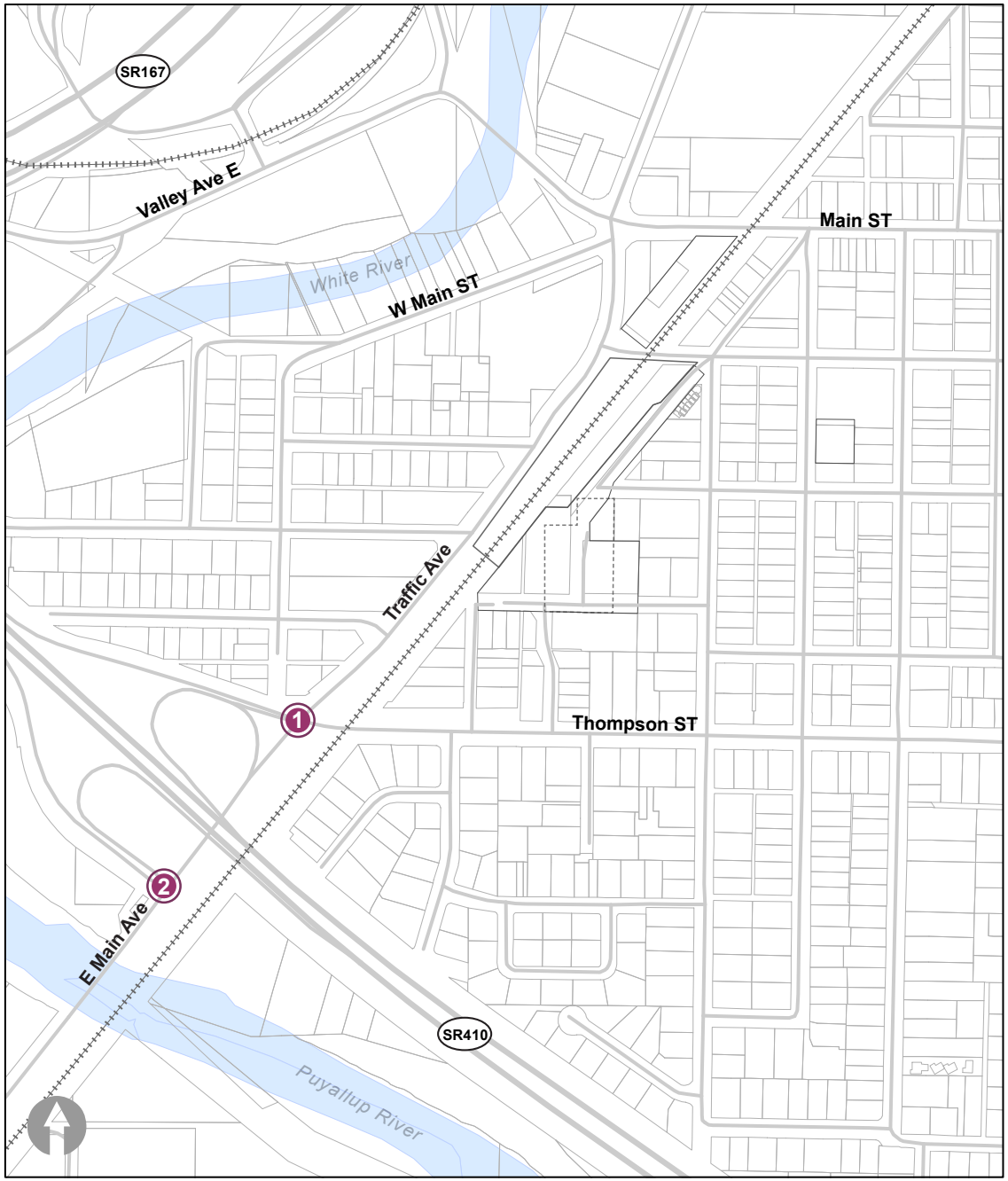
2016 AM Existing



Traffic Ave / Thompson ST
SR 410 Westbound Ramps

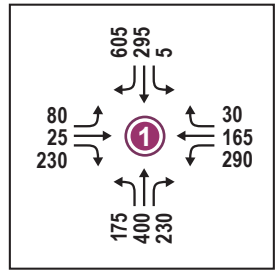


Traffic Ave
SR 410 Eastbound Ramps

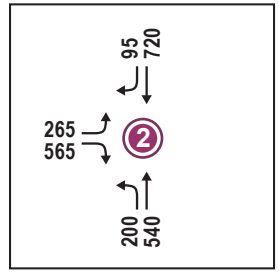


Intersection Turn Movement

2016 PM Existing



Traffic Ave / Thompson ST
SR 410 Westbound Ramps



Traffic Ave
SR 410 Eastbound Ramps

Figure 2-2
Traffic Volumes
2016 Existing Conditions

SR 410 Traffic Avenue

2.5 Collision History

The collision history was reviewed for the SR 410/Traffic Avenue ramp terminal intersections, SR 410 mainline near the study area, and Traffic Avenue on- and off-ramps. Collision data were collected from WSDOT for the previous 5 years (2011 to 2015). Historical collision data were reviewed to identify if any of the study area intersections, SR 410 mainline, or Traffic Avenue on- and off-ramps have safety concerns.

Table 2-2 summarizes collisions by severity. As shown, most of the collisions at the study intersections, along SR 410 near the Traffic Avenue interchange, or on the SR 410 Traffic Avenue ramps resulted in property damage only (142 out of 206 total collisions). The remaining 64 collisions resulted in an injury or was unknown. There were no fatalities during the 5-year period.

Table 2-2. Summary of Collision Data by Severity (January 2013 to September 2016)

Location	Collision Severity				
	Fatality	Injuries	Property Damage Only	Unknown	Total
Traffic Avenue Westbound Ramp Terminal Intersection	0	9	20	0	29
Traffic Avenue between ramps	0	3	3	0	6
Traffic Avenue Eastbound Ramp Terminal Intersection	0	10	9	0	19
Total	**0**	**22**	**32**	**0**	**54**
SR 410 Mainline Freeway (Milepost [MP] 8.84 to MP 10.81)	0	36	85	1	122
SR 410 Eastbound Off-ramp	0	2	9	0	11
SR 410 Eastbound On-ramp	0	0	9	0	9
SR 410 Westbound Off-ramp	0	2	6	1	9
SR 410 Westbound On-ramp	0	0	1	0	1
Total	**0**	**40**	**110**	**2**	**152**

Source: WSDOT Transportation Data and GIS Office

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.

In addition to summarizing the collision data by severity, the 62 injury collisions were summarized by type in **Table 2-3**. For the SR 410/Traffic Avenue ramp terminal intersections, the majority of the injury collisions were rear end and turning (opposite direction). Rear-end collisions often occur in congested locations and turning (opposite direction) often occur when vehicles try to turn in front of oncoming traffic even if the gap does not provide sufficient space to make a left or right turn. The main collision type on the overpass between the ramp terminal intersections is also rear-end collisions caused by congestion at the adjacent intersections. As for the SR 410 mainline and ramp injury collisions, the main collision types are fixed object, rear end, sideswipe, and vehicle overturned/over embankment/ditch.

Table 2-3. Summary of Collision Data by Type (January 2013 to September 2016)

	Collision Type									
Location	**Entering at Angle**	**Fixed Object**	**Other**	**Parking**	**Pedestrian/ Cyclist Involved**	**Rear End**	**Sideswipe**	**Turning (Opposite Direction)**	**Vehicle Overturned/ Over Embankment /Ditch**	**Total**
Traffic Avenue Ramp Terminal Intersections and between Ramps										
Traffic Avenue Westbound Ramp Terminal Intersection	2	2	0	0	1	3	0	1	0	**9**
Traffic Avenue between ramps	0	0	0	1	0	2	0	0	0	**3**
Traffic Avenue Eastbound Ramp Terminal Intersection	1	0	0	0	1	3	0	5	0	**10**
Total	**3**	**2**	**0**	**1**	**2**	**8**	**0**	**6**	**0**	**22**
SR 410 Mainline and Traffic Avenue Ramps										
SR 410 Mainline Freeway	0	6	1	1	0	19	7	0	2	**36**
SR 410 Eastbound Off-ramp	0	0	0	0	0	0	0	0	2	**2**
SR 410 Eastbound On-ramp	0	0	0	0	0	0	0	0	0	**0**
SR 410 Westbound Off-ramp	0	0	0	0	0	2	0	0	0	**2**
SR 410 Westbound On-ramp	0	0	0	0	0	0	0	0	0	**0**
Total	0	6	1	1	0	21	7	0	4	**40**

Source: WSDOT Transportation Data and GIS Office

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.

3. YEAR 2035 TRAFFIC VOLUMES

Design year 2035 traffic volumes are based on existing 2016 volumes plus background growth rates from WSDOT, and Sumner Station Sounder traffic volume forecasts, including the addition of a 623-space parking garage at Sumner Station.

3.1 Background Growth

WSDOT calculated background growth rates using the Pierce County travel demand model being used for the SR 162 Sumner to Orting Corridor Planning Study, which includes the Tehaleh master-planned community south of Bonney Lake and other developments occurring in the vicinity. Using the Pierce County travel demand model, WSDOT calculated annual straightline growth rates of 1.73 percent per year during the AM peak period and 1.46 percent per year during the PM peak period. These annual straightline growth rates were calculated from the Pierce County travel demand model link volumes along SR 410 near the Traffic Avenue interchange and the Traffic Avenue ramps. These growth rates were applied to the existing year 2016 count data to develop the future year 2035 background volumes.

3.2 Sumner Station Growth

As described in **Section 1.0 (Introduction)**, Sound Transit is expanding its South Line Sounder rail service and forecasts Sounder ridership to increase steadily over the next 20 years. Sound Transit has voter-approved funding to improve access for all modes to Sumner Station, including additional parking capacity, congestion management, and pedestrian and bicycle improvements. Two elements of the project will directly increase vehicle traffic through the interchange:

- A 623-space parking garage, which will result in a net increase of 505 parking spaces
- Traffic control measures that will force traffic exiting the garage to turn right on Thompson Street and travel west toward the interchange

Table 3-1 shows the additional peak hour (1 hour) traffic volumes from the Sound Transit Sumner Station.

Table 3-1. Additional Sumner Station Traffic Volumes in Year 2035 (Added to Background Volumes)

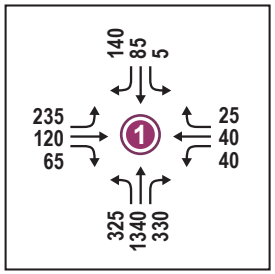
Period	Peak Hour (1 hour)
AM	206
PM	279

Source: Sumner Station Access Improvements Transportation Technical Report, March 2016

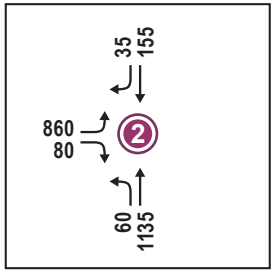
3.3 Design 2035 Traffic Volumes

Design year 2035 traffic volumes were calculated by adding 19 years of background growth to the Sound Transit Sumner Station traffic growth and to the existing 2016 traffic volumes. The resulting year 2035 AM and PM peak hour volumes are shown in **Figure 3-1**. Design year 2035 traffic volume calculations are provided in **Appendix B**.

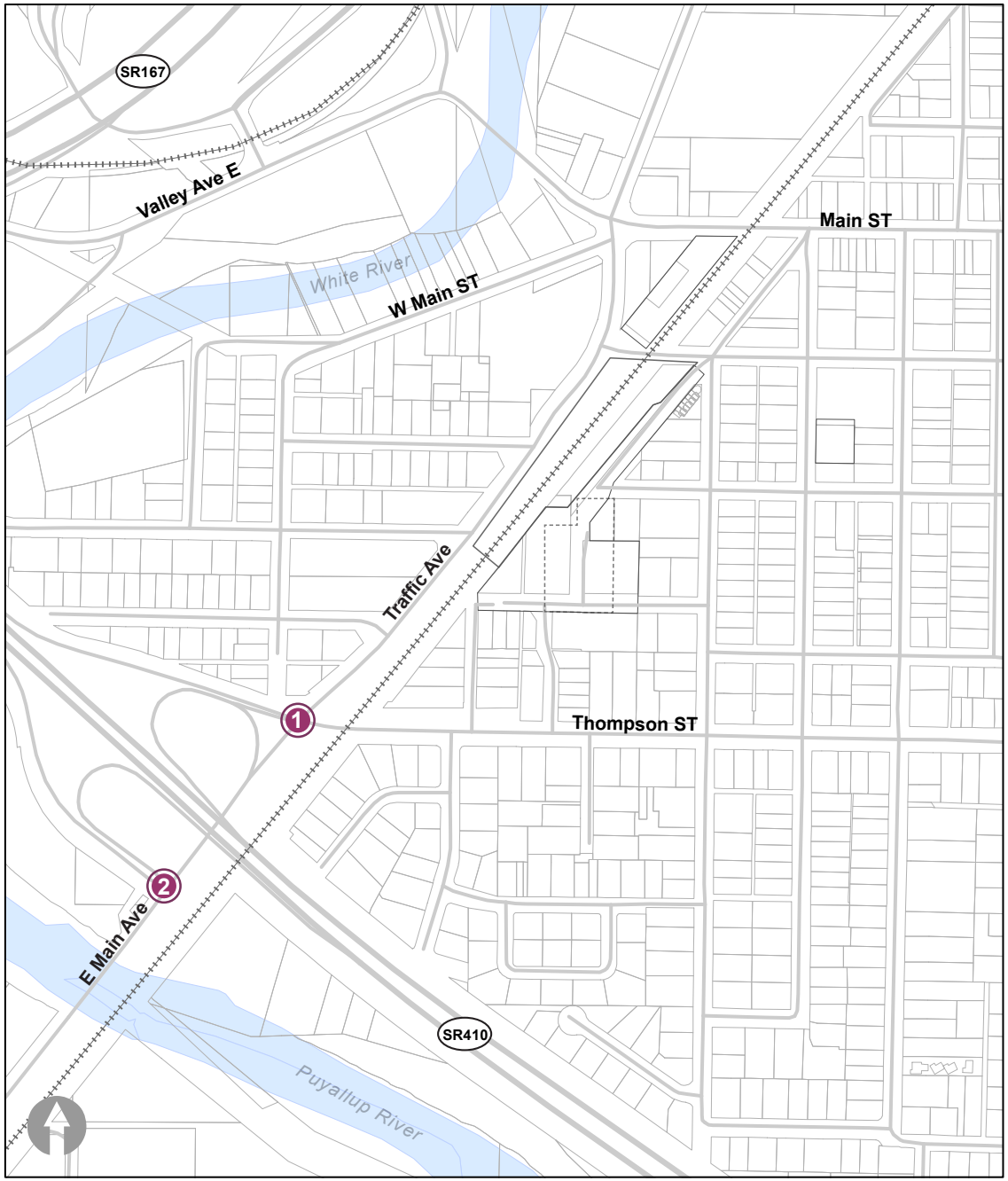
2035 AM



Traffic Ave / Thompson ST
SR 410 Westbound Ramps

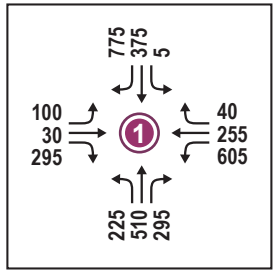


Traffic Ave
SR 410 Eastbound Ramps

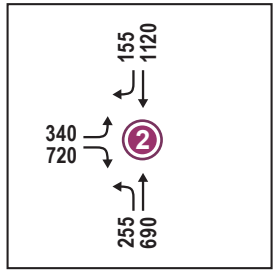


Intersection Turn Movement

2035 PM



Traffic Ave / Thompson ST
SR 410 Westbound Ramps



Traffic Ave
SR 410 Eastbound Ramps

Figure 3-1
Design Year 2035
Traffic Volumes

SR 410 Traffic Avenue

4. INTERSECTION CONTROL ALTERNATIVES

The SR 410/Traffic Avenue ramp terminal intersections were evaluated with different intersection control. The following alternatives were evaluated:

- *No Build Condition*—The No Build condition assumes the existing lane geometry, two-lane overpass, and signalized traffic control that exist today and would remain into the future.
- *Traffic Signals at SR 410/Traffic Avenue Ramp Terminal Intersections* Alternative—This Traffic Signal Alternative includes traffic signals and a new parallel bridge to the east resulting in a five-lane cross section along Traffic Avenue on the overpass.
- *Roundabout at SR 410/Traffic Avenue Ramp Terminal Intersections Alternative*—This Roundabout Alternative includes a new parallel bridge to the east resulting in a five-lane cross section along Traffic Avenue on the overpass. It also converts the traffic control at the SR 410/Traffic Avenue ramp terminal intersections to roundabouts.

4.1 No Build Condition

The No Build condition assumes the lane geometry, two-lane overpass, and signalized traffic control that exist today would remain into the future. See **Figure 4-1** for an illustration of the No Build condition.

<u>SR 410 Westbound Ramp Terminal Intersection</u>

- Traffic Control
  - Signalized
- Lane Geometry
  - Northbound Approach
    - 1 left-turn lane (150 feet)
    - 1 through lane
    - 1 right-turn lane (250 feet)
  - Southbound Approach
    - 1 left-turn lane (200 feet)
    - 1 through lane
    - 1 right-turn lane
  - Eastbound Approach
    - 1 shared left/through lane
    - 1 right-turn lane (yield control)
  - Westbound Approach
    - 1 left-turn lane (250 feet)
    - 1 through lane
    - 1 right-turn lane (yield control)

<u>SR 410 Overpass</u>

- Lane Geometry
  - 1 lane in each direction

SR 410 Eastbound Ramp Terminal Intersection

- Traffic Control
  - Signalized
- Lane Geometry
  - Northbound Approach
    - 1 left-turn lane (greater than 500 feet)
    - 1 through lane
  - Southbound Approach
    - 1 through lane
    - 1 right-turn lane (less than 25 feet)
  - Eastbound Approach
    - 1 left-turn lane (less than 100 feet; however, drivers would use the shoulder during congested periods, increasing the effective turn lane length to approximately 600 feet)
    - 1 right-turn lane

Parametrix

N

0 150

SCALE IN FEET

Figure 4-1
No Build Alternative

SR 410 Traffic Ave

4.2 Traffic Signal Alternative

The Traffic Signal Alternative includes traffic signals and a new parallel bridge to the east resulting in a five-lane cross section along Traffic Avenue on the overpass. See **Figure 4-2** for an illustration of the Traffic Signal Alternative.

SR 410 Westbound Ramp Terminal Intersection

- Traffic Control
  - Signalized
- Lane Geometry
  - Northbound Approach
    - 1 left-turn lane (250 feet)
    - 1 through lane
    - 1 through-right lane
  - Southbound Approach
    - 1 left-turn lane (125 feet)
    - 1 through lane
    - 1 through-right lane
  - Eastbound Approach
    - 1 left-turn lane (250 feet)
    - 1 through lane
    - 1 right-turn lane (150 feet)
  - Westbound Approach
    - 1 left-turn lane (200 feet)
    - 1 through lane
    - 1 right-turn lane (yield control)

SR 410 Overpass

- Lane Geometry
  - 2 lanes in each direction

SR 410 Eastbound Ramp Terminal Intersection

- Traffic Control
  - Signalized
- Lane Geometry
  - Northbound Approach
    - 1 left-turn lane (greater than 250 feet)
    - 2 through lanes
  - Southbound Approach
    - 1 through lane
    - 1 through-right lane
  - Eastbound Approach
    - 1 left-turn lane (300 feet)
    - 1 left-right lane
    - 1 right-turn lane (200 feet)

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SCALE IN FEET

LEGEND:

- STRIPING
- EDGE OF PAVEMENT
- PROPOSED NON-MOTORIZED ROUTE
- EXISTING NON-MOTORIZED ROUTE
- EXISTING BRIDGE TO REMAIN
- NEW BRIDGE

PROPOSED:

- FOUR 12' GENERAL PURPOSE LANES
- CENTER TURN LANE
- 12' MULTIPURPOSE SIDEWALK EASTSIDE
- 120' LEFT TURN LANE TO WESTBOUND ON-RAMP

Figure 4-2
Traffic Signal Alternative

SR 410 Traffic Ave

4.3 Roundabout Alternative

The Roundabout Alternative includes a new parallel bridge to the east resulting in a five-lane cross section along Traffic Avenue on the overpass. This alternative also converts the traffic control at the SR 410/Traffic Avenue ramp terminal intersections to two-lane roundabouts. See **Figure 4-3** for an illustration of the Roundabout Alternative.

SR 410 Westbound Ramp Terminal Intersection

- Traffic Control
  - Roundabout
- Lane Geometry
  - Northbound Approach
    - 1 left-through lane
    - 1 through-right lane
  - Southbound Approach
    - 1 left-through lane
    - 1 right-turn lane
  - Eastbound Approach
    - 1 left-turn lane (250 feet)
    - 1 through-right lane
  - Westbound Approach
    - 1 left-through lane (greater than 250 feet)
    - 1 right-turn lane

SR 410 Overpass

- Lane Geometry
  - 2 lanes in each direction

SR 410 Eastbound Ramp Terminal Intersection

- Traffic Control
  - Roundabout
- Lane Geometry
  - Northbound Approach
    - 1 left-through lane
    - 1 through lane
  - Southbound Approach
    - 1 through lane
    - 1 through-right lane
  - Eastbound Approach
    - 1 left-turn lane
    - 1 left-right lane (greater than 250 feet)

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SCALE IN FEET

LEGEND:

- STRIPING
- EDGE OF PAVEMENT
- PROPOSED NON-MOTORIZED ROUTE
- EXISTING NON-MOTORIZED ROUTE
- EXISTING BRIDGE TO REMAIN
- NEW BRIDGE

PROPOSED:

- FOUR 12' GENERAL PURPOSE LANES
- ROUNDABOUT AT INTERSCTIONS
- 10' MULTIPURPOSE TRAIL EASTSIDE

Figure 4-3
Roundabout Alternative

SR 410 Traffic Ave

5. OPERATIONS ANALYSIS

The operations analysis was conducted for the two study intersections using the software programs Synchro (version 9.1) for signalized intersection alternatives and SIDRA (version 6.1) for roundabout controlled intersections. Synchro is a macroscopic analysis and optimization software application that supports the Highway Capacity Manual's methodology (2000 and 2010 methods) for signalized intersections, and creates optimized signal timing plans for intersections and corridors. SIDRA is an analytical traffic evaluation software application that uses lane-by-lane and vehicle path models to provide estimates of capacity. The roundabout analysis was consistent with WSDOT's SIDRA Policy and Settings[1].

A common method of measuring traffic operations is level of service (LOS), a scale ranging from A to F, to designate the LOS depending on the delay conditions at the intersection. LOS A represents the best conditions with minimal delay and LOS F represents the worst conditions with severe congestion. LOS ratings are based on the ratio of actual traffic volumes to traffic control delay of the intersection or roadway. **Table 5-1** lists the intersection LOS delay thresholds for signalized and roundabout intersections. At signalized intersections, LOS is calculated based on the delay of all vehicles entering the intersection. According to WSDOT's SIDRA Policy and Settings, LOS for roundabout intersections is calculated using the same thresholds as signalized intersections.

Table 5-1. Level of Service Thresholds

	Average Control Delay per Vehicle (seconds)	
Level of Service	**Signalized Intersections (sec/veh)**	**Roundabouts (sec/veh)**
A	≤ 10	≤ 10
B	> 10 and ≤ 20	> 10 and ≤ 20
C	> 20 and ≤ 35	> 20 and ≤ 35
D	> 35 and ≤ 55	> 35 and ≤ 55
E	> 55 and ≤ 80	> 55 and ≤ 80
F	> 80	> 80

Note: The LOS criteria are based on control delay, which includes initial deceleration delay, queue move-up time, stopped delay, and final deceleration delay.
Source: Transportation Research Board Highway Capacity Manual, 2000

[1] http://www.wsdot.wa.gov/design/traffic/analysis/

The LOS criteria for roundabouts are supplemented by using the volume-to-capacity ratio (v/c). The v/c ratio evaluates the congestion of an intersection, approach, or movement based on the observed volume compared to the capacity of the intersection, approach, or movement. As shown in **Table 5-2,** LOS F is assigned to individual lanes in roundabouts regardless of the control delay if the v/c ratio exceeds 1.0. For overall intersection and approaches at roundabouts, LOS is measured solely against the control delay thresholds.

Table 5-2. Level of Service Thresholds for Roundabouts

Control Delay at Roundabouts (sec/veh)	LOS by Volume-to-Capacity Ratio	
	v/c < 1.0	v/c > 1.0
≤ 10	A	F
> 10 and ≤ 20	B	F
> 20 and ≤ 35	C	F
> 35 and ≤ 55	D	F
> 55 and ≤ 80	E	F
> 80	F	F

Note: For approaches and overall intersection assessment, LOS is defined solely by control delay.
Source: Transportation Research Board Highway Capacity Manual, 2010

Default values were used in the Synchro and SIDRA analysis except as noted below:

Synchro Non-Default Value Entries

- Traffic volumes (based on field observation and growth rates)
- Peak hour factors (intersection average, based on field observation)
- Truck percentages (based on field observation)
- Speed limits (based on actual speed limits)
- Cycle lengths
- Phase lengths
- Ideal saturation flow rate (based on critical turn movements having v/c = 1.0)
  - Westbound ramps, northbound approach = 1,800 vehicles per hour (vph)
  - Eastbound ramps, southbound approach = 1,750 vph

SIDRA Non-Default Value Entries

- Traffic volumes (based on field observation and growth rates)
- Peak hour factors (intersection average, based on field observation)
- Truck percentages (based on field observation)
- Environmental factor (1.0 was used for the design year at the eastbound ramp terminal intersection and 1.1 was used for the design year at the westbound ramp terminal intersection based on the limited sight distance from the BNSF bridge just east of the intersection)
- Island diameter (100 feet)

- Circulating width (30 feet for two lanes, 19 feet for one lane)
- Entry lane width (14 feet as specified in WSDOT design manual)
- Entry radius (100 feet as specified in WSDOT design manual)

An operational analysis was conducted for the following traffic volume scenarios for the study intersections:

- Existing 2016 traffic volumes
- Design year 2035 No Build Condition
- Design year 2035 Signal Alternative
- Design year 2035 Roundabout Alternative

5.2 Current Geometry Traffic Operations

The AM and PM peak hour traffic operations for the existing 2016 condition and 2035 No Build conditions are summarized for the study area intersections in **Table 5-3**. The traffic operations include the LOS and average delay for overall intersection, approaches, and individual movements. The two study area intersections are under WSDOT control and have a performance threshold for intersections of LOS D.

As shown in **Table 5-3**, all of the study area intersections meet WSDOT's overall intersection LOS performance threshold for existing year 2016, although some of the individual approaches and movements fall below the performance thresholds.

As shown in **Table 5-3**, in design year 2035 the overall intersections as well as multiple approaches and individual movements are forecast to operate below WSDOT's performance thresholds at both study area intersections. All traffic operations worksheets for existing year 2016 and 2035 No Build conditions are included in **Appendix C**.

Table 5-3. Current Geometry Traffic Operations

	AM Peak Hour				PM Peak Hour			
	Existing Year 2016		2035 No Build Conditions		Existing Year 2016		2035 No Build Conditions	
Intersection	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)
SR 410 Westbound (WB) Ramps	C	23	**F**	**100**	B	13	D	44
Eastbound Approach	*D*	*38*	***F***	***174***	*B*	*11*	*D*	*44*
Left Through	D	44	**F**	**206**	C	26	**F**	**100**
Right	A	8	A	1	A	5	B	20
Westbound Approach	*C*	*21*	*C*	*22*	*D*	*36*	***E***	***74***
Left	C	27	C	28	D	44	**F**	**101**
Through Right	B	18	B	18	C	24	B	18
Northbound Approach	*C*	*22*	***F***	***99***	*A*	*8*	*C*	*27*
Left	A	8	A	4	B	15	D	53
Through	C	28	**F**	**145**	A	10	C	27
Right	A	3	A	6	A	1	A	8
Southbound Approach	*A*	*4*	*A*	*7*	*A*	*6*	*D*	*35*
Left	A	8	A	7	A	10	B	15
Through	A	6	B	15	B	10	C	34
Right	A	2	A	2	A	3	D	36
SR 410 Eastbound (EB) Ramps	D	40	**F**	**149**	**D**	**49**	**F**	**175**
Eastbound Approach	*D*	*35*	***F***	***126***	*D*	*42*	***F***	***126***
Left	D	38	**F**	**137**	C	33	D	40
Right	A	8	A	3	D	46	**F**	**167**
Northbound Approach	*D*	*44*	***F***	***187***	*C*	*31*	***E***	***67***
Left	B	16	B	14	**F**	**82**	**F**	**206**
Through	D	46	**F**	**196**	B	12	B	16
Southbound Approach	*D*	*36*	*C*	*24*	***E***	***73***	***F***	***296***
Through Right	D	36	C	24	**E**	**73**	**F**	**296**

5.3 Design Year 2035 Intersection Alternatives

The design year 2035 No Build analysis indicates that the existing geometry and intersection control will not adequately accommodate the forecast traffic growth within the study area. Therefore, two different design alternatives (Traffic Signal and Roundabout) were analyzed to determine how they would operate in 2035. The Traffic Signal Alternative and Roundabout Alternative were described and shown in **Chapter 4**.

Table 5-4 summarizes the AM and PM peak hour traffic operations for 2035 No Build conditions, 2035 Traffic Signal Alternative, and 2035 Roundabout Alternative. Similar to **Table 5-3**, the traffic operations summarized include the LOS and average delay for overall intersection, approaches, and individual movements.

Table 5-4. Design Year 2035 Traffic Operations - LOS

	AM Peak Hour						PM Peak Hour					
	2035 No Build Conditions		2035 Signal Alternative		2035 Roundabout Alternative		2035 No Build Conditions		2035 Signal Alternative		2035 Roundabout Alternative	
Intersection	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)
SR 410 WB Ramps	**F**	**100**	B	19	B	11	D	44	C	28	B	15
Eastbound Approach	***F***	***174***	*D*	*41*	*A*	*3*	*D*	*44*	*C*	*23*	*B*	*14*
Left	**F**	**206**	D	51	A	5	**F**	**100**	C	32	B	14
Through			D	42	A	1			D	52	B	13
Right	A	1	A	5	A	2	B	20	B	18	B	15
Westbound Approach	*C*	*22*	*C*	*35*	*A*	*10*	***E***	***74***	*D*	*39*	*C*	*27*
Left	C	28	C	29	B	13	**F**	**101**	D	43	C	29
Through	B	18	D	39	A	9	B	18	C	31	C	25
Right					A	6					A	3
Northbound Approach	***F***	***99***	*B*	*15*	*B*	*14*	*C*	*27*	*B*	*19*	*A*	*2*
Left	A	4	B	13	B	19	D	53	C	32	A	7
Through	**F**	**145**	B	15	B	13	C	27	B	15	A	1
Right	A	6			B	12	A	8			A	1
Southbound Approach	*A*	*7*	*A*	*6*	*A*	*2*	*D*	*35*	*C*	*29*	***B***	***17***
Left	A	7	A	7	A	8	B	15	B	12	D	43
Through	B	15	B	15	A	2	C	34	C	30	D	37
Right	A	2	A	0	A	2	D	36	C	29	**A**	**7**
SR 410 EB Ramps	**F**	**149**	C	22	A	9	**F**	**175**	C	23	A	8
Eastbound Approach	***F***	***126***	*C*	*31*	*B*	*12*	***F***	***126***	*C*	*26*	*B*	*16*
Left	**F**	**137**	C	33	B	13	D	40	C	31	B	17
Right	A	3	A	5	A	6	**F**	**167**	B	16	B	16
Northbound Approach	***F***	***187***	*B*	*16*	*A*	*8*	***E***	***67***	*B*	*18*	*A*	*6*
Left	B	14	B	11	B	14	**F**	**206**	D	46	B	10
Through	**F**	**196**	B	16	A	8	B	16	A	7	A	5
Southbound Approach	*C*	*24*	*B*	*14*	*A*	*1*	***F***	***296***	*C*	*24*	*A*	*2*
Through	C	24	B	14	A	0	**F**	**296**	C	24	A	2
Right					A	2					A	3

WSDOT's SIDRA policy indicates that the Measure of Effectiveness (MOE) for roundabouts is not primarily LOS but instead a mix of MOEs. The MOEs for roundabouts in order of importance are v/c, percent stopped, queues, and then LOS. Therefore, **Table 5-5** summarizes v/c ratios for all design year 2035 alternatives for overall intersection, approach, and individual movements. All traffic operations worksheets for the design year 2035 alternatives are included in **Appendix C**.

Table 5-5. Design Year 2035 Traffic Operations—v/c ratio

	AM Peak Hour			PM Peak Hour		
	2035 No Build Conditions	2035 Signal Alternative	2035 Roundabout Alternative	2035 No Build Conditions	2035 Signal Alternative	2035 Roundabout Alternative
Intersection	**v/c**	**v/c**	**v/c**	**v/c**	**v/c**	**v/c**
SR 410 WB Ramps	**1.33**	0.81	0.95	0.96	0.92	0.99
Eastbound Approach						
Left	**1.33**	0.80	0.17	0.92	0.51	0.26
Through		0.45	0.15		0.28	0.57
Right	0.15	0.12		0.68	0.65	
Westbound Approach						
Left	0.22	0.20	0.24	0.93	0.89	0.99
Through	0.14	0.47	0.05	0.34	0.48	0.04
Right						
Northbound Approach						
Left	0.43	0.40	0.95	0.80	0.72	0.44
Through	**1.28**	0.81	0.95	0.71	0.56	0.44
Right	0.36		0.95	0.41		0.44
Southbound Approach						
Left	0.02	0.02	0.09	0.02	0.02	0.84
Through	0.11	0.10	0..09	0.64	0.60	0.84
Right	0.18	0.16	0.14	0.96	0.92	0.76
SR 410 EB Ramps	**1.36**	0.79	0.66	**1.60**	0.83	0.88
Eastbound Approach						
Left	**1.21**	0.79	0.38	0.70	0.81	0.57
Right	0.11	0.14	0.38	**1.28**	0.70	0.88
Northbound Approach						
Left	0.12	0.10	0.66	**1.34**	0.79	0.45
Through	**1.36**	0.60	0.66	0.63	0.30	0.45
Southbound Approach						
Through	0.36	0.14	0.07	**1.60**	0.83	0.52
Right			0.07			0.52

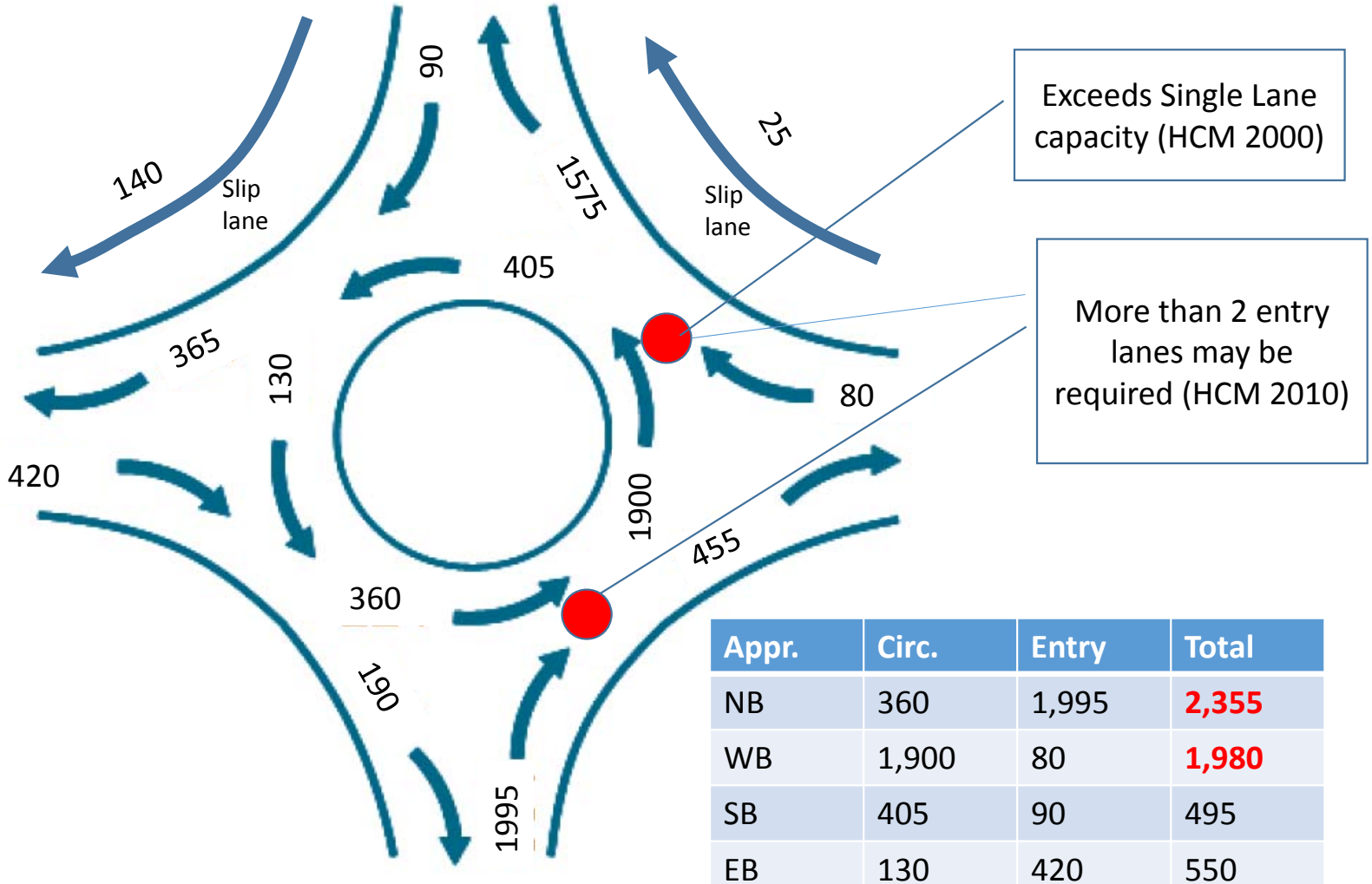
5.3.1 Design Year 2035 Signal Alternative

As shown in **Table 5-4**, the LOS analysis for the Signal Alternative indicates that both study area intersections would operate at an overall LOS D or better for overall intersection, individual approach, and individual movements during the AM and PM peak hours with the traffic signals.

5.3.2 Design Year 2035 Roundabout Alternative

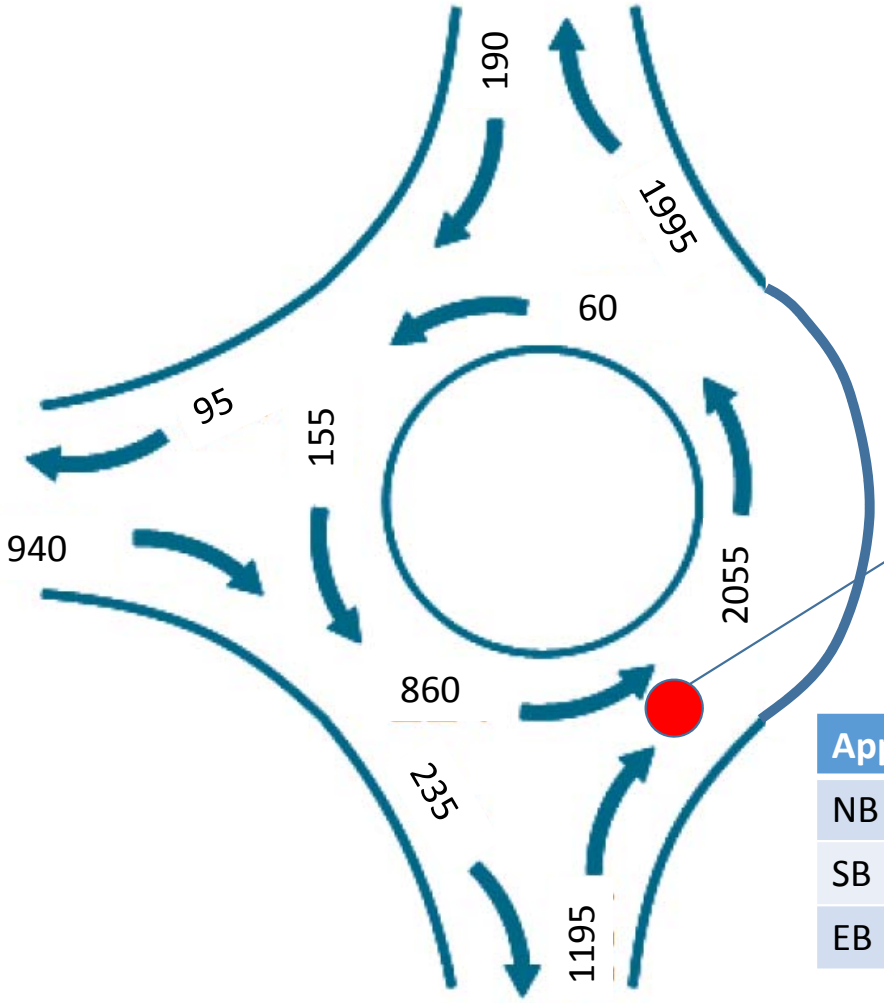
Although both study intersections are forecast to operate at an acceptable LOS (**Table 5-4)**, some movements are forecast to operate with a v/c ratio approaching 1.0 (**Table 5-5**) during each time period. During the AM peak hour, the northbound approach at the SR 410 westbound ramp terminal intersection is forecast to have a v/c ratio of 0.95. During the PM peak hour, the westbound left-through lane at the SR 410 westbound ramp terminal intersection is forecast to have a v/c ratio of 0.99, and the eastbound right-turn at the SR 410 eastbound ramp terminal intersection is forecast to have a v/c ratio of 0.88. These v/c ratios are approaching capacity and may result in long queues and additional delays. As stated in the WSDOT SIDRA Policy settings, v/c ratios above 0.85 are concerning and require additional detailed analysis. Similarly, the Highway Capacity Manual 2010 does not define a standard for v/c ratios, but international and domestic experience suggests that v/c ratios in the range of 0.85 to 0.9 represent an approximate threshold for satisfactory operation.

The capacity of a roundabout is generally driven by the amount of conflicting traffic that is present at each roundabout entry leg. High conflicting volumes reduce the number of opportunities for vehicles to enter the roundabout and therefore reduce the capacity of a particular approach leg. To better understand the critical capacity locations in each roundabout **Figures 5-1** through **5-4** were created. These graphics were developed to show the entering and circulating flows for both ramp terminal intersections during the AM and PM peak periods. As shown in **Figure 5-1**, the northbound and westbound approaches are areas of concern during the AM peak hour at the westbound ramp terminal intersection based on the total volume of entering and circulating flows. As shown in **Figure 5-2**, the northbound approach is an area of concern during the AM peak hour at the eastbound ramp terminal intersection based on the total volume of entering and circulating flows. As shown in **Figure 5-3**, the westbound and southbound approaches are areas of concern during the PM peak hour at the westbound ramp terminal intersection based on the total volume of entering and circulating flows. As shown in **Figure 5-4**, the eastbound approach is an area of concern during the PM peak hour at the eastbound ramp terminal intersection based on the total volume of entering and circulating flows.



Appr.	Circ.	Entry	Total
NB	360	1,995	**2,355**
WB	1,900	80	**1,980**
SB	405	90	495
EB	130	420	550

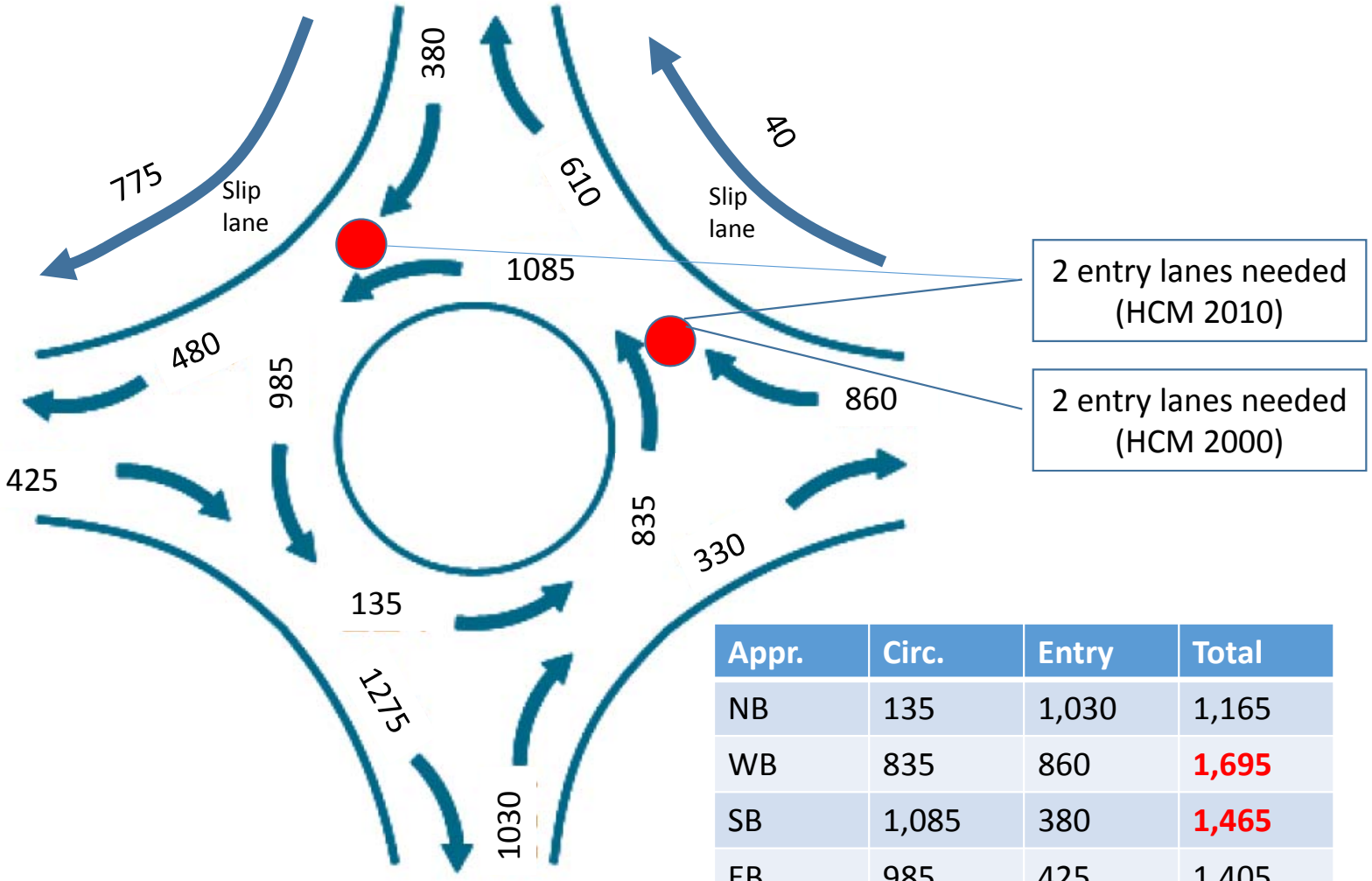
Figure 5-1
2035 AM - Westbound Ramps/Thompson



More than 2 entry lanes may be required (HCM 2010)

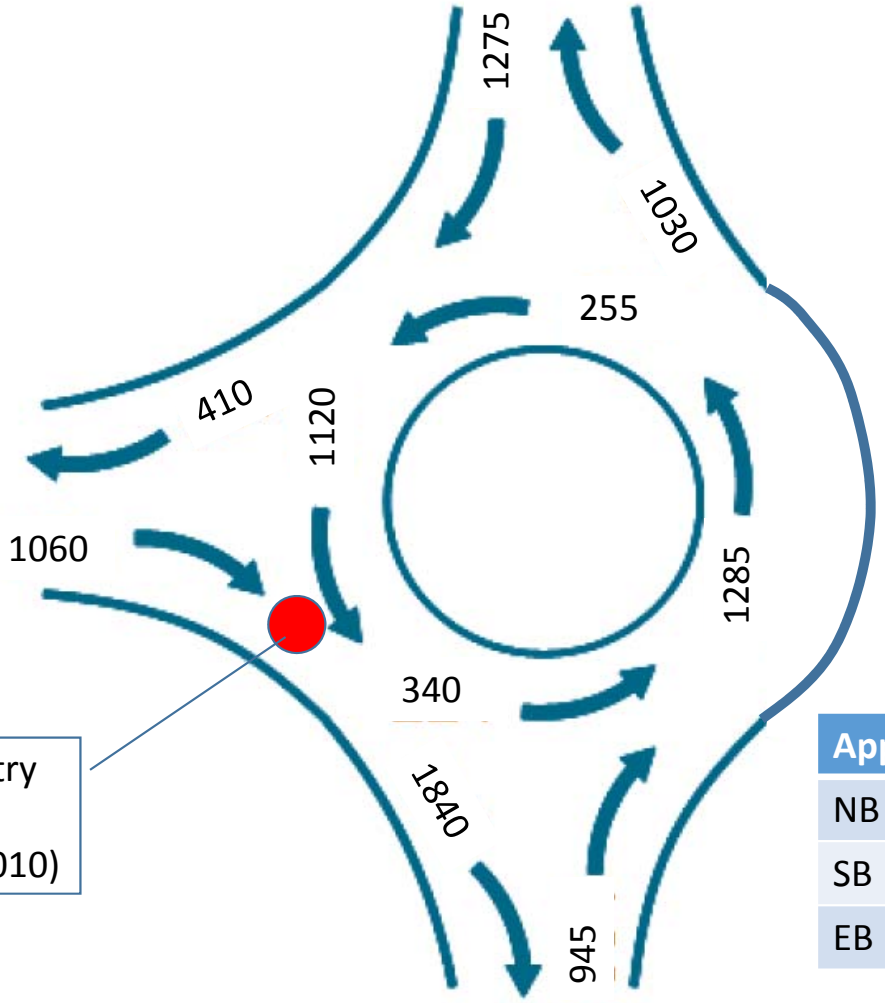
Appr.	Circ.	Entry	Total
NB	860	1,195	**2,055**
SB	60	190	250
EB	155	940	1,095

Figure 5-2
2035 AM - Eastbound Ramps



Appr.	Circ.	Entry	Total
NB	135	1,030	1,165
WB	835	860	**1,695**
SB	1,085	380	**1,465**
EB	985	425	1,405

Figure 5-3
2035 PM - Westbound Ramps/Thompson



More than 2 entry lanes may be required (HCM 2010)

Appr.	Circ.	Entry	Total
NB	340	945	1,285
SB	255	1,275	1,530
EB	1,120	1,060	**2,180**

Figure 5-4
2035 PM - Eastbound Ramps

6. OPERATIONAL CONSIDERATIONS

6.1 Effects of Adjacent Intersections or SR 410 Crossings

Adjacent intersections along Traffic Avenue in relation to the two study intersections were documented in the Sumner Station Access Project completed for Sound Transit. In addition, the Traffic Avenue overpass is one of a limited number of SR 410 crossings within the study area. With the other crossings of SR 410 also approaching capacity or currently over capacity during the AM and PM peak periods, none of the other SR 410 crossings could provide an alternative route or result in enough of a shift in traffic that the intersection improvements would not be needed in the Traffic Avenue corridor.

6.2 Objectives of Proposed Intersection Geometry and Control

The objective of the revised intersection geometry and control at the study area intersections is to relieve the existing bottleneck for freight, transit, and automobile travel, and complete the missing link between the non-motorized facilities north and south of the overpass.

6.3 Collision Frequency

The two study area intersections are experiencing a low volume of collisions based upon the past 5-year history. The amount of collisions should be reduced compared to the current geometry and traffic control at the study area intersections considering the additional travel lanes that are proposed on the Traffic Avenue overpass at the study area intersections. These improvements will reduce the high proportion of rear-end and turning (opposite direction) collisions based on reducing congestion and providing larger gaps for traffic to turn.

6.4 Intersection Design Vehicle

Preliminary designs were developed to evaluate the design concepts. The design vehicle used for intersection design is a key influence on the project footprint. AutoTurn design software was used to verify how a WB-67, WB-50, and BUS vehicles would maneuver through the intersection alternatives.

6.4.1 Signalized Intersection Option Design Vehicle

For the Signalized Intersections Alternative, the following design vehicles were evaluated for the turning movements as shown in **Table 6-1**.

Table 6-1. Operational Considerations

Turning Movement	Design Vehicle	Accommodations[1]
Traffic Avenue / EB SR 410 Ramps Intersection		
Northbound (NB) Traffic Avenue to Eastbound (EB) SR 410 On-Ramp	WB-50	WB-67
EB SR 410 Off-Ramp to Southbound (SB) Traffic Avenue	WB-50	WB-67
EB SR 410 Off-Ramp to NB Traffic Avenue	WB-50	WB-67

Table 6-1. Operational Considerations

Turning Movement	Design Vehicle	Accommodations[1]
SB Traffic Avenue to EB SR 410 On-Ramp	WB-50	WB-67
Traffic Avenue / WB SR 410 Ramps / Thompson Street Intersection		
NB Traffic Avenue to WB SR 410 On-Ramp	WB-50	WB-67
NB Traffic Avenue to EB Thompson Street	BUS	None
SB Traffic Avenue to WB SR 410 On-Ramp	WB-50	WB-67
SB Traffic Avenue to EB Thompson Street	BUS	None
WB SR 410 Off-Ramp to SB Traffic Avenue	WB-50	WB-67
WB SR 410 Off-Ramp to NB Traffic Avenue	WB-50	WB-67
WB Thompson Street to SB Traffic Avenue	BUS	None
WB Thompson Street to NB Traffic Avenue	BUS	None

[1] Accommodation means the accommodated vehicle can maneuver through this turning movement with no encroachments to opposite travelled lanes and without leaving the paved surface (overtracking on paved shoulders or adjacent lanes in same direction of travel).

The design vehicles can maneuver through the turning movement with no encroachments on opposing lanes of travel, adjacent lanes of travel, or adjacent paved shoulders.

6.4.2 Roundabout Option Design Vehicle

A well-designed roundabout achieves a balance of safety and efficiency. The design process, as discussed in Chapter 1320 of the WSDOT Design Manual, involves creating a smooth curvature, channelization, and deflection to achieve low, consistent speeds (between 15 and 25 mph), well-marked lane paths, and appropriate sight distance. The single-lane roundabout option at SR 305 and Johnson Road is designed for a maximum speed of 25 mph.

The roundabout option accommodates all design vehicles, WB-67, WB-50, and BUS for both intersections.

6.5 Sight Distance Evaluation

Traffic Avenue consists of level terrain starting with a 250-foot-crest vertical curve on the existing bridge with a grade change of 5.3 percent. A 150-foot sag curve is located at the intersection of Thompson Street and Traffic Avenue with a grade change of 8.3 percent. Both vertical curves meet the WSDOT minimum vertical curve criteria described in WSDOT Design Manual M22-01.12, section 1220.02(2).

There is one location in the project footprint where sight distance is limited. The westbound approach to the westbound ramp intersection has limited sight distance because of the BNSF railroad bridge. The Traffic Signal Alternative would experience less of a negative effect from the limited sight distance than the Roundabout Alternative, because roundabouts function best when approaching motorists can see circulating vehicles and judge the gaps.

6.6 Right-of-Way

No additional right-of-way is expected to be needed to construct the Traffic Signal Alternative. The Roundabout Alternative would require purchase and demolition of an existing commercial building in the northwest corner of the westbound ramp intersection. The total project cost for the Roundabout Alternative listed in Section 7.3 includes $1.2 million for the acquisition of the building and relocation of three businesses that currently occupy the building.

6.7 Environmental Impacts

The City of Sumner has recently completed a State Environmental Policy Act (SEPA) checklist documenting environmental impacts of the project. Impacts identified are considered non-significant, and easily mitigated.

7. BENEFIT/COST ANALYSIS

Both of the proposed alternatives meet the stated Project Need and provide benefits over the No Build condition but do not cost the same or provide the same amount of benefit. This review of the proposed alternatives is in line with the WSDOT Design Manual that defines the goal of Practical Design as developing a solution for the Project Need at the least cost. Both alternatives meet the WSDOT performance thresholds for the study intersections, although the Roundabout Alternative is approaching capacity on some approaches. Based upon the intersection operations, cost, and lowest risk of environmental and right-of-way impacts, the Traffic Signal Alternative provides the highest benefit-to-cost ratio.

7.1 No Build Condition

7.1.1 Benefit

None. The No Build condition does not meet the Project Need.

7.1.2 Costs

No construction costs.

7.2 Traffic Signal Alternative

7.2.1 Benefit

- Provides overall intersection and all individual approaches and movements at LOS D or better.
- Relieves bottleneck for all directions of travel during AM and PM peak periods.
- Provides non-motorized connections at the study area intersections and completes the missing link between the non-motorized facilities north and south of the overpass.

7.2.2 Costs

- Estimated total project cost $17.7 million.
- Estimated maintenance of $5,000 to $10,000 per year.

7.3 Roundabout Alternative

7.3.1 Benefit

- Overall intersection and approaches meet WSDOT performance threshold of LOS D or better, although some approaches and individual movement v/c ratios are approaching 1.0 and exceed WSDOT's guidance of 0.85 to 0.90 as a maximum.
- Provides non-motorized connections at the study area intersections and completes the missing link between the non-motorized facilities north and south of the overpass.

7.3.2 Costs

- Estimated total project cost $19.9 million.
- Estimated maintenance of $1,000 per year.

8. NON-MOTORIZED FACILITIES

The study intersections do not experience a large volume of bicycle and pedestrian traffic. During the traffic count data collection, minimal pedestrian or bicyclist activity was observed through the study intersections. Regardless of the existing usage, the new overcrossing and intersections will have pedestrian and bicycle facilities. A 14-foot shared use path will be provided on the new overpass. The Traffic Signal Alternative would provide typical pedestrian and bicycle facilities through the signals as shown in **Figure 4-2**. It would include enough time during the signal phases for pedestrians to cross the intersection. The Roundabout Alternative would provide typical pedestrian crossings as shown in **Figure 4-3**.

9. CONTEXT SENSITIVE/SUSTAINABLE DESIGN

Because of its location in the regional transportation system, the interchange is important for multiple modes of travel. It is a key facility for the mobility and economic viability of east Pierce County. The Project Need Statement reflects the importance of the interchange in accommodating both motorized and non-motorized users; either the Traffic Signal Alternative or the Roundabout Alternative will meet the Project Need.

The Roundabout Alternative has one substantial advantage in terms of sustainability—it does not require electrical equipment to control traffic.

The Traffic Signal Alternative has the following advantages compared to the Roundabout Alternative:

- It can be constructed within the existing right-of-way, avoiding the demolition of a commercial building and relocation of three businesses.
- It is approximately $2.2 million less expensive.
- Its operation is less affected by the limited sight distance along Thompson Street for motorists driving under the BNSF bridge.
- It is the overwhelming preference of the community. The City held a public open house on November 9, 2016 and also had an online survey available concurrently. A total of 217 individuals expressed a preference on the alternatives, and nearly 69% of the respondents preferred the Signal Alternative. The results of the community outreach program are summarized in **Appendix D**.

10. RECOMMENDATION

The purpose of the SR 410/Traffic Avenue ramp terminal intersection improvements is to relieve the bottleneck for freight, transit, and automobile travel and to complete the missing link between the non- motorized facilities north and south of the overpass.

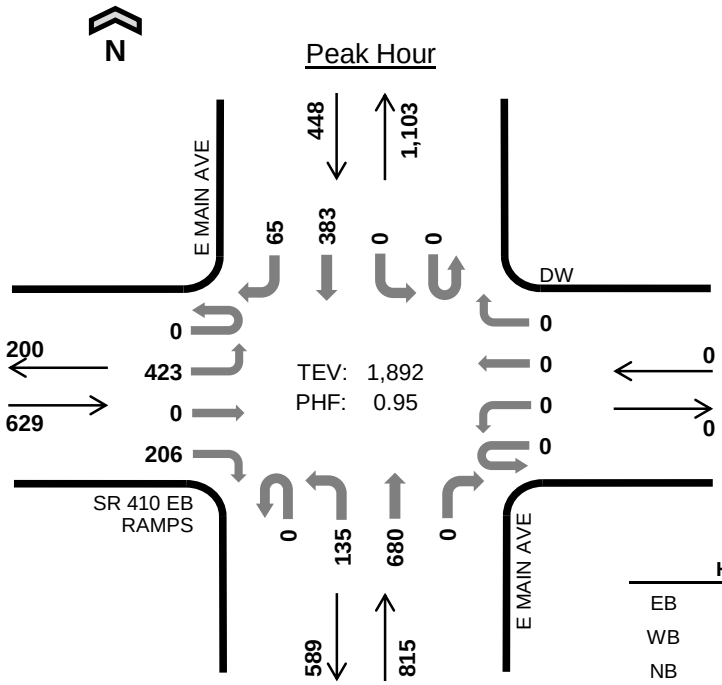
Based on the analysis presented in this ICA, the **Traffic Signal Alternative** is the recommended method of intersection control. The contributing factors for this recommendation include the traffic operations analysis, effects on adjacent intersections or SR 410 crossings, collision frequency, design vehicles, no additional right-of-way needs, route connectivity, context sensitive/sustainable design issues, and cost.

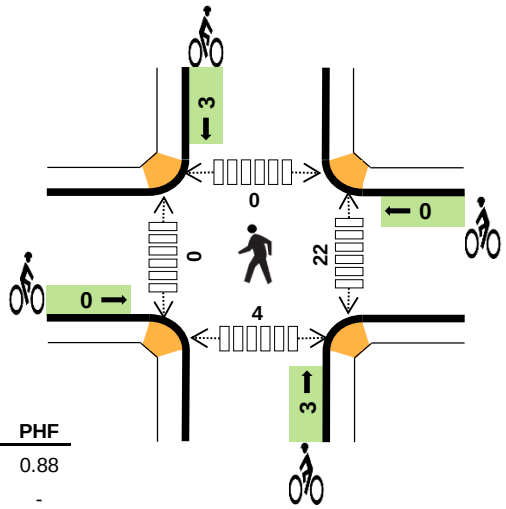
Appendix A

Traffic Count Data

E MAIN AVE
SR 410 EB RAMPS

Date: Tue, Sep 13, 2016
Count Period: 4:30 AM to 9:30 AM
Peak Hour: 7:30 AM to 8:30 AM





	HV %:	PHF
EB	6.2%	0.88
WB	-	-
NB	0.9%	0.94
SB	2.7%	0.95
TOTAL	3.1%	0.95

Five-Hour Count Summaries

Interval Start	SR 410 EB RAMPS				DW				E MAIN AVE				E MAIN AVE				15-min Total	Rolling One Hour
	Eastbound				Westbound				Northbound				Southbound					
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
7:30 AM	0	89	0	50	0	0	0	0	0	41	175	0	0	0	91	17	463	0
7:45 AM	0	117	0	62	0	0	0	0	0	22	181	0	0	0	101	14	497	0
8:00 AM	0	105	0	47	0	0	0	0	0	41	175	0	0	0	95	12	475	0
8:15 AM	0	112	0	47	0	0	0	0	0	31	149	0	0	0	96	22	457	1,892
Peak Hour	0	423	0	206	0	0	0	0	0	135	680	0	0	0	383	65	1,892	0

Note: For all three-hour count summary, see next page.

Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
7:30 AM	6	0	4	2	*12*	0	0	0	2	*2*	10	0	0	3	*13*
7:45 AM	6	0	0	4	*10*	0	0	3	1	*4*	1	0	0	0	*1*
8:00 AM	14	0	2	3	*19*	0	0	0	0	*0*	6	0	0	0	*6*
8:15 AM	13	0	1	3	*17*	0	0	0	0	*0*	5	0	0	1	*6*
Peak Hour	39	0	7	12	*58*	0	0	3	3	*6*	22	0	0	4	*26*

Five-Hour Count Summaries

Interval Start	SR 410 EB RAMPS				DW				E MAIN AVE				E MAIN AVE				15-min Total	Rolling One Hour
	Eastbound				Westbound				Northbound				Southbound					
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
4:30 AM	0	98	0	15	0	0	0	0	0	4	158	0	0	0	16	3	294	0
4:45 AM	0	107	0	9	0	0	0	0	0	2	184	0	0	0	16	3	321	0
5:00 AM	0	132	0	10	0	1	0	0	1	5	169	0	0	0	17	10	345	0
5:15 AM	0	156	0	9	0	0	0	0	0	13	167	0	0	0	19	5	369	1,329
5:30 AM	0	144	0	11	0	0	0	0	0	13	183	0	0	0	36	7	394	1,429
5:45 AM	0	158	0	28	0	0	0	0	0	10	145	0	0	0	40	7	388	1,496
6:00 AM	0	139	0	13	0	0	0	0	0	8	169	0	0	0	25	8	362	1,513
6:15 AM	0	122	0	38	0	0	0	0	0	12	175	0	0	0	33	17	397	1,541
6:30 AM	0	138	0	39	0	0	0	0	0	28	188	0	0	0	44	13	450	1,597
6:45 AM	0	100	0	33	0	0	0	0	0	29	188	0	0	0	55	16	421	1,630
7:00 AM	0	136	0	35	0	0	0	0	0	29	173	0	0	0	78	12	463	1,731
7:15 AM	0	109	0	36	0	0	0	0	0	18	151	0	0	0	88	20	422	1,756
7:30 AM	**0**	**89**	**0**	**50**	**0**	**0**	**0**	**0**	**0**	**41**	**175**	**0**	**0**	**0**	**91**	**17**	**463**	1,769
7:45 AM	**0**	**117**	**0**	**62**	**0**	**0**	**0**	**0**	**0**	**22**	**181**	**0**	**0**	**0**	**101**	**14**	**497**	1,845
8:00 AM	**0**	**105**	**0**	**47**	**0**	**0**	**0**	**0**	**0**	**41**	**175**	**0**	**0**	**0**	**95**	**12**	**475**	1,857
8:15 AM	**0**	**112**	**0**	**47**	**0**	**0**	**0**	**0**	**0**	**31**	**149**	**0**	**0**	**0**	**96**	**22**	**457**	**1,892**
8:30 AM	0	93	0	53	0	0	0	0	0	36	150	0	0	0	90	18	440	1,869
8:45 AM	0	89	0	47	0	0	0	0	0	37	171	0	0	0	101	17	462	1,834
9:00 AM	0	73	0	32	0	0	0	0	0	27	155	0	0	0	104	18	409	1,768
9:15 AM	0	63	0	49	0	0	0	0	0	21	144	0	0	0	88	14	379	1,690
Count Total	0	2,280	0	663	0	1	0	0	1	427	3,350	0	0	0	1,233	253	8,208	0
Peak Hour	**0**	**423**	**0**	**206**	**0**	**0**	**0**	**0**	**0**	**135**	**680**	**0**	**0**	**0**	**383**	**65**	**1,892**	**0**

Note: Five-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
4:30 AM	3	0	1	0	*4*	0	1	0	0	*1*	0	0	0	0	*0*
4:45 AM	4	0	1	1	*6*	0	0	1	1	*2*	0	0	0	0	*0*
5:00 AM	3	0	2	2	*7*	0	0	0	0	*0*	1	0	0	0	*1*
5:15 AM	3	0	3	0	*6*	0	0	0	0	*0*	0	0	0	0	*0*
5:30 AM	4	0	2	1	*7*	0	1	5	0	*6*	1	0	0	0	*1*
5:45 AM	4	0	0	1	*5*	0	1	1	0	*2*	1	0	0	1	*2*
6:00 AM	7	0	3	4	*14*	0	0	2	0	*2*	1	0	0	0	*1*
6:15 AM	5	0	5	0	*10*	0	0	2	0	*2*	8	0	0	2	*10*
6:30 AM	7	0	4	1	*12*	0	0	2	0	*2*	4	0	0	1	*5*
6:45 AM	11	0	4	2	*17*	0	0	0	0	*0*	3	0	1	1	*5*
7:00 AM	10	0	4	0	*14*	0	0	1	0	*1*	5	0	0	1	*6*
7:15 AM	9	0	3	3	*15*	0	0	0	2	*2*	1	0	0	0	*1*
7:30 AM	**6**	**0**	**4**	**2**	***12***	**0**	**0**	**0**	**2**	***2***	**10**	**0**	**0**	**3**	*13*
7:45 AM	**6**	**0**	**0**	**4**	***10***	**0**	**0**	**3**	**1**	***4***	**1**	**0**	**0**	**0**	*1*
8:00 AM	**14**	**0**	**2**	**3**	***19***	**0**	**0**	**0**	**0**	***0***	**6**	**0**	**0**	**0**	*6*
8:15 AM	**13**	**0**	**1**	**3**	***17***	**0**	**0**	**0**	**0**	***0***	**5**	**0**	**0**	**1**	***6***
8:30 AM	13	0	3	4	*20*	0	0	0	1	*1*	1	0	0	0	*1*
8:45 AM	11	0	4	4	*19*	0	0	0	0	*0*	0	0	0	0	*0*
9:00 AM	17	0	4	1	*22*	0	0	0	1	*1*	0	0	0	0	*0*
9:15 AM	9	0	4	3	*16*	0	0	0	0	*0*	2	0	0	1	*3*
Count Total	159	0	54	39	*252*	0	3	17	8	*28*	50	0	1	11	*62*
Peak Hour	**39**	**0**	**7**	**12**	***58***	**0**	**0**	**3**	**3**	***6***	**22**	**0**	**0**	**4**	***26***

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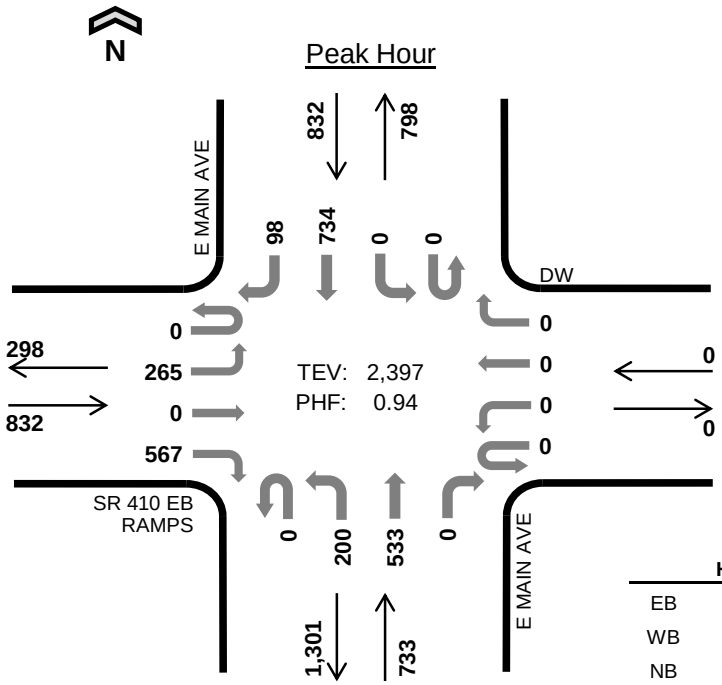
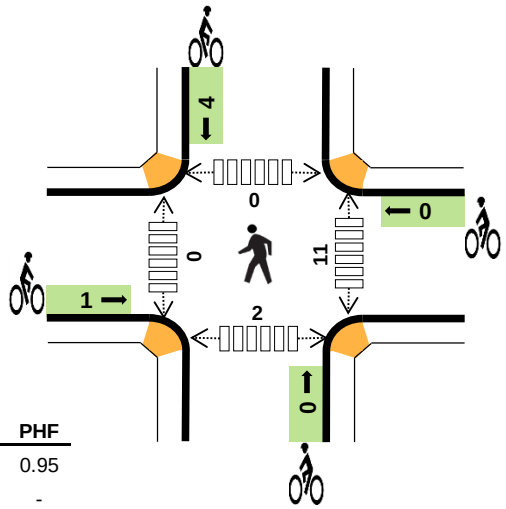
E MAIN AVE
SR 410 EB RAMPS

Date: Tue, Sep 13, 2016
Count Period: 2:00 PM to 7:00 PM
Peak Hour: 4:15 PM to 5:15 PM





	HV %:	PHF
EB	1.7%	0.95
WB	-	-
NB	0.5%	0.90
SB	0.8%	0.97
TOTAL	1.0%	0.94

Five-Hour Count Summaries

Interval Start	SR 410 EB RAMPS				DW				E MAIN AVE				E MAIN AVE				15-min Total	Rolling One Hour
	Eastbound				Westbound				Northbound				Southbound					
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
4:15 PM	0	64	0	145	0	0	0	0	0	43	123	0	0	0	182	27	584	0
4:30 PM	0	74	0	145	0	0	0	0	0	52	151	0	0	0	189	26	637	0
4:45 PM	0	62	0	144	0	0	0	0	0	51	134	0	0	0	178	22	591	0
5:00 PM	0	65	0	133	0	0	0	0	0	54	125	0	0	0	185	23	585	2,397
Peak Hour	0	265	0	567	0	0	0	0	0	200	533	0	0	0	734	98	2,397	0

Note: For all three-hour count summary, see next page.

Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
4:15 PM	3	0	2	3	*8*	0	0	0	0	*0*	2	0	0	0	*2*
4:30 PM	3	0	1	1	*5*	1	0	0	1	*2*	1	0	0	0	*1*
4:45 PM	5	0	1	3	*9*	0	0	0	1	*1*	6	0	0	1	*7*
5:00 PM	3	0	0	0	*3*	0	0	0	2	*2*	2	0	0	1	*3*
Peak Hour	14	0	4	7	*25*	1	0	0	4	*5*	11	0	0	2	*13*

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Five-Hour Count Summaries

Interval Start	SR 410 EB RAMPS				DW				E MAIN AVE				E MAIN AVE				15-min Total	Rolling One Hour
	Eastbound				Westbound				Northbound				Southbound					
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
2:00 PM	0	81	0	101	0	0	0	0	0	29	137	0	0	0	144	36	528	0
2:15 PM	0	80	0	93	0	0	0	0	0	34	152	0	0	0	151	32	542	0
2:30 PM	0	74	0	109	0	0	0	0	1	34	139	0	0	0	183	36	576	0
2:45 PM	0	81	0	133	0	0	0	0	0	42	143	0	0	0	170	31	600	2,246
3:00 PM	0	86	0	155	0	0	0	0	0	40	139	0	0	0	161	32	613	2,331
3:15 PM	0	74	0	126	0	0	0	0	0	36	150	0	0	0	171	24	581	2,370
3:30 PM	0	62	0	140	0	0	0	0	0	51	146	0	0	0	163	35	597	2,391
3:45 PM	0	68	0	130	0	0	0	0	0	49	123	0	0	0	181	29	580	2,371
4:00 PM	0	48	0	99	0	0	0	0	0	48	127	0	0	0	186	24	532	2,290
4:15 PM	**0**	**64**	**0**	**145**	**0**	**0**	**0**	**0**	**0**	**43**	**123**	**0**	**0**	**0**	**182**	**27**	**584**	2,293
4:30 PM	**0**	**74**	**0**	**145**	**0**	**0**	**0**	**0**	**0**	**52**	**151**	**0**	**0**	**0**	**189**	**26**	**637**	2,333
4:45 PM	**0**	**62**	**0**	**144**	**0**	**0**	**0**	**0**	**0**	**51**	**134**	**0**	**0**	**0**	**178**	**22**	**591**	2,344
5:00 PM	**0**	**65**	**0**	**133**	**0**	**0**	**0**	**0**	**0**	**54**	**125**	**0**	**0**	**0**	**185**	**23**	**585**	**2,397**
5:15 PM	0	43	0	131	0	0	0	0	0	50	144	0	0	0	175	28	571	2,384
5:30 PM	0	52	0	140	0	0	0	0	0	37	134	0	0	0	182	24	569	2,316
5:45 PM	0	64	1	139	0	0	0	0	0	40	112	0	0	0	184	26	566	2,291
6:00 PM	0	60	0	132	0	0	0	0	0	37	121	0	0	0	168	31	549	2,255
6:15 PM	0	46	0	121	0	0	0	0	0	34	122	0	0	0	192	18	533	2,217
6:30 PM	0	31	0	103	0	0	0	0	0	28	94	0	0	0	192	32	480	2,128
6:45 PM	0	34	0	97	0	0	0	0	0	37	104	0	0	0	131	31	434	1,996
Count Total	0	1,249	1	2,516	0	0	0	0	1	826	2,620	0	0	0	3,468	567	11,248	0
Peak Hour	**0**	**265**	**0**	**567**	**0**	**0**	**0**	**0**	**0**	**200**	**533**	**0**	**0**	**0**	**734**	**98**	**2,397**	**0**

Note: Five-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
2:00 PM	11	0	3	6	*20*	0	0	1	0	*1*	0	0	0	1	*1*
2:15 PM	8	0	0	1	*9*	0	0	1	2	*3*	1	0	0	1	*2*
2:30 PM	6	0	2	3	*11*	0	0	0	1	*1*	0	0	0	0	*0*
2:45 PM	7	0	1	3	*11*	0	0	1	1	*2*	2	0	0	0	*2*
3:00 PM	7	0	1	6	*14*	0	0	1	0	*1*	1	0	0	1	*2*
3:15 PM	3	0	3	3	*9*	0	0	3	1	*4*	1	0	0	0	*1*
3:30 PM	5	0	4	4	*13*	0	1	1	1	*3*	2	1	0	4	*7*
3:45 PM	11	0	0	2	*13*	0	0	0	1	*1*	2	0	0	2	*4*
4:00 PM	3	0	2	4	*9*	0	0	1	0	*1*	1	0	0	0	*1*
4:15 PM	**3**	**0**	**2**	**3**	***8***	**0**	**0**	**0**	**0**	***0***	**2**	**0**	**0**	**0**	*2*
4:30 PM	**3**	**0**	**1**	**1**	***5***	**1**	**0**	**0**	**1**	***2***	**1**	**0**	**0**	**0**	*1*
4:45 PM	**5**	**0**	**1**	**3**	***9***	**0**	**0**	**0**	**1**	***1***	**6**	**0**	**0**	**1**	*7*
5:00 PM	**3**	**0**	**0**	**0**	***3***	**0**	**0**	**0**	**2**	***2***	**2**	**0**	**0**	**1**	***3***
5:15 PM	2	0	1	1	*4*	0	0	2	1	*3*	15	0	0	6	*21*
5:30 PM	3	0	2	2	*7*	0	0	0	3	*3*	7	0	0	0	*7*
5:45 PM	3	0	1	2	*6*	0	0	0	1	*1*	7	0	0	3	*10*
6:00 PM	3	0	1	1	*5*	0	0	0	2	*2*	4	0	0	1	*5*
6:15 PM	5	0	0	1	*6*	0	0	0	0	*0*	0	0	0	0	*0*
6:30 PM	1	0	1	1	*3*	0	0	0	1	*1*	6	0	0	3	*9*
6:45 PM	1	0	0	0	*1*	0	0	0	2	*2*	1	0	0	0	*1*
Count Total	93	0	26	47	*166*	1	1	11	21	*34*	61	1	0	24	*86*
Peak Hour	**14**	**0**	**4**	**7**	***25***	**1**	**0**	**0**	**4**	***5***	**11**	**0**	**0**	**2**	***13***

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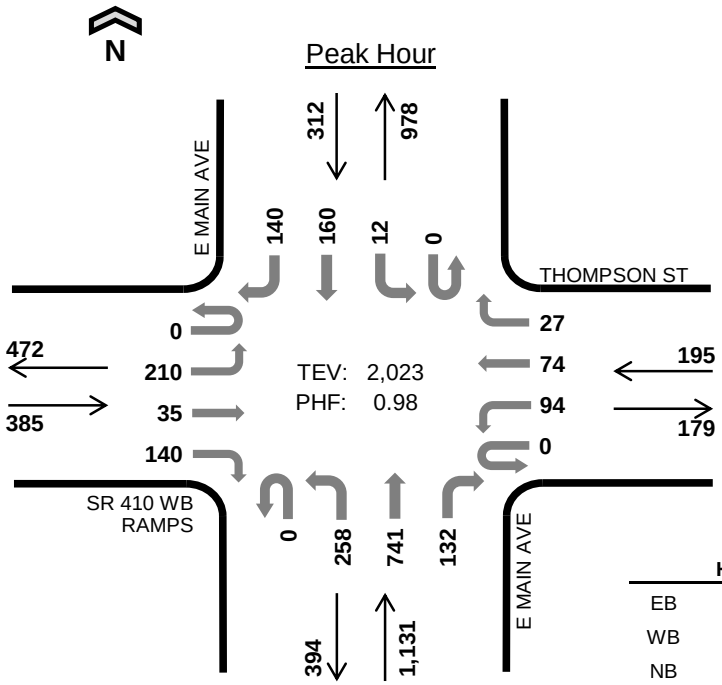
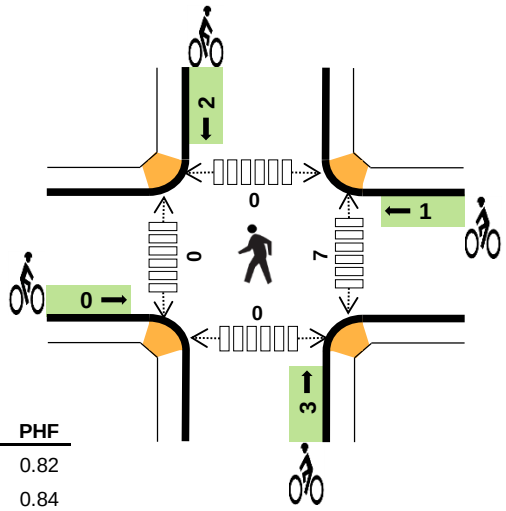
E MAIN AVE
SR 410 WB RAMPS

Date: Tue, Sep 13, 2016
Count Period: 4:30 AM to 9:30 AM
Peak Hour: 7:00 AM to 8:00 AM





	HV %:	PHF
EB	1.6%	0.82
WB	2.6%	0.84
NB	3.3%	0.92
SB	7.7%	0.74
TOTAL	3.6%	0.98

Five-Hour Count Summaries

Interval Start	SR 410 WB RAMPS				THOMPSON ST				E MAIN AVE				E MAIN AVE				15-min Total	Rolling One Hour
	Eastbound				Westbound				Northbound				Southbound					
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
7:00 AM	0	39	19	27	0	25	23	8	0	73	186	47	0	4	26	32	509	0
7:15 AM	0	50	3	27	0	28	21	9	0	72	171	30	0	4	55	46	516	0
7:30 AM	0	67	12	38	0	13	18	6	0	52	186	22	0	2	45	28	489	0
7:45 AM	0	54	1	48	0	28	12	4	0	61	198	33	0	2	34	34	509	2,023
Peak Hour	0	210	35	140	0	94	74	27	0	258	741	132	0	12	160	140	2,023	0

Note: For all three-hour count summary, see next page.

Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
7:00 AM	2	0	13	4	*19*	0	0	1	0	*1*	3	0	0	0	*3*
7:15 AM	0	3	11	7	*21*	0	0	0	1	*1*	2	0	0	0	*2*
7:30 AM	3	0	10	9	*22*	0	1	0	1	*2*	0	0	0	0	*0*
7:45 AM	1	2	3	4	*10*	0	0	2	0	*2*	2	0	0	0	*2*
Peak Hour	6	5	37	24	*72*	0	1	3	2	*6*	7	0	0	0	*7*

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Five-Hour Count Summaries

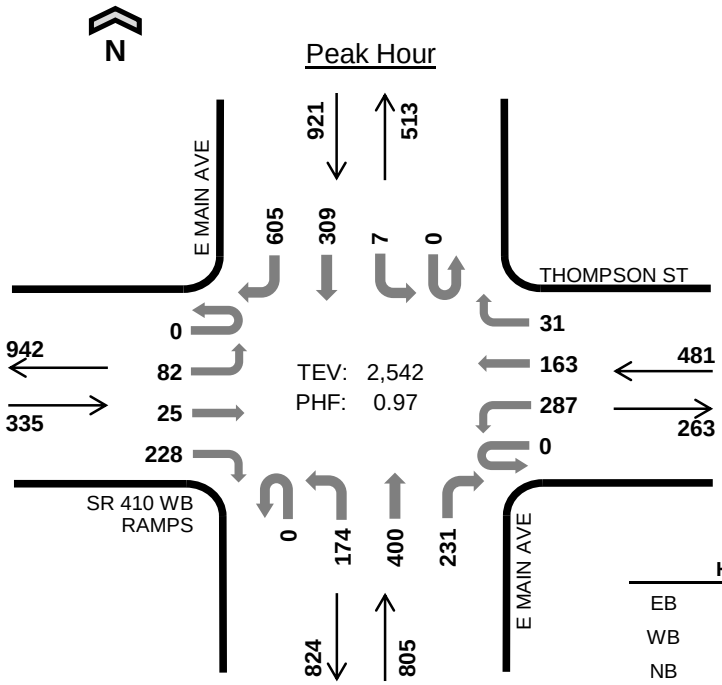
Interval Start	SR 410 WB RAMPS				THOMPSON ST				E MAIN AVE				E MAIN AVE				15-min Total	Rolling One Hour
	Eastbound				Westbound				Northbound				Southbound					
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
4:30 AM	0	19	10	5	0	1	6	0	0	94	139	16	0	0	12	21	323	0
4:45 AM	0	40	32	6	0	0	19	2	0	73	181	26	0	0	9	14	402	0
5:00 AM	0	38	36	8	0	9	10	3	0	70	184	27	0	0	13	16	414	0
5:15 AM	0	50	16	5	0	5	7	2	0	53	253	19	0	1	11	25	447	1,586
5:30 AM	0	45	24	9	0	6	8	5	0	44	238	21	0	0	21	35	456	1,719
5:45 AM	0	34	7	22	0	6	6	8	0	67	231	20	0	0	17	19	437	1,754
6:00 AM	1	46	23	8	0	10	10	6	0	61	192	46	0	0	10	25	438	1,778
6:15 AM	0	29	12	12	0	16	20	8	0	57	210	33	0	0	19	26	442	1,773
6:30 AM	0	45	11	10	0	13	15	6	0	54	217	41	0	1	30	23	466	1,783
6:45 AM	0	45	14	15	0	21	20	3	0	38	192	55	0	6	29	31	469	1,815
7:00 AM	**0**	**39**	**19**	**27**	**0**	**25**	**23**	**8**	**0**	**73**	**186**	**47**	**0**	**4**	**26**	**32**	**509**	1,886
7:15 AM	**0**	**50**	**3**	**27**	**0**	**28**	**21**	**9**	**0**	**72**	**171**	**30**	**0**	**4**	**55**	**46**	**516**	1,960
7:30 AM	**0**	**67**	**12**	**38**	**0**	**13**	**18**	**6**	**0**	**52**	**186**	**22**	**0**	**2**	**45**	**28**	**489**	1,983
7:45 AM	**0**	**54**	**1**	**48**	**0**	**28**	**12**	**4**	**0**	**61**	**198**	**33**	**0**	**2**	**34**	**34**	**509**	**2,023**
8:00 AM	0	20	5	44	0	16	11	3	0	62	192	37	0	5	46	38	479	1,993
8:15 AM	0	27	5	52	0	22	10	9	0	68	156	31	0	4	48	40	472	1,949
8:30 AM	0	30	2	37	0	20	8	2	0	64	161	25	0	2	53	37	441	1,901
8:45 AM	0	21	2	56	0	9	14	3	0	72	157	39	0	2	50	53	478	1,870
9:00 AM	0	20	3	51	0	17	16	3	0	66	119	29	0	2	46	45	417	1,808
9:15 AM	0	28	0	33	0	16	15	5	0	75	115	18	0	3	59	52	419	1,755
Count Total	1	747	237	513	0	281	269	95	0	1,276	3,678	615	0	38	633	640	9,023	0
Peak Hour	**0**	**210**	**35**	**140**	**0**	**94**	**74**	**27**	**0**	**258**	**741**	**132**	**0**	**12**	**160**	**140**	**2,023**	**0**

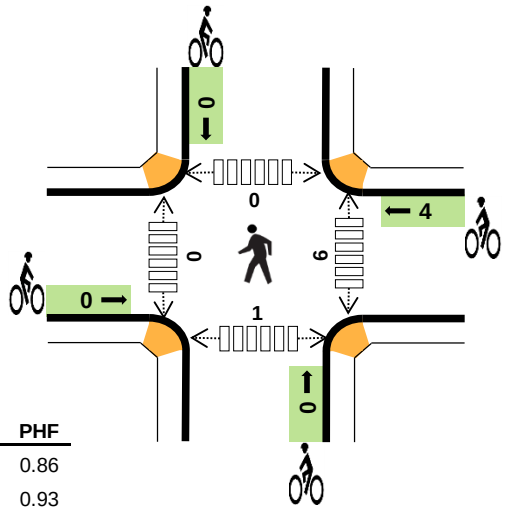
Note: Five-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
4:30 AM	0	0	4	4	*8*	0	0	1	0	*1*	0	0	0	0	*0*
4:45 AM	0	0	4	6	*10*	0	0	0	0	*0*	2	0	0	0	*2*
5:00 AM	1	1	7	2	*11*	0	0	0	0	*0*	2	0	0	0	*2*
5:15 AM	2	0	12	6	*20*	0	0	0	0	*0*	0	0	0	0	*0*
5:30 AM	2	1	5	6	*14*	0	0	3	0	*3*	1	0	0	0	*1*
5:45 AM	0	0	6	1	*7*	0	0	1	0	*1*	1	0	0	0	*1*
6:00 AM	1	2	7	4	*14*	0	0	0	0	*0*	3	0	0	1	*4*
6:15 AM	2	0	9	4	*15*	0	0	2	0	*2*	3	0	0	0	*3*
6:30 AM	0	1	9	7	*17*	0	0	1	0	*1*	1	0	0	0	*1*
6:45 AM	2	1	12	6	*21*	0	0	0	0	*0*	6	0	0	0	*6*
7:00 AM	**2**	**0**	**13**	**4**	***19***	**0**	**0**	**1**	**0**	***1***	**3**	**0**	**0**	**0**	*3*
7:15 AM	**0**	**3**	**11**	**7**	***21***	**0**	**0**	**0**	**1**	***1***	**2**	**0**	**0**	**0**	*2*
7:30 AM	**3**	**0**	**10**	**9**	***22***	**0**	**1**	**0**	**1**	***2***	**0**	**0**	**0**	**0**	*0*
7:45 AM	**1**	**2**	**3**	**4**	***10***	**0**	**0**	**2**	**0**	***2***	**2**	**0**	**0**	**0**	***2***
8:00 AM	1	0	13	8	*22*	0	0	0	1	*1*	0	0	0	0	*0*
8:15 AM	3	2	12	9	*26*	0	0	0	0	*0*	4	0	0	0	*4*
8:30 AM	0	2	13	8	*23*	0	1	0	0	*1*	0	0	0	0	*0*
8:45 AM	2	1	16	10	*29*	0	0	0	0	*0*	0	0	0	0	*0*
9:00 AM	1	0	18	8	*27*	0	0	0	1	*1*	0	0	0	0	*0*
9:15 AM	1	2	12	12	*27*	0	0	0	0	*0*	1	0	0	0	*1*
Count Total	24	18	196	125	*363*	0	2	11	4	*17*	31	0	0	1	*32*
Peak Hour	**6**	**5**	**37**	**24**	***72***	**0**	**1**	**3**	**2**	***6***	**7**	**0**	**0**	**0**	***7***

E MAIN AVE
SR 410 WB RAMPS

Date: Tue, Sep 13, 2016
Count Period: 2:00 PM to 7:00 PM
Peak Hour: 4:15 PM to 5:15 PM





	HV %:	PHF
EB	3.9%	0.86
WB	2.1%	0.93
NB	2.0%	0.85
SB	2.6%	0.91
TOTAL	2.5%	0.97

Five-Hour Count Summaries

Interval Start	SR 410 WB RAMPS				THOMPSON ST				E MAIN AVE				E MAIN AVE				15-min Total	Rolling One Hour
	Eastbound				Westbound				Northbound				Southbound					
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
4:15 PM	0	29	5	63	0	76	38	12	0	31	98	58	0	0	73	151	634	0
4:30 PM	0	21	4	55	0	74	35	7	0	63	106	68	0	0	84	135	652	0
4:45 PM	0	22	9	56	0	70	34	6	0	35	102	46	0	2	83	141	606	0
5:00 PM	0	10	7	54	0	67	56	6	0	45	94	59	0	5	69	178	650	2,542
Peak Hour	0	82	25	228	0	287	163	31	0	174	400	231	0	7	309	605	2,542	0

Note: For all three-hour count summary, see next page.

Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
4:15 PM	5	2	5	7	*19*	0	0	0	0	*0*	2	0	0	0	*2*
4:30 PM	0	4	2	1	*7*	0	1	0	0	*1*	0	0	0	0	*0*
4:45 PM	5	3	8	6	*22*	0	1	0	0	*1*	2	0	0	1	*3*
5:00 PM	3	1	1	10	*15*	0	2	0	0	*2*	2	0	0	0	*2*
Peak Hour	13	10	16	24	*63*	0	4	0	0	*4*	6	0	0	1	*7*

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Five-Hour Count Summaries

Interval Start	SR 410 WB RAMPS				THOMPSON ST				E MAIN AVE				E MAIN AVE				15-min Total	Rolling One Hour
	Eastbound				Westbound				Northbound				Southbound					
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
2:00 PM	0	12	0	32	0	25	19	3	0	43	122	45	0	7	123	110	541	0
2:15 PM	0	17	2	28	0	34	21	7	0	61	126	44	0	4	113	105	562	0
2:30 PM	0	22	3	32	0	41	24	4	0	44	120	47	0	5	143	133	618	0
2:45 PM	0	18	3	40	0	42	23	2	0	46	124	46	0	9	120	143	616	2,337
3:00 PM	0	21	2	44	0	43	13	4	0	41	136	40	0	3	95	132	574	2,370
3:15 PM	0	24	3	51	0	67	29	3	0	34	132	49	0	5	72	131	600	2,408
3:30 PM	0	22	5	56	0	46	31	7	0	55	112	53	0	3	92	136	618	2,408
3:45 PM	0	18	5	61	0	63	32	8	0	37	100	57	0	2	86	128	597	2,389
4:00 PM	0	22	7	61	0	73	42	7	0	44	76	43	0	0	92	167	634	2,449
4:15 PM	**0**	**29**	**5**	**63**	**0**	**76**	**38**	**12**	**0**	**31**	**98**	**58**	**0**	**0**	**73**	**151**	**634**	2,483
4:30 PM	**0**	**21**	**4**	**55**	**0**	**74**	**35**	**7**	**0**	**63**	**106**	**68**	**0**	**0**	**84**	**135**	**652**	2,517
4:45 PM	**0**	**22**	**9**	**56**	**0**	**70**	**34**	**6**	**0**	**35**	**102**	**46**	**0**	**2**	**83**	**141**	**606**	2,526
5:00 PM	**0**	**10**	**7**	**54**	**0**	**67**	**56**	**6**	**0**	**45**	**94**	**59**	**0**	**5**	**69**	**178**	**650**	**2,542**
5:15 PM	0	13	4	52	0	77	46	2	0	55	95	49	0	4	73	127	597	2,505
5:30 PM	0	9	8	53	0	69	30	8	0	46	79	51	0	1	90	147	591	2,444
5:45 PM	0	20	4	52	0	63	23	7	0	40	85	54	0	2	99	125	574	2,412
6:00 PM	0	5	3	46	0	61	31	3	0	37	89	40	0	2	94	103	514	2,276
6:15 PM	0	8	7	52	0	56	24	0	0	35	82	61	0	3	89	83	500	2,179
6:30 PM	0	15	6	54	0	56	26	6	0	32	58	35	0	5	117	60	470	2,058
6:45 PM	0	7	1	34	0	25	18	2	0	44	62	39	0	4	118	53	407	1,891
Count Total	0	335	88	976	0	1,128	595	104	0	868	1,998	984	0	66	1,925	2,488	11,555	0
Peak Hour	**0**	**82**	**25**	**228**	**0**	**287**	**163**	**31**	**0**	**174**	**400**	**231**	**0**	**7**	**309**	**605**	**2,542**	**0**

Note: Five-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
2:00 PM	0	1	12	16	*29*	0	0	1	0	*1*	0	0	0	0	*0*
2:15 PM	3	1	9	12	*25*	0	1	1	2	*4*	1	0	0	0	*1*
2:30 PM	6	0	10	8	*24*	0	1	0	0	*1*	1	0	0	0	*1*
2:45 PM	1	3	10	11	*25*	0	0	1	1	*2*	0	1	0	0	*1*
3:00 PM	1	1	7	12	*21*	0	0	0	0	*0*	2	0	0	0	*2*
3:15 PM	1	4	7	7	*19*	0	0	4	2	*6*	0	0	0	0	*0*
3:30 PM	2	2	7	7	*18*	0	0	0	0	*0*	2	0	0	2	*4*
3:45 PM	9	1	10	5	*25*	0	1	0	0	*1*	2	0	0	2	*4*
4:00 PM	0	2	5	7	*14*	0	0	1	0	*1*	0	0	0	0	*0*
4:15 PM	**5**	**2**	**5**	**7**	***19***	**0**	**0**	**0**	**0**	***0***	**2**	**0**	**0**	**0**	*2*
4:30 PM	**0**	**4**	**2**	**1**	***7***	**0**	**1**	**0**	**0**	***1***	**0**	**0**	**0**	**0**	*0*
4:45 PM	**5**	**3**	**8**	**6**	***22***	**0**	**1**	**0**	**0**	***1***	**2**	**0**	**0**	**1**	*3*
5:00 PM	**3**	**1**	**1**	**10**	***15***	**0**	**2**	**0**	**0**	***2***	**2**	**0**	**0**	**0**	***2***
5:15 PM	2	1	2	5	*10*	0	0	2	1	*3*	6	0	0	3	*9*
5:30 PM	1	0	3	5	*9*	0	2	0	1	*3*	6	0	0	3	*9*
5:45 PM	1	2	4	7	*14*	0	0	0	1	*1*	2	0	0	0	*2*
6:00 PM	1	1	3	4	*9*	0	1	0	1	*2*	4	0	0	0	*4*
6:15 PM	1	1	4	4	*10*	0	0	0	0	*0*	0	0	0	0	*0*
6:30 PM	1	1	0	3	*5*	0	0	0	1	*1*	2	0	0	0	*2*
6:45 PM	1	1	2	1	*5*	0	2	0	0	*2*	0	0	0	0	*0*
Count Total	44	32	111	138	*325*	0	12	10	10	*32*	34	1	0	11	*46*
Peak Hour	**13**	**10**	**16**	**24**	***63***	**0**	**4**	**0**	**0**	***4***	**6**	**0**	**0**	**1**	***7***

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Appendix B

Design Year 2035 Traffic Volume Calculations

AM Peak Hour

	2016 Existing	2035 Background Growth Only	2035 Sounder Growth	2035 Background + Sounder	2035 Rounded
Traffic/E Main and Thompson/SR 410 WB Ramps	1920	2551	206	2347	2750
Eastbound	295	392	27	356	420
left	175	233		195	235
thru	70	93	27	105	120
right	50	66		56	65
Westbound	80	106	0	89	105
left	30	40		33	40
thru	30	40		33	40
right	20	27		22	25
Northbound	1370	1820	179	1707	1995
left	245	326		273	325
thru	1,010	1342		1126	1340
right	115	153	179	307	330
Southbound	175	233	0	195	230
left	5	7		6	5
thru	65	86		72	85
right	105	140		117	140
E Main and SR 410 EB Ramps	1620	2152	179	1986	2325
Eastbound	685	910	31	795	940
left	625	830	31	728	860
right	60	80		67	80
Northbound	790	1050	148	1029	1195
left	45	60		50	60
thru	745	990	148	979	1135
Southbound	145	193	0	162	190
thru	120	159		134	155
right	25	33		28	35

PM Peak Hour

	2016 Existing	2035 Background Growth Only	2035 Sounder Growth	2035 Background + Sounder	2035 Rounded
Traffic/E Main and Thompson/SR 410 WB Ramps	2530	3232	279	3230	3510
Eastbound	335	428	0	391	425
left	80	102		93	100
thru	25	32		29	30
right	230	294		268	295
Westbound	485	620	279	845	900
left	290	370	237	575	605
thru	165	211	42	234	255
right	30	38		35	40
Northbound	805	1028	0	939	1030
left	175	224		204	225
thru	400	511		467	510
right	230	294		268	295
Southbound	905	1156	0	1056	1155
left	5	6		6	5
thru	295	377		344	375
right	605	773		706	775
E Main and SR 410 EB Ramps	2385	3047	237	3019	3280
Eastbound	830	1060	0	968	1060
left	265	339		309	340
right	565	722		659	720
Northbound	740	945	0	863	945
left	200	255		233	255
thru	540	690		630	690
Southbound	815	1041	237	1188	1275
thru	720	920	201	1041	1120
right	95	121	36	147	155

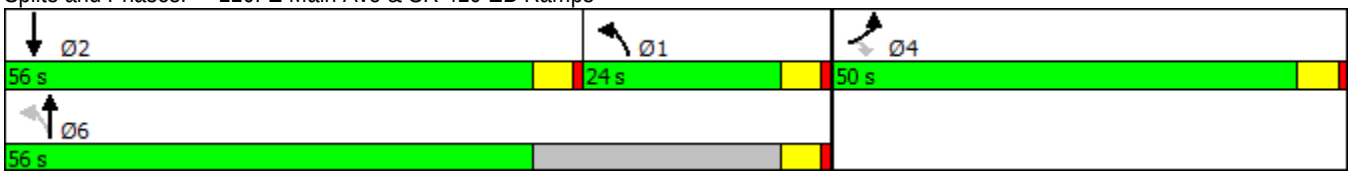
Appendix C

Operations Analysis Results

Lane Group	EBL	EBR	NBL	NBT	SBT
Lane Configurations					
Traffic Volume (vph)	625	60	45	745	120
Future Volume (vph)	625	60	45	745	120
Turn Type	Prot	Perm	pm+pt	NA	NA
Protected Phases	4		1	6	2
Permitted Phases		4	6		
Detector Phase	4	4	1	6	2
Switch Phase					
Minimum Initial (s)	10.0	10.0	6.0	10.0	10.0
Minimum Split (s)	30.0	30.0	11.0	15.0	15.0
Total Split (s)	50.0	50.0	24.0	56.0	56.0
Total Split (%)	38.5%	38.5%	18.5%	43.1%	43.1%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0
Lead/Lag			Lag		Lead
Lead-Lag Optimize?			Yes		Yes
Recall Mode	None	None	None	Min	Min
Act Effct Green (s)	45.2	45.2	45.3	45.3	26.3
Actuated g/C Ratio	0.45	0.45	0.45	0.45	0.26
v/c Ratio	0.84	0.09	0.08	0.94	0.36
Control Delay	37.8	8.4	15.6	45.5	36.3
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	37.8	8.4	15.6	45.5	36.3
LOS	D	A	B	D	D
Approach Delay	35.2			43.8	36.3
Approach LOS	D			D	D

Intersection Summary	
Cycle Length: 130	
Actuated Cycle Length: 100.5	
Natural Cycle: 80	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.94	
Intersection Signal Delay: 39.5	Intersection LOS: D
Intersection Capacity Utilization 82.2%	ICU Level of Service E
Analysis Period (min) 15	

Splits and Phases: 110: E Main Ave & SR 410 EB Ramps

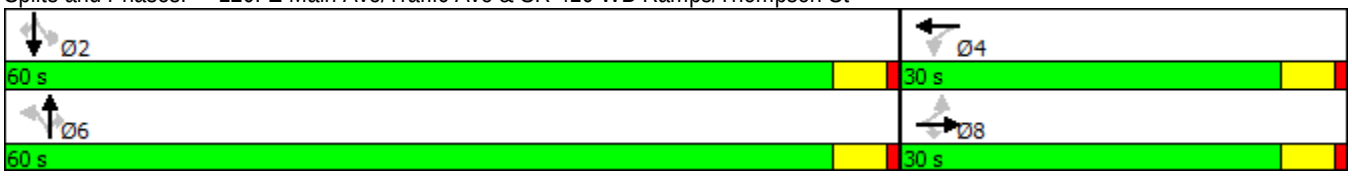


Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Traffic Volume (vph)	175	70	50	30	30	245	1010	115	5	65	105
Future Volume (vph)	175	70	50	30	30	245	1010	115	5	65	105
Turn Type	Perm	NA	Perm	Perm	NA	Perm	NA	Perm	Perm	NA	Perm
Protected Phases		8			4		6			2	
Permitted Phases	8		8	4		6		6	2		2
Detector Phase	8	8	8	4	4	6	6	6	2	2	2
Switch Phase											
Minimum Initial (s)	6.0	6.0	6.0	6.0	6.0	10.0	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	10.6	10.6	10.6	10.6	10.6	25.6	25.6	25.6	14.6	14.6	14.6
Total Split (s)	30.0	30.0	30.0	30.0	30.0	60.0	60.0	60.0	60.0	60.0	60.0
Total Split (%)	33.3%	33.3%	33.3%	33.3%	33.3%	66.7%	66.7%	66.7%	66.7%	66.7%	66.7%
Yellow Time (s)	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)		4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6
Lead/Lag											
Lead-Lag Optimize?											
Recall Mode	None	None	None	None	None	Min	Min	Min	Min	Min	Min
Act Effct Green (s)		19.0	19.0	19.0	19.0	51.7	51.7	51.7	51.7	51.7	51.7
Actuated g/C Ratio		0.24	0.24	0.24	0.24	0.64	0.64	0.64	0.64	0.64	0.64
v/c Ratio		0.75	0.12	0.16	0.12	0.31	0.91	0.12	0.04	0.06	0.11
Control Delay		44.0	8.2	27.1	17.5	8.3	26.8	2.8	7.6	6.4	1.8
Queue Delay		0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0
Total Delay		44.0	8.2	27.1	17.5	8.3	28.1	2.8	7.6	6.4	1.8
LOS		D	A	C	B	A	C	A	A	A	A
Approach Delay		38.0			21.1		22.4			3.7	
Approach LOS		D			C		C			A	

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 80.2
Natural Cycle: 80
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.91
Intersection Signal Delay: 23.0 Intersection LOS: C
Intersection Capacity Utilization 83.8% ICU Level of Service E
Analysis Period (min) 15

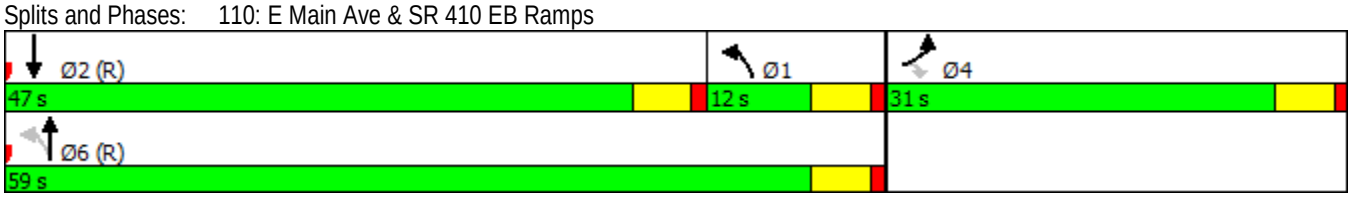
Splits and Phases: 120: E Main Ave/Traffic Ave & SR 410 WB Ramps/Thompson St



Lane Group	EBL	EBR	NBL	NBT	SBT
Lane Configurations					
Traffic Volume (vph)	265	565	200	540	720
Future Volume (vph)	265	565	200	540	720
Turn Type	Prot	Perm	pm+pt	NA	NA
Protected Phases	4		1	6	2
Permitted Phases		4	6		
Detector Phase	4	4	1	6	2
Switch Phase					
Minimum Initial (s)	10.0	10.0	6.0	10.0	10.0
Minimum Split (s)	30.0	30.0	11.0	15.0	15.0
Total Split (s)	31.0	31.0	12.0	59.0	47.0
Total Split (%)	34.4%	34.4%	13.3%	65.6%	52.2%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0
Lead/Lag			Lag		Lead
Lead-Lag Optimize?			Yes		Yes
Recall Mode	None	None	None	C-Min	C-Min
Act Effct Green (s)	24.8	24.8	55.2	55.2	43.2
Actuated g/C Ratio	0.28	0.28	0.61	0.61	0.48
v/c Ratio	0.57	0.96	0.95	0.49	1.05
Control Delay	33.0	46.0	81.8	11.8	72.7
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	33.0	46.0	81.8	11.8	72.7
LOS	C	D	F	B	E
Approach Delay	41.8			30.8	72.7
Approach LOS	D			C	E

Intersection Summary	
Cycle Length: 90	
Actuated Cycle Length: 90	
Offset: 0 (0%), Referenced to phase 2:SBT and 6:NBTL, Start of Green	
Natural Cycle: 90	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 1.05	
Intersection Signal Delay: 48.9	Intersection LOS: D
Intersection Capacity Utilization 90.9%	ICU Level of Service E
Analysis Period (min) 15	

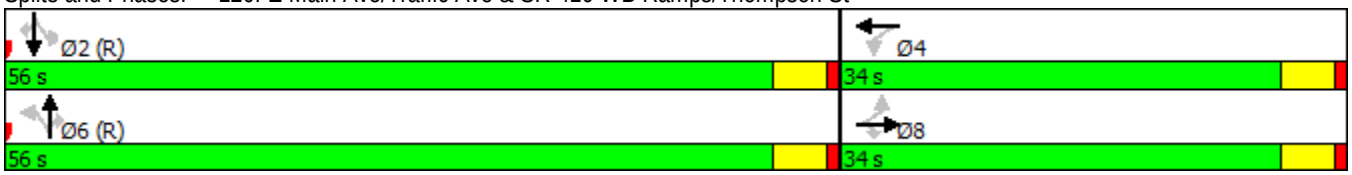
Splits and Phases: 110: E Main Ave & SR 410 EB Ramps



Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Traffic Volume (vph)	80	25	230	290	165	175	400	230	5	295	605
Future Volume (vph)	80	25	230	290	165	175	400	230	5	295	605
Turn Type	Perm	NA	Perm	Perm	NA	Perm	NA	Perm	Perm	NA	Perm
Protected Phases		8			4		6			2	
Permitted Phases	8		8	4		6		6	2		2
Detector Phase	8	8	8	4	4	6	6	6	2	2	2
Switch Phase											
Minimum Initial (s)	6.0	6.0	6.0	6.0	6.0	10.0	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	10.6	10.6	10.6	10.6	10.6	25.6	25.6	25.6	14.6	14.6	14.6
Total Split (s)	34.0	34.0	34.0	34.0	34.0	56.0	56.0	56.0	56.0	56.0	56.0
Total Split (%)	37.8%	37.8%	37.8%	37.8%	37.8%	62.2%	62.2%	62.2%	62.2%	62.2%	62.2%
Yellow Time (s)	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)		4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6
Lead/Lag											
Lead-Lag Optimize?											
Recall Mode	None	None	None	None	None	C-Min	C-Min	C-Min	C-Min	C-Min	C-Min
Act Effct Green (s)		25.9	25.9	25.9	25.9	54.9	54.9	54.9	54.9	54.9	54.9
Actuated g/C Ratio		0.29	0.29	0.29	0.29	0.61	0.61	0.61	0.61	0.61	0.61
v/c Ratio		0.32	0.38	0.79	0.37	0.30	0.38	0.24	0.01	0.27	0.52
Control Delay		25.6	4.7	43.8	24.4	15.0	9.5	1.2	9.8	10.4	3.4
Queue Delay		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		25.6	4.7	43.8	24.4	15.0	9.5	1.2	9.8	10.4	3.4
LOS		C	A	D	C	B	A	A	A	B	A
Approach Delay		11.2			36.0		8.3			5.7	
Approach LOS		B			D		A			A	

Intersection Summary	
Cycle Length: 90	
Actuated Cycle Length: 90	
Offset: 0 (0%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green	
Natural Cycle: 50	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.79	
Intersection Signal Delay: 13.1	Intersection LOS: B
Intersection Capacity Utilization 75.3%	ICU Level of Service D
Analysis Period (min) 15	

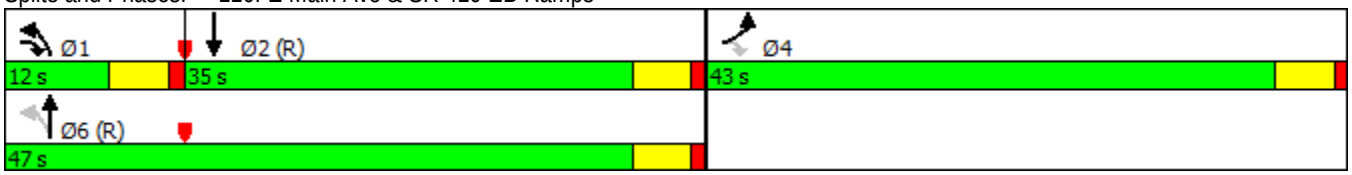
Splits and Phases: 120: E Main Ave/Traffic Ave & SR 410 WB Ramps/Thompson St



Lane Group	EBL	EBR	NBL	NBT	SBT
Lane Configurations					
Traffic Volume (vph)	860	80	60	1135	155
Future Volume (vph)	860	80	60	1135	155
Turn Type	Prot	pm+ov	pm+pt	NA	NA
Protected Phases	4	1	1	6	2
Permitted Phases		4	6		
Detector Phase	4	4	1	6	2
Switch Phase					
Minimum Initial (s)	10.0	6.0	6.0	10.0	10.0
Minimum Split (s)	30.0	11.0	11.0	15.0	15.0
Total Split (s)	43.0	12.0	12.0	47.0	35.0
Total Split (%)	47.8%	13.3%	13.3%	52.2%	38.9%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0
Lead/Lag		Lead	Lead		Lag
Lead-Lag Optimize?		Yes	Yes		Yes
Recall Mode	None	None	None	C-Min	C-Min
Act Effct Green (s)	38.0	43.5	42.0	42.0	32.5
Actuated g/C Ratio	0.42	0.48	0.47	0.47	0.36
v/c Ratio	1.21	0.11	0.12	1.36	0.32
Control Delay	134.0	2.7	14.0	195.2	24.1
Queue Delay	3.4	0.0	0.0	1.2	0.0
Total Delay	137.4	2.7	14.0	196.4	24.1
LOS	F	A	B	F	C
Approach Delay	126.0			187.3	24.1
Approach LOS	F			F	C

Intersection Summary	
Cycle Length: 90	
Actuated Cycle Length: 90	
Offset: 59 (66%), Referenced to phase 2:SBT and 6:NBTL, Start of Green	
Natural Cycle: 150	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 1.36	
Intersection Signal Delay: 149.2	Intersection LOS: F
Intersection Capacity Utilization 115.7%	ICU Level of Service H
Analysis Period (min) 15	

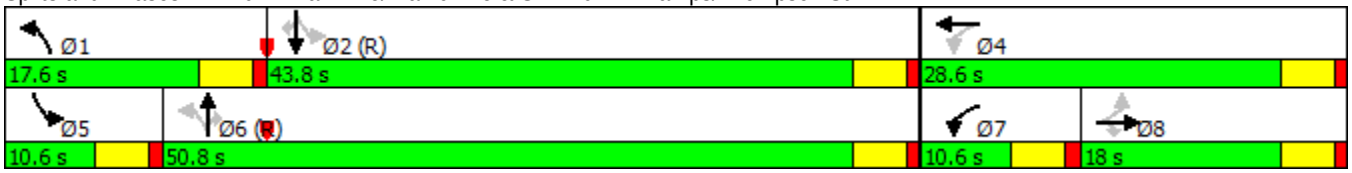
Splits and Phases: 110: E Main Ave & SR 410 EB Ramps



Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Traffic Volume (vph)	235	120	65	40	40	325	1340	330	5	85	140
Future Volume (vph)	235	120	65	40	40	325	1340	330	5	85	140
Turn Type	Perm	NA	Perm	pm+pt	NA	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		8		7	4	1	6		5	2	
Permitted Phases	8		8	4		6		6	2		2
Detector Phase	8	8	8	7	4	1	6	6	5	2	2
Switch Phase											
Minimum Initial (s)	6.0	6.0	6.0	6.0	6.0	6.0	10.0	10.0	6.0	10.0	10.0
Minimum Split (s)	10.6	10.6	10.6	10.6	10.6	10.6	25.6	25.6	10.6	14.6	14.6
Total Split (s)	18.0	18.0	18.0	10.6	28.6	17.6	50.8	50.8	10.6	43.8	43.8
Total Split (%)	20.0%	20.0%	20.0%	11.8%	31.8%	19.6%	56.4%	56.4%	11.8%	48.7%	48.7%
Yellow Time (s)	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)		4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6
Lead/Lag	Lag	Lag	Lag	Lead		Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	None	None	None	None	None	C-Min	C-Min	None	C-Min	C-Min
Act Effct Green (s)		17.6	17.6	24.0	24.0	56.8	54.7	54.7	46.1	40.1	40.1
Actuated g/C Ratio		0.20	0.20	0.27	0.27	0.63	0.61	0.61	0.51	0.45	0.45
v/c Ratio		1.33	0.15	0.22	0.14	0.43	1.28	0.36	0.02	0.11	0.18
Control Delay		205.9	0.7	27.8	17.9	4.3	145.0	5.5	7.2	15.4	1.6
Queue Delay		0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0
Total Delay		205.9	0.7	27.8	17.9	4.3	145.2	5.5	7.2	15.4	1.6
LOS		F	A	C	B	A	F	A	A	B	A
Approach Delay		174.2			21.7		99.1			6.8	
Approach LOS		F			C		F			A	

Intersection Summary	
Cycle Length: 90	
Actuated Cycle Length: 90	
Offset: 0 (0%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green	
Natural Cycle: 150	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 1.33	
Intersection Signal Delay: 99.8	Intersection LOS: F
Intersection Capacity Utilization 108.1%	ICU Level of Service G
Analysis Period (min) 15	

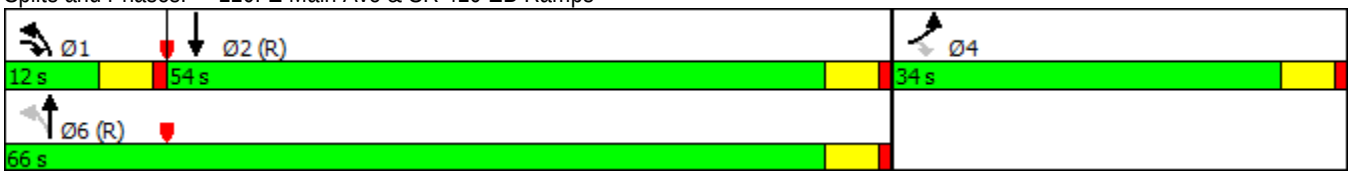
Splits and Phases: 120: E Main Ave/Traffic Ave & SR 410 WB Ramps/Thompson St



Lane Group	EBL	EBR	NBL	NBT	SBT
Lane Configurations					
Traffic Volume (vph)	340	720	255	690	1120
Future Volume (vph)	340	720	255	690	1120
Turn Type	Prot	pm+ov	pm+pt	NA	NA
Protected Phases	4	1	1	6	2
Permitted Phases		4	6		
Detector Phase	4	4	1	6	2
Switch Phase					
Minimum Initial (s)	10.0	6.0	6.0	10.0	10.0
Minimum Split (s)	30.0	11.0	11.0	15.0	15.0
Total Split (s)	34.0	12.0	12.0	66.0	54.0
Total Split (%)	34.0%	12.0%	12.0%	66.0%	54.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0
Lead/Lag		Lead	Lead		Lag
Lead-Lag Optimize?		Yes	Yes		Yes
Recall Mode	None	None	None	C-Min	C-Min
Act Effct Green (s)	29.0	36.0	61.0	61.0	49.0
Actuated g/C Ratio	0.29	0.36	0.61	0.61	0.49
v/c Ratio	0.70	1.28	1.34	0.63	1.60
Control Delay	40.0	166.9	205.8	15.5	296.0
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	40.0	166.9	205.8	15.5	296.0
LOS	D	F	F	B	F
Approach Delay	126.2			66.8	296.0
Approach LOS	F			E	F

Intersection Summary	
Cycle Length: 100	
Actuated Cycle Length: 100	
Offset: 42 (42%), Referenced to phase 2:SBT and 6:NBTL, Start of Green	
Natural Cycle: 150	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 1.60	
Intersection Signal Delay: 175.1	Intersection LOS: F
Intersection Capacity Utilization 127.3%	ICU Level of Service H
Analysis Period (min) 15	

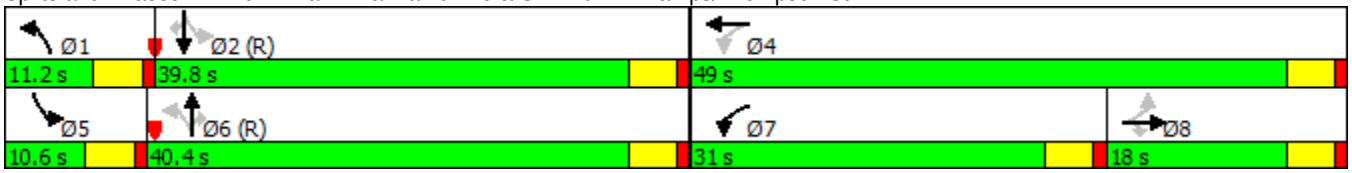
Splits and Phases: 110: E Main Ave & SR 410 EB Ramps



Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Traffic Volume (vph)	100	30	295	605	255	225	510	295	5	375	775
Future Volume (vph)	100	30	295	605	255	225	510	295	5	375	775
Turn Type	Perm	NA	Perm	pm+pt	NA	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		8		7	4	1	6		5	2	
Permitted Phases	8		8	4		6		6	2		2
Detector Phase	8	8	8	7	4	1	6	6	5	2	2
Switch Phase											
Minimum Initial (s)	6.0	6.0	6.0	6.0	6.0	6.0	10.0	10.0	6.0	10.0	10.0
Minimum Split (s)	10.6	10.6	10.6	10.6	10.6	10.6	25.6	25.6	10.6	14.6	14.6
Total Split (s)	18.0	18.0	18.0	31.0	49.0	11.2	40.4	40.4	10.6	39.8	39.8
Total Split (%)	18.0%	18.0%	18.0%	31.0%	49.0%	11.2%	40.4%	40.4%	10.6%	39.8%	39.8%
Yellow Time (s)	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)		4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6
Lead/Lag	Lag	Lag	Lag	Lead		Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	None	None	None	None	None	C-Min	C-Min	None	C-Min	C-Min
Act Effct Green (s)		13.4	13.4	47.0	47.0	43.0	41.7	41.7	38.6	32.6	32.6
Actuated g/C Ratio		0.13	0.13	0.47	0.47	0.43	0.42	0.42	0.39	0.33	0.33
v/c Ratio		0.92	0.68	0.93	0.34	0.80	0.71	0.41	0.02	0.64	0.96
Control Delay		100.4	15.4	46.1	18.4	53.4	27.0	7.6	14.8	33.5	35.9
Queue Delay		0.0	4.0	55.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0
Total Delay		100.4	19.5	101.1	18.4	53.4	27.0	7.6	14.8	33.7	35.9
LOS		F	B	F	B	D	C	A	B	C	D
Approach Delay		44.3			74.0		27.2			35.1	
Approach LOS		D			E		C			D	

Intersection Summary	
Cycle Length: 100	
Actuated Cycle Length: 100	
Offset: 0 (0%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green	
Natural Cycle: 90	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.96	
Intersection Signal Delay: 43.9	Intersection LOS: D
Intersection Capacity Utilization 106.2%	ICU Level of Service G
Analysis Period (min) 15	

Splits and Phases: 120: E Main Ave/Traffic Ave & SR 410 WB Ramps/Thompson St



Lane Group	EBL	EBR	NBL	NBT	SBT
Lane Configurations					
Traffic Volume (vph)	860	80	60	1135	155
Future Volume (vph)	860	80	60	1135	155
Turn Type	Prot	Perm	pm+pt	NA	NA
Protected Phases	4		1	6	2
Permitted Phases		4	6		
Detector Phase	4	4	1	6	2
Switch Phase					
Minimum Initial (s)	10.0	10.0	6.0	10.0	10.0
Minimum Split (s)	30.0	30.0	11.0	15.0	15.0
Total Split (s)	39.0	39.0	11.0	51.0	40.0
Total Split (%)	43.3%	43.3%	12.2%	56.7%	44.4%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0
Lead/Lag			Lead		Lag
Lead-Lag Optimize?			Yes		Yes
Recall Mode	None	None	None	C-Min	C-Min
Act Effct Green (s)	30.1	30.1	49.9	49.9	40.6
Actuated g/C Ratio	0.33	0.33	0.55	0.55	0.45
v/c Ratio	0.79	0.14	0.10	0.60	0.14
Control Delay	32.5	5.4	10.9	15.7	13.7
Queue Delay	0.2	0.0	0.0	0.1	0.0
Total Delay	32.8	5.4	10.9	15.8	13.7
LOS	C	A	B	B	B
Approach Delay	30.7			15.5	13.7
Approach LOS	C			B	B

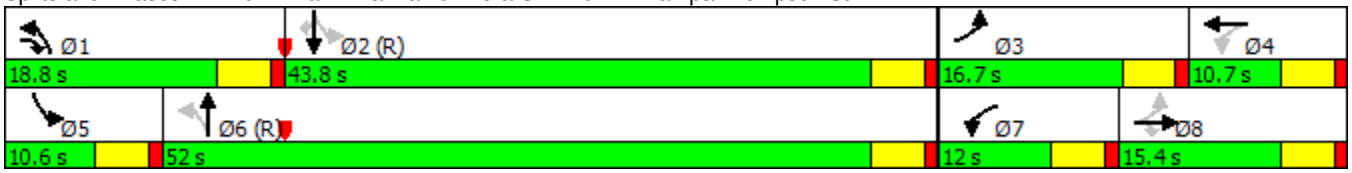
Intersection Summary	
Cycle Length: 90	
Actuated Cycle Length: 90	
Offset: 30 (33%), Referenced to phase 2:SBT and 6:NBTL, Start of Green	
Natural Cycle: 60	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.79	
Intersection Signal Delay: 21.5	Intersection LOS: C
Intersection Capacity Utilization 65.1%	ICU Level of Service C
Analysis Period (min) 15	

Splits and Phases: 110: E Main Ave & SR 410 EB Ramps

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	235	120	65	40	40	325	1340	5	85	140
Future Volume (vph)	235	120	65	40	40	325	1340	5	85	140
Turn Type	pm+pt	NA	pm+ov	pm+pt	NA	pm+pt	NA	pm+pt	NA	Perm
Protected Phases	3	8	1	7	4	1	6	5	2	
Permitted Phases	8		8	4		6		2		2
Detector Phase	3	8	8	7	4	1	6	5	2	2
Switch Phase										
Minimum Initial (s)	5.0	6.0	6.0	6.0	6.0	6.0	10.0	6.0	10.0	10.0
Minimum Split (s)	9.5	10.6	10.6	10.6	10.6	10.6	25.6	10.6	14.6	14.6
Total Split (s)	16.7	15.4	18.8	12.0	10.7	18.8	52.0	10.6	43.8	43.8
Total Split (%)	18.6%	17.1%	20.9%	13.3%	11.9%	20.9%	57.8%	11.8%	48.7%	48.7%
Yellow Time (s)	3.5	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6
Lead/Lag	Lead	Lag	Lead	Lead	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes				Yes					
Recall Mode	None	None	None	None	None	None	C-Min	None	C-Min	C-Min
Act Effct Green (s)	20.6	13.3	30.2	11.7	6.1	60.3	58.2	49.5	43.5	43.5
Actuated g/C Ratio	0.23	0.15	0.34	0.13	0.07	0.67	0.65	0.55	0.48	0.48
v/c Ratio	0.80	0.45	0.12	0.20	0.47	0.40	0.81	0.02	0.10	0.16
Control Delay	51.1	41.9	5.2	28.7	38.6	13.2	14.8	7.0	15.0	0.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0
Total Delay	51.1	41.9	5.2	28.7	38.6	13.2	15.0	7.0	15.0	0.4
LOS	D	D	A	C	D	B	B	A	B	A
Approach Delay		41.4			34.8		14.7		6.0	
Approach LOS		D			C		B		A	

Intersection Summary	
Cycle Length: 90	
Actuated Cycle Length: 90	
Offset: 0 (0%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green	
Natural Cycle: 90	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.81	
Intersection Signal Delay: 18.8	Intersection LOS: B
Intersection Capacity Utilization 77.7%	ICU Level of Service D
Analysis Period (min) 15	

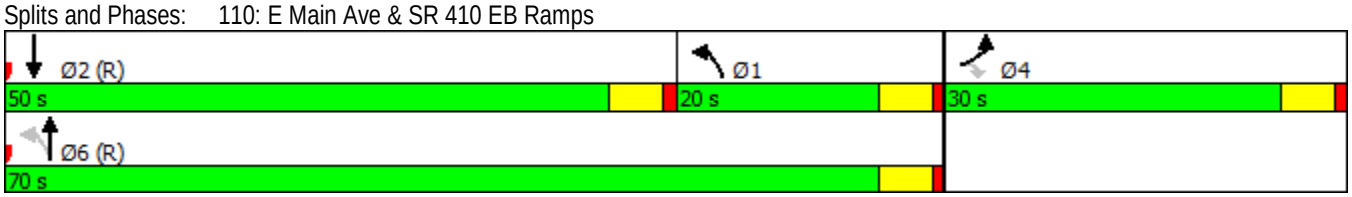
Splits and Phases: 120: E Main Ave/Traffic Ave & SR 410 WB Ramps/Thompson St



Lane Group	EBL	EBR	NBL	NBT	SBT
Lane Configurations					
Traffic Volume (vph)	340	720	255	690	1120
Future Volume (vph)	340	720	255	690	1120
Turn Type	Prot	Perm	pm+pt	NA	NA
Protected Phases	4		1	6	2
Permitted Phases		4	6		
Detector Phase	4	4	1	6	2
Switch Phase					
Minimum Initial (s)	10.0	10.0	6.0	10.0	10.0
Minimum Split (s)	30.0	30.0	11.0	15.0	25.0
Total Split (s)	30.0	30.0	20.0	70.0	50.0
Total Split (%)	30.0%	30.0%	20.0%	70.0%	50.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0
Lead/Lag			Lag		Lead
Lead-Lag Optimize?			Yes		Yes
Recall Mode	None	None	None	C-Min	C-Min
Act Effct Green (s)	22.1	22.1	67.9	67.9	49.7
Actuated g/C Ratio	0.22	0.22	0.68	0.68	0.50
v/c Ratio	0.81	0.70	0.79	0.30	0.83
Control Delay	31.2	15.8	46.3	7.2	24.4
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	31.2	15.8	46.3	7.2	24.4
LOS	C	B	D	A	C
Approach Delay	25.9			17.8	24.4
Approach LOS	C			B	C

Intersection Summary	
Cycle Length: 100	
Actuated Cycle Length: 100	
Offset: 89 (89%), Referenced to phase 2:SBT and 6:NBTL, Start of Green	
Natural Cycle: 90	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.83	
Intersection Signal Delay: 23.0	Intersection LOS: C
Intersection Capacity Utilization 83.2%	ICU Level of Service E
Analysis Period (min) 15	

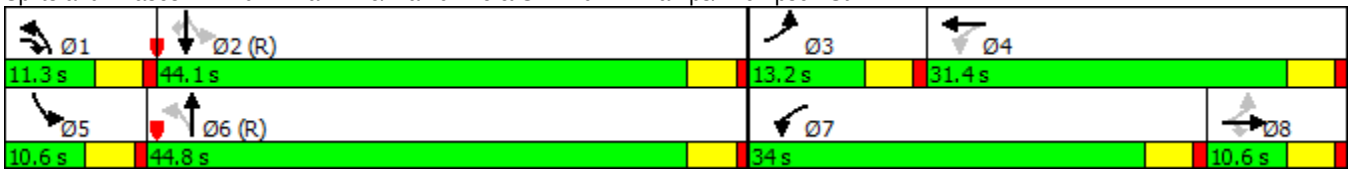
Splits and Phases: 110: E Main Ave & SR 410 EB Ramps



Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	100	30	295	605	255	225	510	5	375	775
Future Volume (vph)	100	30	295	605	255	225	510	5	375	775
Turn Type	pm+pt	NA	pm+ov	pm+pt	NA	pm+pt	NA	pm+pt	NA	Perm
Protected Phases	3	8	1	7	4	1	6	5	2	
Permitted Phases	8		8	4		6		2		2
Detector Phase	3	8	8	7	4	1	6	5	2	2
Switch Phase										
Minimum Initial (s)	6.0	6.0	6.0	6.0	6.0	6.0	10.0	6.0	10.0	10.0
Minimum Split (s)	10.6	10.6	10.6	10.6	28.6	10.6	25.6	10.6	24.6	24.6
Total Split (s)	13.2	10.6	11.3	34.0	31.4	11.3	44.8	10.6	44.1	44.1
Total Split (%)	13.2%	10.6%	11.3%	34.0%	31.4%	11.3%	44.8%	10.6%	44.1%	44.1%
Yellow Time (s)	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6
Lead/Lag	Lead	Lag	Lead	Lead	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?										
Recall Mode	None	None	None	None	None	None	C-Min	None	C-Min	C-Min
Act Effct Green (s)	14.0	6.0	17.9	44.0	33.6	46.0	44.7	40.9	34.9	34.9
Actuated g/C Ratio	0.14	0.06	0.18	0.44	0.34	0.46	0.45	0.41	0.35	0.35
v/c Ratio	0.51	0.28	0.65	0.89	0.48	0.72	0.56	0.02	0.60	0.92
Control Delay	31.7	51.9	17.6	43.4	31.4	32.0	15.3	12.4	30.1	29.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	31.7	51.9	17.6	43.4	31.4	32.0	15.3	12.4	30.1	29.0
LOS	C	D	B	D	C	C	B	B	C	C
Approach Delay		23.3			39.4		19.0		29.3	
Approach LOS		C			D		B		C	

Intersection Summary	
Cycle Length: 100	
Actuated Cycle Length: 100	
Offset: 0 (0%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green	
Natural Cycle: 90	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.92	
Intersection Signal Delay: 28.1	Intersection LOS: C
Intersection Capacity Utilization 88.5%	ICU Level of Service E
Analysis Period (min) 15	

Splits and Phases: 120: E Main Ave/Traffic Ave & SR 410 WB Ramps/Thompson St



MOVEMENT SUMMARY

Site: 2035 Option 5B(1.1) AM E Main Ave/Traffic Ave and Thompson St/SR 410 WB Ramps

Network: 2035 Option 5B(1.1) AM

2035 Option 5 AM
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival 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
East: Thompson St													
1a	L1	41	0.0	41	0.0	0.237	12.9	LOS B	1.4	34.3	0.92	0.95	20.4
6	T1	41	0.0	41	0.0	0.237	8.6	LOS A	1.4	34.3	0.92	0.95	29.1
16b	R3	26	0.0	26	0.0	0.052	5.8	LOS A	0.3	6.6	0.80	0.79	23.6
Approach		107	0.0	107	0.0	0.237	9.6	LOS A	1.4	34.3	0.89	0.91	24.9
NorthEast: Traffic Ave													
1bx	L3	5	10.0	5	10.0	0.093	7.9	LOS A	0.5	14.7	0.57	0.32	25.9
6x	T1	87	10.0	87	10.0	0.093	1.9	LOS A	0.5	14.7	0.57	0.32	23.1
16ax	R1	143	10.0	143	10.0	0.141	1.7	LOS A	0.9	23.0	0.56	0.31	31.2
Approach		235	10.0	235	10.0	0.141	1.9	LOS A	0.9	23.0	0.57	0.32	28.7
West: SR 520 WB Ramps													
5a	L1	240	2.0	240	2.0	0.174	5.1	LOS A	1.0	24.4	0.31	0.49	24.6
2	T1	122	2.0	122	2.0	0.155	0.8	LOS A	0.8	20.9	0.32	0.22	25.4
12b	R3	66	2.0	66	2.0	0.155	2.4	LOS A	0.8	20.9	0.32	0.22	23.7
Approach		429	2.0	429	2.0	0.174	3.4	LOS A	1.0	24.4	0.32	0.37	24.8
SouthWest: E Main Ave													
5bx	L3	332	2.0	332	2.0	0.950	18.9	LOS B	20.1	510.8	1.00	1.39	29.0
2x	T1	1367	2.0	1367	2.0	0.950	12.7	LOS B	20.4	517.0	1.00	1.37	21.7
12ax	R1	337	2.0	337	2.0	0.950	12.3	LOS B	20.4	517.0	1.00	1.36	21.7
Approach		2036	2.0	2036	2.0	0.950	13.6	LOS B	20.4	517.0	1.00	1.37	22.6
All Vehicles		2806	2.6	2806	2.6	0.950	10.9	LOS B	20.4	517.0	0.86	1.11	23.6

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: 2035 Option 5B(1.1) PM E Main Ave/Traffic Ave and Thompson St/SR 410 WB Ramps

Network: 2035 Option 5B(1.1)

2035 Option 5 PM
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival 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
East: Thompson St													
1a	L1	617	0.0	617	0.0	0.986	29.1	LOS C	22.1	553.0	1.00	1.99	15.9
6	T1	260	0.0	260	0.0	0.986	24.7	LOS C	22.1	553.0	1.00	1.99	23.9
16b	R3	41	0.0	41	0.0	0.041	2.7	LOS A	0.2	3.8	0.46	0.48	24.3
Approach		918	0.0	918	0.0	0.986	26.7	LOS C	22.1	553.0	0.98	1.92	18.9
NorthEast: Traffic Ave													
1bx	L3	5	3.0	5	3.0	0.841	42.9	LOS D	13.7	350.4	1.00	1.59	18.8
6x	T1	383	3.0	383	3.0	0.841	36.9	LOS D	13.7	350.4	1.00	1.59	14.0
16ax	R1	791	3.0	791	3.0	0.757	7.4	LOS A	10.4	266.6	0.93	1.02	29.9
Approach		1179	3.0	1179	3.0	0.841	17.1	LOS B	13.7	350.4	0.95	1.21	24.3
West: SR 520 WB Ramps													
5a	L1	102	4.0	102	4.0	0.259	14.1	LOS B	1.7	42.6	0.90	0.94	22.7
2	T1	31	4.0	31	4.0	0.572	13.1	LOS B	5.9	152.1	1.00	1.17	22.3
12b	R3	301	4.0	301	4.0	0.572	14.6	LOS B	5.9	152.1	1.00	1.17	18.9
Approach		434	4.0	434	4.0	0.572	14.4	LOS B	5.9	152.1	0.98	1.11	20.5
SouthWest: E Main Ave													
5bx	L3	230	2.0	230	2.0	0.439	6.7	LOS A	2.9	72.5	0.41	0.36	35.8
2x	T1	520	2.0	520	2.0	0.439	0.9	LOS A	2.9	72.9	0.40	0.26	25.1
12ax	R1	301	2.0	301	2.0	0.439	0.8	LOS A	2.9	72.9	0.40	0.13	25.2
Approach		1051	2.0	1051	2.0	0.439	2.1	LOS A	2.9	72.9	0.40	0.25	26.9
All Vehicles		3582	2.1	3582	2.1	0.986	14.9	LOS B	22.1	553.0	0.80	1.10	22.9

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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MOVEMENT SUMMARY

Site: 2035 Option 5 AM E Main Ave and SR 410 EB Ramps

Network: 2035 Option 5B(1.1) AM

2035 Option 5 AM
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
NorthEast: E Main Ave													
6x	T1	163	4.0	163	4.0	0.068	0.4	LOS A	0.4	10.3	0.21	0.09	31.8
16x	R2	37	4.0	37	4.0	0.068	1.5	LOS A	0.4	10.3	0.21	0.12	24.8
Approach		200	4.0	200	4.0	0.068	0.6	LOS A	0.4	10.3	0.21	0.09	30.2
NorthWest: SR 410 EB Ramps													
7x	L2	905	3.0	905	3.0	0.403	15.3	LOS B	2.8	71.3	0.46	0.67	31.4
14x	R2	84	3.0	84	3.0	0.403	8.9	LOS A	2.8	71.3	0.45	0.66	33.3
Approach		989	3.0	989	3.0	0.403	14.8	LOS B	2.8	71.3	0.46	0.67	31.6
SouthWest: E Main Ave													
5x	L2	63	1.0	63	1.0	0.727	16.5	LOS B	6.0	151.4	0.83	1.06	27.4
2x	T1	1195	1.0	1195	1.0	0.727	10.3	LOS B	6.7	167.6	0.84	1.05	26.7
Approach		1258	1.0	1258	1.0	0.727	10.6	LOS B	6.7	167.6	0.84	1.05	26.8
All Vehicles		2447	2.1	2447	2.1	0.727	11.5	LOS B	6.7	167.6	0.63	0.82	28.9

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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MOVEMENT SUMMARY

Site: 2035 Option 5 PM E Main Ave and SR 410 EB Ramps

Network: 2035 Option 5B(1.1)

2035 Option 5 PM
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
NorthEast: E Main Ave													
6x	T1	1179	1.0	1179	1.0	0.520	1.7	LOS A	4.3	108.5	0.61	0.28	30.2
16x	R2	163	1.0	163	1.0	0.520	2.6	LOS A	4.3	108.5	0.59	0.28	23.9
Approach		1342	1.0	1342	1.0	0.520	1.8	LOS A	4.3	108.5	0.61	0.28	29.3
NorthWest: SR 410 EB Ramps													
7x	L2	358	2.0	358	2.0	0.570	17.4	LOS B	3.3	84.3	0.79	1.00	29.5
14x	R2	758	2.0	758	2.0	0.879	15.8	LOS B	10.0	254.7	0.94	1.20	32.0
Approach		1116	2.0	1116	2.0	0.879	16.3	LOS B	10.0	254.7	0.89	1.13	31.4
SouthWest: E Main Ave													
5x	L2	268	1.0	268	1.0	0.449	10.4	LOS B	2.9	74.3	0.61	0.65	28.3
2x	T1	726	1.0	726	1.0	0.449	4.5	LOS A	3.1	77.5	0.61	0.52	28.7
Approach		995	1.0	995	1.0	0.449	6.1	LOS A	3.1	77.5	0.61	0.55	28.5
All Vehicles		3453	1.3	3453	1.3	0.879	7.7	LOS A	10.0	254.7	0.70	0.64	29.8

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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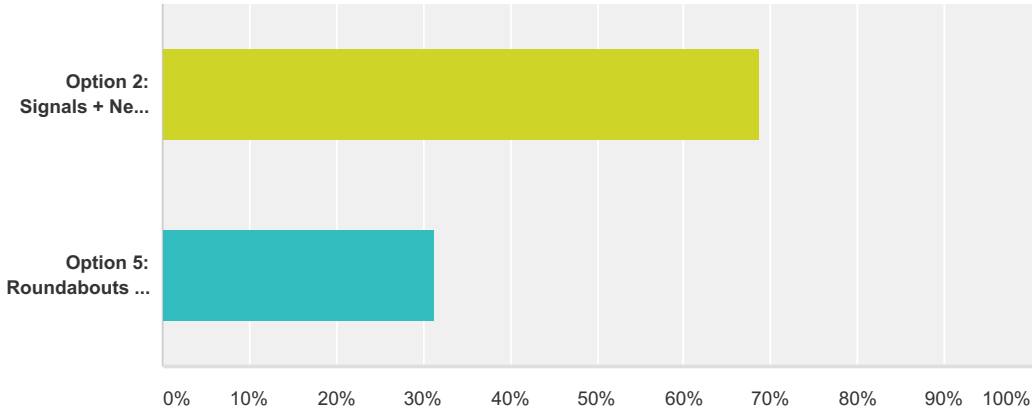
Appendix D

Community Outreach Summary

Q1 Which option do you prefer?

Answered: 217 Skipped: 1



Answer Choices	Responses	
Option 2: Signals + New Parallel Overpass East	**68.66%**	149
Option 5: Roundabouts + New Parallel Overpass East	**31.34%**	68
Total		**217**

Q2 Any further comments?

Answered: 78 Skipped: 132

#	Responses	Date
1	Upgrade turn lanes. living here since 1984. we are going to back traffic up to the library. Need a new bridge and park and ride. we need planners to look at flyovers. We need the trucks to use the 24th street exit, not this one. I'm also concerned over the cost of this project. NO INCREASED TAXES!!!	11/15/2016 11:55 AM
2	with roundabouts in such close proximity to each other, the size & amount of vehicles. There is only ONE choice.	11/15/2016 11:52 AM
3	These two options DONT WORK. the solution is fly overs to get a steady traffic stream NOT interrupted by traffic signals. If this was in King County this wouldn't be a problem.	11/15/2016 11:51 AM
4	As a daily pedestrian commuter, a nice wide multi-use sidewalk is much needed. As many vehicle lanes as possible would be welcome by everyone!! Thank you for having this open house. -from Puyallup	11/15/2016 11:37 AM
5	Usually I prefer roundabouts but in this case with such high volumes of traffic on the roundabouts they will be constantly full.	11/15/2016 11:32 AM
6	1. Put in fly over for Shaw Rd. traffic 2. 5 lane over freeway I drive a 85' semi and don't like roundabouts	11/15/2016 11:31 AM
7	I prefer roundabouts, but not for this intersection. However, please make this intersection attractive.	11/15/2016 11:30 AM
8	New station needed for Sound Transit OUTSIDE of Sumner, near old golf course	11/15/2016 11:29 AM
9	Truck traffic is a huge problem. Roundabouts will still cause backups. Need left turn NOW for those coming from Puyallup.	11/15/2016 11:28 AM
10	Both options look good. The trail should be brought under traffic Ave. to avoids bike/pedestrian to vehicle conflict.	11/15/2016 11:27 AM
11	If trucks dislike then maybe more trucks will stay out of downtown. Plus, multiple lights make you wait unnecessarily.	11/15/2016 11:26 AM
12	Roundabouts done correctly are far better than signals.	11/15/2016 11:26 AM
13	Will help after big rig traffic from proposed Pioneer Warehouse project.	11/15/2016 11:25 AM
14	Concerned the high volume of traffic can keep moving. It will of people learns roundabout system.	11/15/2016 11:24 AM
15	I like roundabouts	11/15/2016 10:13 AM
16	like roundabouts	11/15/2016 10:12 AM
17	IF they are big enough	11/15/2016 10:12 AM
18	traffic lights= backups roundabouts= flow	11/15/2016 10:12 AM
19	Fund without raising excessive taxes	11/15/2016 10:11 AM
20	Vehicles would plug roundabouts creating worseness.	11/15/2016 10:11 AM
21	The sooner the better	11/15/2016 10:10 AM
22	1. This option costs less. 2. As a person who has trouble with directions, roundabouts confuse me, so I'd slow down traffic.	11/15/2016 10:10 AM
23	Please no roundabouts	11/15/2016 10:08 AM
24	I think option 2 is the best	11/15/2016 10:08 AM
25	Enforce traffic speed on Traffic Ave.	11/15/2016 10:07 AM
26	Make it happen.... Puyallupites support you!	11/15/2016 10:07 AM
27	Hopefully a four lane overpass will be constructed in the near future.	11/15/2016 10:07 AM
28	Roundabouts are an issue with traffic control. It will slow it down.	11/15/2016 10:06 AM
29	Preferred due to seeming a better option for non-motorized traffic. Fewer number of crosswalks and dedicated crossing times due to signals	11/15/2016 10:05 AM
30	Please no roundabouts. Too many trucks to safely navigate.	11/15/2016 10:04 AM

31	NO roundabouts!	11/15/2016 10:03 AM
32	No roundabouts	11/15/2016 10:03 AM
33	Roundabouts will slow this city down even more. Build a new overpass please.	11/15/2016 10:02 AM
34	Trucks should not be a consideration because they should use 24th St. exit. Easy fix for that- lights work better in small towns. Will create more frustration and backups.	11/15/2016 10:01 AM
35	Roundabouts will increase the bottleneck and back up at E. Main and Traffic Ave. like never before.	11/15/2016 10:00 AM
36	Roundabouts are not appropriate here. Too many trucks, too much traffic. Unsafe for bicycles heading to the trail. They are scary!	11/15/2016 9:59 AM
37	Better for peak traffic	11/15/2016 9:58 AM
38	I trust your judgment. Thank you!	11/15/2016 9:58 AM
39	Signals would be the only way Sumner could access 410 & 167	11/15/2016 9:57 AM
40	There is to much traffic during peak hours for a roundabout and it also tends to create problems for larger vehicles. Yes a signal does mean it takes longer during non-peak hours but I live on Thompson St right off the exit and it doesn't take me very long with signals even when I have to wait for them. It is really just a matter of programming the timing of the lights to adjust for peak and nonpeak hours.	11/15/2016 9:25 AM
41	We already have traffic signals at those locations and it just causes traffic backup. I believe roundabouts will alleviate the congestion issues.	11/14/2016 4:02 PM
42	I like the idea of the roundabouts, but I'm skeptical, esp. at Thompson and Traffic with the new ST Garage. The flood of cars out of there when the train comes in I think would overwhelm - that might force signals??	11/13/2016 4:05 PM
43	Once drivers become accustomed to them, roundabouts actually speed traffic through intersections faster than signals, no matter what time of day (you analysis didn't say how much 'slower' you think roundabouts would be during peak times...1 minute, 2, 5?) "Myh Busters' on TV did a study...check it out! Secondly, pedestrian crossings should be of minimal concern here. People are not going to cross east to west (except to get to the trail and those users will be/are few and far between). Most pedestrians will be walking in the north/south direction to get to and from the Sounder station so they will not be affected by either option. I love roundabouts!!	11/12/2016 10:41 AM
44	Roundabouts frustrate me because they confuse other drives who then mess up the system and don't take turns.	11/11/2016 7:36 PM
45	NO ROUND ABOUTS. They will just cause confusion.	11/11/2016 7:33 PM
46	Safer and just about the same price.	11/11/2016 11:41 AM
47	A roundabout needs to be created at 60th st eand 160th ave E. Since the YMCA has been added this has become a very dangerous intersection, the design of the intersection is not working, the yield sign is dangerous, the visibility for traffic is not good, and the speed to which drivers come down the road is not safe. Please look to create a roundabout there.	11/11/2016 10:06 AM
48	Round-a-bouts confuse too many people around here. Let's try to keep it simple and use forms that people are familiar with. Stop lights work just fine!!!	11/11/2016 9:47 AM
49	It's worth the slight delays in non-peak periods due to signaling, to relieve the excruciating delays that occur in peak periods. The roundabout option has potential to relieve traffic going from Sumner to SR410 and E. Main, Puyallup, but it would create a new bottleneck for traffic trying to get from E. Main on to 410 East, and having to merge from the roundabout into traffic from Sumner heading onto 410 East. Even one truck heading that way and trying to merge could back things up for several blocks. Option 2, while perhaps slightly slower during non-peak hours, would have more predictable results, as well as being better for trucks. As a Sumner resident who travels this intersection frequently, I appreciate this opportunity to express my opinion - thank you!	11/11/2016 2:34 AM
50	If the option doesn't not relieve congestion during peak commute times, it is almost worthless. Minor delays during non-peak times cause barely any aggravation. Signals please!	11/10/2016 6:42 PM
51	Semis can barely navigate the road now and a roundabout will make the issue worse	11/10/2016 4:46 PM
52	Roundabouts cause accidents with trucks	11/10/2016 1:44 PM
53	Roundabouts are stupid!!!	11/10/2016 1:36 PM
54	Roundabouts will be cumbersome and traffic accidents likely.	11/10/2016 9:51 AM
55	Feel the roundabouts would continue to cause the bottle neck during am and pm peak hours.	11/10/2016 9:20 AM
56	It would move the people better and not have them back up as much.	11/10/2016 9:17 AM

57	Until construction is complete, it would be nice if you would sync the traffic lights to work together, and apply a a.m. and p.m. Traffic schedule.	11/9/2016 4:21 PM
58	My only concern with this option is the SW crosswalk. I can see how drivers would be looking to the left for traffic while exiting 410 onto Traffic and not see a pedestrian. Hopefully there will be some sort of signal warning the drivers and visibility will be improved.	11/9/2016 3:47 PM
59	roundabouts move much more traffic more efficiently.	11/9/2016 3:16 PM
60	Round abouts will cause severe back ups. People will still not follow the yield signs, just like people run red lights. I have seen this in Federal Way with their round abouts.	11/9/2016 9:35 AM
61	Roundabouts work great when people know how to use them, and they're actually large enough to keep traffic flowing. Some are built too small and it's tight going through or around them. This is an extremely high volume area for quite a few hours every day, and these intersections would require large roundabouts to keep the traffic flowing smoothly - instead of slowing down to get through them; especially large trucks. It seems like a good idea, but I don't think it will be enough to fix the terrible traffic in that area during commuting hours.	11/8/2016 9:39 AM
62	Using other roundabouts, I find quite a few drivers are hesitant and confused upon entering and others are overly aggressive.	11/7/2016 4:48 PM
63	Roundabouts would only increase the lines during peak traffic hours. Synchronizing the signals would certainly be beneficial.	11/5/2016 12:13 PM
64	Concern that at 5:00 pm weekdays that the "round about" solution would not be effective	11/4/2016 8:53 PM
65	Keep it flowing..just like plumbing... stop the toilet and see what happens... it all backs up!	11/4/2016 5:08 PM
66	Roundabouts are not viable for large trucks and are confusing for a large percentage of motorists.	11/4/2016 9:58 AM
67	Too much truck traffic (and too many unaware drivers) to successfully employ round-abouts.	11/4/2016 6:39 AM
68	Without considering the rest of Traffic Ave between Hwy 410 and downtown traffic circles will not function. The similar traffic would back up at the remaining signals. The similar traffic would also have difficulty managing the circles themselves. Widening the bridge, try to sync the traffic signals, and outlaw the simi traffic and you might have something.	11/4/2016 6:33 AM
69	I think both options are great. I have lived in Sumner for 40 years and for many years now there is never a time I go through this intersection that there is not significant traffic so I think traffic signals have a slight advantage to keep traffic moving through.	11/4/2016 6:28 AM
70	Roundabouts are horrible. I am in this area 5 days a week. Traffic in the evenings is a nightmare.	11/3/2016 9:33 PM
71	My experience is roundabouts slow all traffic and arent ideal at high volume intersections. I like them some places, but here, two stoplights that are synchronized would be better	11/3/2016 7:08 PM
72	Roundabouts just send people/cars to another intersection to clog. Improving established intersections keeps people/cars from racing through housing developments. Roundabouts get torn up by tractor trailers and require more money to maintain. This pushingthe cost of installation of a roundabout up to the original costs to add a lane. Please keep traffic moving where it belongs, not in the neighborhoods endangering people/cars. I would miss shopping in Sumner year round, due to roundabouts slowing uneducated drivers.	11/3/2016 6:20 PM
73	Ask an actual truck driver. Most roundabouts, are not able to be used without hopping curbs and taking both lanes. Worst idea. Please..no roundabouts! Many car drivers don't understand how they work either.	11/3/2016 4:07 PM
74	There is to much traffic in am and pm that i fear will bottle neck a lot more traffic as one way of traffic could dominate the roundabouts and not let other vehicles in from other ddirection.	11/3/2016 4:00 PM
75	Roundabouts are not user friendly.	11/3/2016 3:50 PM
76	use best fix for rush hours	11/3/2016 3:41 PM
77	Roundabouts almost never have backups!!!	11/3/2016 3:02 PM
78	Do not install roundabouts. As a biker I do not feel comfortable with roundabouts. Thank you	11/1/2016 8:51 PM

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November 17, 2016, 12:46 pm

« Return to Stats

Top Posts for 30 days ending 2016-11-17 (Summarized)

7 Days | **30 Days** | Quarter | Year | All time

2016-10-18 to Today

Title	Views
Home page / Archives	7,486
Employment	2,044
Online Utility Bill Pay	1,467
Calendar	1,300
SR 410 Virtual Open House	776
Contact Us	612
Police Department	592
Permits	407
Senior Center	381
Bids	322
Public Works	277
Maps	255
Permit Forms	245
Public Records & Forms	244
Utilities	234
Edgewood's Jovita Blvd Closure	196
Municipal Court	184
Parks	147
Community Development	145
Trail Map	141
City Council	135
Trails	134
Pay Court Fines	123
Police Records	111
Cemetery	106
Transportation	94
Reading Your Utility Bill	92
Online Report	89
Parks, Trails and Recreation	88
Permit Information & Fees	87
RFQ: Roadway Restoration 24th St & 142nd Ave	83
Reserved Parking	82

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SR 410 Virtual Open House

October 24, 2016 | Filed under: Regional Issues, Transportation | Edit

VIRTUAL OPEN HOUSE

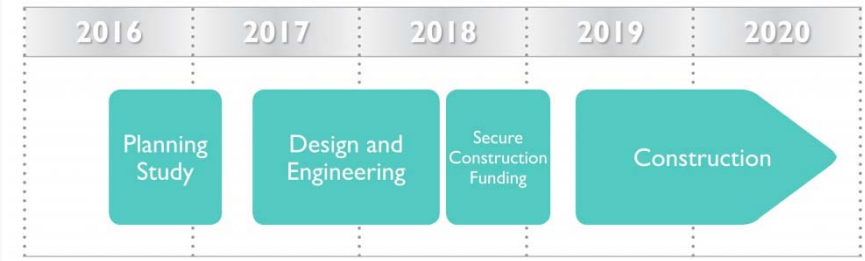
Couldn't make it to look at the materials in person? Here are the highlights. At the bottom is your chance to give us your feedback on how you think we should proceed.

Project Needs Statement

The SR 410/Traffic Avenue interchange is a key element of the transportation system in east Pierce County. The overpass is a bottleneck for motorized travel and a gap in the system for nonmotorized travel. Improvements are needed to

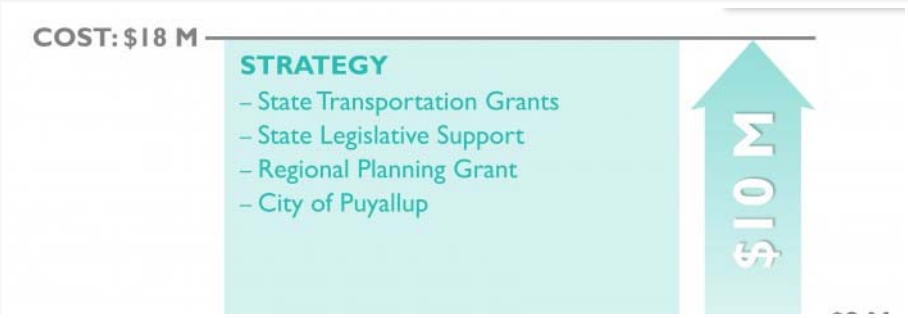
1. Relieve the BOTTLENECK for freight, transit, and automobile travel.
2. Complete the MISSING LINK between the non-motorized facilities north and south of the interchange.

Timeline



Planning and Study will continue from 2016 into the first part of 2017. Later in 2017, Design & Engineering will begin, lasting to mid-2018. In 2018 and into the beginning of 2019, we will secure construction funding with Construction beginning in 2019.

Funding



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UPCOMING EVENTS
November 19, 2016
Live Music: PK Dwyer
November 20, 2016
Train to Seahawks Game
Train to Seahawks Game
November 21, 2016
City Council Meeting
November 23, 2016
Thanksgiving Party
November 24, 2016
Thanksgiving

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Our #Sumner friends knc everything is better with rhubarb pie. This is marketing, people. Well c

16

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The total cost of the project is $18 million. We have already received $8 million from the State of Washington, Port of Tacoma, Sound Transit, private funding, Freight Mobility Strategic Investment Board and the City of Sumner. For the remaining $10 million, we will be seeking funding from State Transportation Grants, State Legislative Support, Regional Planning Grant and City of Puyallup.

Interchange Options

OPTION 1

Signals + Complete Overpass Replacement **$24.4 Million**
Status: Dropped from Consideration Due to High Cost

OPTION 2

Signals + New Parallel Overpass East **$17.6 Million**
Status: Still Being Considered

OPTION 3

Signals + New Parallel Overpass West **$18.0 Million**
Status: Dropped from Consideration, Non-Motorized Route Crosses Ramp Traffic, Vertical Clearance with SR 410 is Problematic

OPTION 4

Roundabouts + New Single Overpass **$23.4 Million**
Status: Dropped from Consideration Due to High Cost

OPTION 5

Roundabouts + New Parallel Overpass East **$18.2 Million**
Status: Still Being Considered

OPTION 6

Roundabouts + Existing Overpass **$12.6 Million**
Status: Dropped from Consideration, Does Not Relieve Bottleneck, Does Not Complete the Missing Link in Non-Motorized Facilities

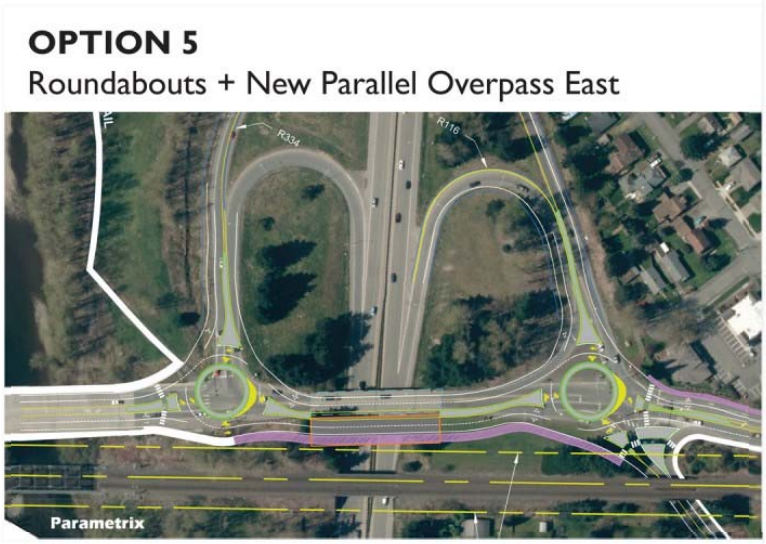
Comparison of Options Still Being Considered

TOPIC	Option 2: Parallel Bridge Signals at Intersections	Option 5: Parallel Bridge Roundabouts at Intersections	Comments
COMMUTE PERIOD TRAFFIC	Relieves bottleneck for all directions of travel during both the AM and PM peak periods.	Some directions of travel will have long delays and queuing in both the AM and PM peak periods.	Roundabouts often reduce delay and improve traffic flow compared to traffic signals when volumes are balanced and low. At this interchange, traffic volumes are high and unbalanced, so signals may have an advantage during peak commute.
OFF-PEAK TRAFFIC	Traffic signals will stop two or more directions of traffic at one time. This results in delay even during low volume time periods.	Minimal to no delay during the off-peak periods.	
TRUCK TRAFFIC	Generally acceptable for large trucks	Drivers of large trucks often express opposition to roundabouts	
NON-MOTORIZED TRAVEL	Non-motorized users generally cross travel lanes comfortably with signals	Some non-motorized users feel less comfortable crossing travel lanes at roundabouts	
INJURIES	Higher likelihood of injury accidents	Lower likelihood of injury accidents	Severe accidents can occur at signalized intersections when drivers run red lights or misjudge left turns. Roundabouts operate at low speeds and force drivers to pay attention.
OPERATIONAL COST	Higher Cost	Lower Cost	Signals have electronic components which require maintenance and use electricity. A signal can cost $5 – 10K per year to operate and maintain.
CONSTRUCTION COST	Slightly Lower	Slightly Higher	

Choosing an Option

Again, here are the final two options remaining:

Option 2: Signals + New Parallel Overpass East



Option 5: Roundabouts + New Parallel Overpass East

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